

SMALL-WOODLAND OWNERS' ATTITUDES TOWARDS ENERGY FROM
FOREST BIOMASS IN NOVA SCOTIA

by

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Submitted in partial fulfilment of the requirements
for the degree of Master of Environmental Studies

at

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DALHOUSIE UNIVERSITY

SCHOOL FOR RESOURCE AND ENVIRONMENTAL STUDIES

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This thesis is dedicated to my mother and father in honor of their patience, support, thoughtful input and guidance throughout this journey.

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ABSTRACT

The use of forest biomass (by thermal combustion to electricity processes), has been recognized by the Government of Nova Scotia (NS) as one option which could help meet short- and long term energy generation goals (aggressively set at 25% and 40% by 2015 and 2020 respectively). However, while approximately 77% of NS land area is forest covered, there is significant concern about the sustainability and stewardship of this natural resource. This controversy inspired a deeper investigation into the attitudes towards forest biomass held by one particular stakeholder group—small-woodland owners—and also the rural community members living in the same regions. 51% of the forested area in NS is owned by small-private woodland owners and as such, they will play an integral role in the future of NS’s forest economy and sustainability. How these stakeholders feel about the forests, the alternative uses for forest biomass and its use in large scale energy production could have a significant impact on the future of forest biomass use - particularly for energy - in NS. 489 small-woodland owners responded to mail-out surveys and 14 rural community members participated in three focus groups. Three major findings emerged. Firstly, it was found that the acceptability of using forest products varied depending on multiple factors— the source of biomass, harvesting methods, and [predicted] end-use. Secondly, forest sustainability and keeping resources local were the two most important concerns amongst respondents. Finally, respondents felt that better collaboration with other stakeholders and objective education around the issues would be the best strategies to overcoming these concerns.

LIST OF ABBREVIATIONS USED

CHP – Combined Heat and Power

DNR – Department of Natural Resources

EAC – Ecology Action Centre

EES – Energy Efficiency Strategy

EGSPA – Environmental Goals and Sustainable Prosperity Act

ENGO – Environmental Non-Governmental Organization

GHG – Greenhouse Gas

GWh – Gigawatt hours

IEA – International Energy Agency

MWh – Megawatt hours

NRCan – Natural Resources Canada

NRS – Natural Resources Strategy

NS – Nova Scotia

NSPI – Nova Scotia Power Inc.

RES – Renewable Energy Strategy

UARB – Utility and Review Board

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CHAPTER 1 INTRODUCTION

1.1. Problem Statement

The use of forest biomass for the generation of electricity has become increasingly controversial in the province of Nova Scotia (NS). This controversy was exacerbated by the inclusion of biomass as one alternative energy source that could be used to reduce or replace fossil fuel energy production in the province's Renewable Electricity Plan (NS Department of Energy, 2010). Many stakeholders expressed significant concern about the sustainability of using forest materials for the production of electricity, while other groups were excited about the development of a new market for forest products. Making effective policy decisions becomes increasingly difficult due to these clashing perspectives. Given that a number of stakeholder groups can be strongly impacted by policy decisions regarding biomass energy – such as energy companies, the forest industry and environmental non-governmental organizations (ENGO's) – having timely and effective policy decision making is crucial.

The problem this research was designed to address was the controversy related to the use of biomass for electricity. The problem needed to be addressed immediately so that future policy decision making processes are more timely and effective. In order to understand this controversy, small-woodland owners were surveyed on their attitudes towards using biomass energy. They were chosen because of the integral role they will play in the future of NS's forest economy and sustainability, since they own over half of the forest land in NS and because their view remain unknown. Rural

community members were engaged with as well in order to get more in-depth results from other people living in the same regions as the small-woodland owners. By understating the major concerns of these stakeholders, policy makers will be better equipped to address the concerns that surround this issue.

1.2. Study Purpose

To meet renewable energy targets made by the Government of NS, the use of forest biomass (for conversion into electricity primarily) has been recognized as one option that could help meet both short- and long-term goals (Adams & Wheeler, 2009). While approximately 77% of NS land area is forest covered (DNR, 2008), there is significant concern about the sustainability and care of this natural resource and some stakeholders (e.g. Ecology Action Centre, 2011) are strongly opposed to using additional biomass for energy in NS. As the debate evolves, it becomes increasingly important to understand the point of view of the various stakeholder groups, particularly the small-woodland owners and members of their surrounding communities.

Small-woodland owners can

play a significant role in the future of NS's forest economy and sustainability as they own over half of the forest land in NS. Their feelings and attitudes about the forests, the alternative uses for forest biomass, and its use in large-scale energy production could have a significant impact on policy direction as it relates to the future of forest biomass use - particularly for energy - in NS. Therefore the primary

purpose of this research was to fill an information gap on small-woodland owners' attitudes towards using forest biomass for energy in NS.

A secondary purpose to this research was to address concern that has arisen within certain stakeholder groups, such as the energy providers, that small-woodland owners' had not been adequately represented during the various stakeholder engagement processes held to discuss potential renewable energy strategies (RES) as the province strives to reach its renewable energy targets. Nova Scotia Power Inc. (NSPI), for example, recognized that it could be directly affected by the policy decisions made around biomass as they would influence renewable energy development options. NSPI provided additional financial support for the research in order to facilitate garnering more information from the small-woodland owners around this topic.

1.3. Research Questions

The research sought to answer this foundational question: how do woodland owners and rural community members feel about using biomass for energy? From that core question, five specific research questions were developed and explored:

1. Does the acceptability of using biomass for energy change depending on: a) the source of the biomass; b) the harvest methods used; and c) the end-uses or products?
2. What are the demographic and land-ownership statistics of the woodland owner cohort and are any of these variables correlated with their attitudes towards using biomass for energy?

3. What are the perceived benefits of using more forest biomass for energy in NS and what are the barriers to using forest biomass energy?
4. What do small-woodland owners and rural community members consider as the most important sources of information on biomass? What does this mean for future engagement with these stakeholders?
5. What is the level of knowledge that woodland owners and rural community members have on the topic of biomass energy?

1.4. Outline of the Thesis

This thesis is divided into four chapters. Chapter one is an introduction to and background of the research. This chapter is followed by the first of two stand-alone manuscripts structured in a manner appropriate for journal submission. Chapter two is a body of work focused mainly on interpreting the quantitative results of the research. The chapter begins with an introduction to, and background on, energy, forests and biomass in NS. Results from mail-out surveys sent to small-woodland owners are the centre of the analysis and discussion section. These results highlight the issues and opportunities which are most important to woodland owners and are then connected back to relevant literature for contrast and comparison.

Chapter three is a balancing counterpart to chapter two and explores the nature of stakeholder engagement and energy policy development in NS. This chapter focuses equally on both quantitative and qualitative results from the mail-out surveys and focus group and brings the reader's attention to some of the underlying factors affecting attitudes towards biomass such as communication channels and education.

Chapter four is the concluding chapter of the thesis. This chapter reiterates some of the highlights of the research findings and makes connections between chapters two and three. Chapter four also suggests areas for further research and acknowledges some of the limitations of the project.

1.5. Background

1.5.1. Nova Scotia's Energy

According to Natural Resources Canada's (NRCan) latest energy demand statistics from 2008, Nova Scotia's (NS) annual energy demand is approximately 56,000 GWh (NRCan, 2008). While the transportation and industry sectors have the largest demand, electricity makes up a significant portion, at approximately 23% of total demand (NRCan, 2008). Nova Scotia Power Inc (NSPI), a private-sector electricity utility company, provides 95% of Nova Scotia's electricity and generates on average 13,000 GWh annually (NSPI, 2011); the other 5% comes from independent power producers.

75% of NS's electricity generation comes from coal and 13% from natural gas; the remaining 12% is a mix of oil, hydro, wind and tidal (NSPI, 2011). The associated greenhouse gas (GHG) emissions for transporting and combusting the coal used in NS (2819 kilotonnes CO₂ equivalent in 2009; Statistics Canada, 2011) are becoming increasingly unacceptable. Nearly 50% of NS's total GHG emissions come from coal-powered electricity generation (Government of NS, 2010a). Furthermore, for NS to meet provincial goals and environmental standards, such as those put forth by the Environmental Goals and Sustainable Prosperity Act (EGSPA) (Government of NS,

2010a), GHG emissions from coal will have to be significantly reduced to specific targets laid out for years 2015 and 2020.

Currently, electricity generation from biomass makes only a minimal contribution to the grid in NS. The amount of biomass being used for electricity is enough to power 7500 homes (NSPI, 2011), less than 2% of total electricity generation. Of the total renewable electricity generation in the province, biomass makes up about 13% of the 1690 GWh produced annually (NSPI, 2011).

However, despite the minimal contribution that biomass currently makes to the grid, there are plans to greatly increase this capacity through the installation of a 60MW (525.6-GWh annual production capacity) Combined Heat and Power (CHP) facility. NewPage, a US-based company with a pulp-and-paper facility located in Port Hawkesbury NS is working in partnership with NSPI to build the CHP facility.¹ The sale of its electricity back to the grid was recently approved by the Utility and Review Board (UARB, 2010). NewPage states that this project will contribute an additional 3% of NS's electricity supply (NewPage, 2011). This would bring the total amount of biomass-based electricity generation up to 746.6 GWh annually, and would increase biomass's contribution to renewable electricity generation in NS from 13% to 34%.

1.5.2. Biomass as an Energy Source

The Biomass Energy Centre of the United Kingdom defines biomass as:

“biological material derived from living, or recently living, organisms. In the context of biomass for energy this is often used to mean plant based material, but biomass can

¹ NewPage pulp-and-paper facility recently released information about a pending shut-down which may affect the development of the new CHP plant

equally apply to both animal and vegetable derived material” (Biomass Energy Centre, 2011). The Biomass Energy Centre also includes five specific categories of biomass materials: a) virgin wood, from forestry, arboricultural activities or wood processing; b) energy crops: high-yield crops grown specifically for energy applications; c) agricultural residues: residues from agriculture harvesting or processing; d) food waste from food and drink manufacture, preparation and processing, and post-consumer waste; and e) industrial waste and co-products from manufacturing and industrial processes (Biomass Energy Centre, 2011).

Wood from trees or tree parts is one of the oldest natural resources which humans have learned to utilize to meet their basic energy needs. Using other biomass materials such as energy crops or industrial waste is a much newer concept and its application has only become more mainstream in the last ten to fifteen years. However, with an increasing demand for energy, particularly electricity, all forms of biomass are being integrated into the energy mix at a greater scale (Beyond Petroleum, 2011). They are being converted into different energy forms primarily through thermal and chemical means. For example, biomass combustion can provide the heat needed to generate electricity in thermal generation facilities, providing it to transmission grids. Or biomass can go through torrefaction and densification to transform it into pellets which can then be traded globally.

According to the most recent world energy outlook, the use of biomass is going to triple between 2008 and 2035 (International Energy Agency, 2010). Between 2009 and 2010 in Canada alone, the production of biofuels (biodiesel and ethanol) rose 38.1% from 721 to 996 thousand tonnes oil equivalent (BP, 2011). In Canada,

biomass energy is the second most prominent renewable energy source and accounts for approximately 6% of the total demand (NRCAN, 2011b). This biomass is used in industry to generate heat and electricity, as well as to produce ethanol and biodiesel. Large quantities of biomass are also used at the residential level for home heating, which were not measured in the NRCAN data.

In NS, biomass is used in the following ways: firewood for over 100,000 homes, fuel for two CHP facilities, fuel for energy systems within pulp-and-paper plants and two sawmills to produce heat energy, raw material for pellet manufacturing and as fuel for other wood-related industries to power their facilities (waste wood/production waste) (NS Department of Energy, 2010). There are also several institutional users, including some in the planning and development stages.

While biomass comes in many forms and has many functions, the majority of the biomass production and consumption in NS would fall into category A as defined by the BEC; i.e. “virgin wood” from forestry or wood processing industries. Currently most of the forest biomass being used for energy production (other than firewood) is a by-product of milling processes or production facilities. Any additional future biomass harvested for the purpose of supplying new renewable energy systems will be limited to 350,000 dry tonnes (DNR, 2011). The regulations on forest biomass harvesting for renewable energy supplies are as follows:

“All fuel from forest harvesting and silviculture must come only from stem boles. Vendors shall not harvest or acquire fuel from coarse or fine woody debris, tree crowns, tops, or stumps from forestry operations. Vendors may use fuel made from other tree parts only if it

originates in a non-forestry operation, such as agricultural land clearing, highway right of way clearing, or commercial or residential construction.” (NS Department of Energy, 2010)

Current practices and recent legislation indicate that forest biomass is the number one choice for biomass energy in NS. Therefore, for the remainder of this document, forest biomass will simply be referred to as biomass and is defined as per the material source category from the Biomass Energy Centre (2011).

1.5.3. Nova Scotia’s Forests

NS has 4.3 million hectares of forested land, covering nearly 77% of the province. Ownership of the land in NS is divided four ways: 3% federal, 29% provincial, 18% industrial, and 51% small private ownerships (for a combined total of 69% private ownership) (NRCan, 2011a).

Many industries in NS rely on forest products and forest-derived resources. In order of financial significance, this includes: the paper-and-pulp industry; the saw timber industry; the wood-pellet industry; and the Christmas tree and maple syrup industries. Many of the forest industries export their products and approximately four million cubic metres of wood were harvested in 2009 (Registry of Buyers, 2010).

There are more than 30,000 small-woodland owners living in NS and they are defined as individuals owning between 2 and 2000 hectares of land (NS Royal Commission on Forestry, 1984). Small-woodland owners can have influence at both the community and provincial level as the supply chain for biomass can rely heavily on their decisions to supply materials from their forests (Joshi & Mehmood, 2011).

1.5.4. Stakeholder Engagement and Forest Biomass Policy Development

According to Owens and Driffill on the subject of renewable energy policy development (2008), there is a “need for more interactive, deliberative communication between decision-makers, technical experts, other stakeholders and the public” (p. 4414). When this interactive approach is taken, attitudes towards policy changes can be much more positive. Mendonca, Lacey and Hvelplund (2009) also argue that for effective policy development processes, stakeholder engagement is not only necessary during policy development but should also be continued both during and after policy implementation.

Stakeholder engagement approaches to policy development can complement traditional ‘top-down’ bureaucratic approaches. This process serves the dual purpose of helping policy-makers implement policy changes that truly reflect the needs of the affected constituencies, and satisfying the needs of stakeholders to contribute to the process in a meaningful way. Stakeholder engagement can improve trust between actors (Rayner, 2010; Ricci, Bellaby & Flynn, 2010) and can improve transparency and accountability of the government agency (Zoellner, Schweizer-Ries, & Wenheuer, 2008; Mendonca et al., 2009).

The government of NS has recently used stakeholder engagement processes to guide and inform policy changes—for the Energy Efficiency Strategy (EES), the Renewable Energy Strategy (RES), and for the new Natural Resources Strategy (NRS) (NS Department of Energy 2009; Adams & Wheeler, 2009; DNR, 2011). The government of NS hired independent facilitators from the Faculty of Management, Dalhousie University, for both the EES and the RES. The EES consultation took

place between January and April 2008. The process focused on finding ways to improve the efficiency of all energy systems, such as transportation or household heating. This process only indirectly affected the integration of more biomass into an energy plan by framing the larger energy efficiency picture for NS.

The RES engagement process, however, had a direct focus on developing a plan that would increase the renewable energy portfolio in NS, particularly in terms of renewable electricity, in order to be able to meet both short- and long-term renewable electricity targets (Adams & Wheeler, 2009). The RES consultations took place between September and December 2009 with the ultimate goal of creating the best renewable energy scenario option for all stakeholders involved.

The final RES report titled *Stakeholder Consultation Process for: A New Renewable Energy Strategy for Nova Scotia* (2009) suggested that 500 GWh of additional electricity generation above current levels could come from biomass by 2015 (Adams & Wheeler, 2009). The RES report also recommended that a community feed-in-tariff (COMFIT) system be implemented for medium-size and small biomass ventures as well as others (Adams & Wheeler, 2009). These recommendations from the RES were for the most part directly integrated into the Government of NS's new Renewable Electricity Plan released in 2010. The plan capped new electricity generation from biomass amounts to ~600-700 GWh (slightly above the recommendations), until post-2015 review (NS Department of Energy, 2010), using a "proceed with caution" principle highlighted in the RES report.

The NRS involved multiple phases, over three and a half years from 2007 to 2011. Outcomes from the NRS have implications for how businesses and industries

are able to meet the new biomass energy targets as the mandated changes in forest harvest regulations could impact the availability and supply of biomass resources. For example, clear-cutting, which is the harvest method used for 96% of all harvests, will be limited to 50% over the next five years (DNR, 2011). Also, the requirements for harvesting forest biomass commercially are mandated to be incorporated into the Code of Forest Practices (DNR, 2011).

The most significant impact these processes had on biomass policy development was the increased cap on biomass energy generation. 600-700 GWh of new electricity from biomass is a significant increase from the ~180 GWh currently being produced. Compared to other Canadian jurisdictions, however, this cap is low. For example, in Ontario in 2009, 114 TWh of electricity was produced from biomass; more than 600 times that being produced in Nova Scotia. And while Ontario has nearly 13 times the number of residents and nearly 20 times the amount of land, this is still a large difference between capacities. The other major policy outcome is the cap on forest biomass harvesting of 350,000 dry tonnes (DNR, 2011). These two policy outcomes in combination set the expectation and standard for future biomass energy developments in NS.

1.5.5. Attitudes towards Using Biomass for Energy

The acceptability of technologies such as wind energy (Cass & Walker, 2009) and agriculturally derived bioenergy (Selfa et al., 2009) have been well documented and explored. Agriculturally derived bioenergy research has focused mainly on issues of food security, rain-forest preservation and net GHG emissions (Koh & Ghazoul,

2008). Other biomass research centres on citing controversies and opposition to developments (Upreti & van der Horst, 2004) or NIMBY (not-in-my-back-yard) issues of proximity of new energy developments (van der Horst, 2007). Many of these issues do not concern or cannot be generalized to forest biomass developments and many of these issues are not comparable or transferable to the context of NS.

In recent research by Monroe and Oxarart (2011), concerns about using forest biomass for energy were measured among single-family home owners in Alachua County (north-central Florida). In order of most significant concern, they were: loss of local forests; increased air pollution; higher costs of electricity; increased traffic from wood delivery; increased competition for wood; and increased noise from plant operations. Participants also rated their level of knowledge on the topic of biomass energy and less than 5% of respondents considered themselves to be very knowledgeable about biomass energy and over half considered themselves to be not at all knowledgeable on the subject (Monroe & Oxarart, 2011). Despite this lack of knowledge, just over half of the participants were still eager to be part of planning and development processes (Monroe & Oxarart, 2011).

The study by Monroe and Oxarart (2011) illustrates the way in which recent research on forest biomass is beginning to focus on some of the social issues around public concern, knowledge and public participation; however, some key components are still missing. What is absent from the research is a differentiation between attitudes towards: a) harvest methods, b) source selections, and c) end-uses. Opinions and attitudes may be much more embedded in the harvest practices or source

selections than in the end-uses (such as for energy) themselves or vice-versa, but so far this has been a gap in the literature.

Of further concern is not only the lack of knowledge in the general public but the knowledge of the woodland owners themselves. In places such as NS where a large portion of the woodland is owned by small-woodland owners, it is essential to understand how they think and feel about the topic of biomass when they ultimately can wield a lot of control over the future of forests in the region.

1.5.6. Perceived Benefits and Barriers to using Biomass Energy

The perceived benefits and barriers are organized into environmental, economic, social and political categories. The most prevalent benefits (McKay, 2006) and barriers (multiple sources) to using biomass for energy are compiled below so readers can understand and interpret both sides of the argument.

Benefits	
Environmental	<ul style="list-style-type: none"> ○ Reduced GHG emissions by replacing fossil-fuel-dependent technologies or by decreasing emissions from transportation by using local resources. ○ Increased carbon sequestration capacity from the growth of new forest stands.
Economic	<ul style="list-style-type: none"> ○ The creation of a new market for low-value products such as mill/process wastes, dead or dying trees, and power-line/road-side clearings. ○ Emissions trading and carbon-credit trading opportunities.
Social	<ul style="list-style-type: none"> ○ Improved rural development and create job opportunities in forestry and energy sectors. ○ Decreased or eliminate fuel poverty and improved energy security.
Political	<ul style="list-style-type: none"> ○ The ability to meet renewable energy and GHG emission targets.

	<ul style="list-style-type: none"> ○ Diversification of the energy portfolio to protect against energy crises. (Source: McKay 2006)
Barriers	
Environmental	<ul style="list-style-type: none"> ○ Increased strain on forest ecosystems and difficulty maintaining sustainable forest practices (Monroe & Oxarart, 2011). ○ Increased carbon emissions from deforestation (Monroe & Oxarart, 2011).
Economic	<ul style="list-style-type: none"> ○ High costs associated with transportation and infrastructure (Monroe & Oxarart, 2011). ○ Low efficiency of processing and conversion technologies (Gautam, Pulkki, Shahi & Leitch, 2010).
Social	<ul style="list-style-type: none"> ○ The problem of siting controversies of biomass plants (Upreti & van der Horst, 2004). ○ A general lack of education on biomass and bioenergy (Upreti, 2004). ○ Fear and mistrust of industry and government within the general public on the topic of biomass (Upreti & van der Horst, 2004).
Political	<ul style="list-style-type: none"> ○ Harvest regulations either being too strict or, to the contrary, too slack and unsustainable for a long-term supply (NSDNR, 2011). ○ Energy generation caps that are too low (limiting growth in the sector) or targets too high (demanding more resources than sustainably available) (NS DOE, 2011).

It should be noted that some of the benefits and barriers completely contradict or overlap with one another, depending on circumstance and point of view. For example, the carbon status of forest products depends on multiple factors such as the nature of the harvest material, whether it is dead-wood and waste wood or if it is living wood being harvested, and if the forest is being regenerated naturally or otherwise (Johnson, 2009). Whether burning biomass is viewed as a sink or a source is complicated—each case needs independent calculation (Johnson, 2009).

Similarly, while maintaining forest sustainability is viewed by many as a significant barrier to using biomass for energy (Monroe & Oxarart, 2011), others see using biomass as a way to restore unhealthy forests (Noss et al., 2011). The biomass debate is clearly very complicated and it really depends on circumstance and intentions. The benefits to using biomass in one region or not necessarily applicable to another, and similarly neither are the barriers. Each jurisdiction would need to perform an independent analysis to estimate the overall value of pursuing a biomass energy development project.

1.6. Methods

1.6.1. Research Approach

This research took a mixed-methods approach. Mail-out surveys were sent to the small-woodland owners from three counties. Focus groups were conducted with community members from the same counties. The mail-out surveys were structured to obtain primarily quantitative data, while the focus groups added qualitatively rich components. An ethical application was reviewed by the Dalhousie University Research Ethics Board and approved.

1.6.2. Mail-out Surveys

Following the methods used in other research with woodland owners on the topic of biomass (e.g. Monroe & Oxarart 2011; Mendonca et al., 2009), it was decided that mail-out surveys would be the most effective way to reach small-woodland owners. Surveys were sent out, with pre-paid return postage, to 2937 small-

woodland owners in three NS counties: Antigonish, Annapolis and Colchester. These counties were chosen (out of eighteen) to represent eastern, central and western forest regions in the province. They were also selected to provide the opportunity (if possible) to compare differences in attitudes between counties that have: a) more industrial harvest activity (Annapolis); b) more small-woodland owner harvest activity (Colchester); and c) marginal activity of both types (Antigonish) (Registry of Buyers, 2010). The DNR landowner database was used to acquire the names and addresses of all small-woodland owners in the three counties and a stratified random sample was taken from each cohort (Bryman & Teevan, 2005). A representational fraction was taken from each county, resulting in fewer participants being selected from Antigonish, but there was still a proportionally representative number. The random samples were selected using a digital random number generator.

Where appropriate, a Likert scale (1 to 5) was used to measure participant responses to questions, as they relate to factors such as the acceptability or significance of each item in the question. Otherwise space was provided for written responses to questions. The survey generally followed Dillman's method in structure and procedure. The primary deviation was the decision to not send out reminder post-cards as follow up; this was due to budget restraints (Dillman et al., 2008).

The survey was divided into three sections to obtain data about the following:

- 1) land ownership and management;
- 2) woodland owner attitudes (e.g. towards biomass for energy, harvest practices, and end-uses of forest products); and
- 3) demographics.

Two ‘stand-alone’ questions focused on information sources and attitudes around biomass-to-energy issues. The first question asked participants to rate the relative level of importance of eight information sources that might be used to inform their opinions about biomass. The second asked them to rate how important they felt the topic of biomass energy was for them personally.

Of all the surveys sent to woodland owners in the three counties, 238 surveys came back as “return to sender”. 489 completed surveys were returned in the allocated time-frame of eight weeks and response rate varied by cohort for an average response rate of 18% (Table 1). While response rate was low, in aggregate, the sample is still large enough to show significant differences across categories with a confidence level of 95% and a margin of error of +/-5% (or expressed as $\alpha = .05$) (Dillman et al., 2008). However, during independent analysis of each county, the margin of error increases and the confidence level ranges from $\alpha = .05$ to $\alpha = .10$, indicating a lower level of significance to results in cross-analysis.

Table 1 - Research participation by county					
	Number of small-woodland owners	Total stratified sample	Number of responses	Response rate	Focus group participants
Annapolis	2,414	1,076	190	18%	6
Antigonish	1,314	590	92	16%	4
Colchester	2,357	1,032	207	20%	4
Aggregate	6,085	2,698	489	18%	14

1.6.3. Focus Groups

As previously mentioned, focus groups were conducted in the same counties chosen for the mail-out surveys and took place during the eight-week period allotted

for the return of the mail-out surveys. In total, fourteen participants (four in Colchester, four in Antigonish and six in Annapolis) took part in three independent, two-hour discussions. All participants were recruited with the help of the respective local Regional Development Authorities (RDAs) in each county. The RDAs shared a list of names and contacts for individuals who fit the following profile: full-time residents of the selected counties who were interested in the topic of biomass for energy but did not necessarily have specific expertise on the topic. The intent was to capture the knowledge and opinions of rural community members on the subject of biomass. Participants were contacted directly by telephone or email and were informed on the discussion topic, time and location of the focus group and no incentives were used.

The focus-group questions were also divided into three parts. Part one focused on finding out how participants defined biomass (and forest biomass) and included a general discussion about feelings toward using biomass for energy. Part two allowed for a more in-depth discussion about the acceptability of using different harvest practices and different sources for biomass, and whether those issues mattered. During part two there was also a discussion on the end-uses of forest products, asking if they mattered, and why.

Part three began with a scenario-based question which asked: ‘if your community were to develop and own an electricity generating station, powered by forest biomass, how would this impact the community?’ This question was followed by ‘is there a better or alternative option (to the previous question)?’ Part three concluded with questions about the benefits and barriers to using biomass for energy,

and participants were asked to name their number-one concerns about potentially using more biomass for energy.

At the end of the focus group, participants were given pens and paper to write any additional thoughts or comments. They were also asked to provide a written answer to the question, ‘of the many sources available to inform your opinions about biomass for energy, (e.g. television, newspapers, journals etc.) what are the most important to you?’ This question was included in writing because the answers were essential for the research, yet a group discussion on the topic was not feasible in the time available.

1.6.4. Data Analysis

Surveys:

Both Microsoft Excel (Leingme, 2009) and Minitab 16 (Bryman & Cramer, 1996) were used for basic descriptive statistics while Minitab 16 was used to perform two non-parametric tests, the Mann-Whitney and Spearman’s Rho. The Mann-Whitney confidence interval and test procedure was used to make inferences about the differences between medians (Bryman & Cramer, 1996). Spearman’s Rho was used to measure the association between variables based on the ranks of the data values (Bryman & Cramer, 1996). In chapter 2, each county cohort was analyzed independently to measure for any significant differences between them, while in chapter 3 all results are presented in aggregate for the surveys.

Focus groups:

A note-taker was present during the focus groups and typed out all questions and responses in a text document. The focus groups were also audio-recorded so that they could be later transcribed and cross-check with the note-taker's outputs. Once all details from the focus groups were included in a text document, the themes, keywords and other points of interest were thematically coded and entered into a digital spreadsheet. This made comparisons between focus groups more accessible and the most salient themes and/or discrepancies were identified. Responses were not linked to individual focus-group participants in any way, and no direct indication of which responses came from which county is mentioned either.

1.7. Study Limitations

There are two primary limitations to this body research project. The first limitation is the comparatively small sample size for each county (~20%); this lowers the confidence level to between .05 and .10 depending on the county, its population size and response rate. This limits the statistical rigour of any comparisons between counties and lowers the level of significance found in the results.

The second limitation to this research would be the small number of participants in the focus groups. Two of the focus groups had four participants and the third focus group had six participants. Some literature recommends larger groups ranging from 8 to 12 or even up to 15 participants (David & Sutton, 2004; Babbie, 1998). However, Greenbaum (1988) encourages the use of such small focus groups, depending on the topic, length of discussion, the anticipated outcomes and the

participants themselves. Reflecting on the outcome from the focus groups, more participants would most likely have yielded a more robust and diverse data set.

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CHAPTER 2 SMALL-WOODLAND OWNERS' ATTITUDES TOWARDS FOREST BIOMASS FOR ENERGY

2.1. Introduction

Nova Scotia (NS), like many jurisdictions around the world, has set renewable energy targets for both short and long-term energy generation. By 2015, the province of NS is aiming to produce 25% of its electrical generation from renewable resources, and 40% by 2020 (NS Department of Energy, 2010a). To meet these targets, the use of forest biomass for thermal combustion to energy processes has been recognized as one option that could help meet both short- and long-term goals (Adams & Wheeler, 2009). However, while approximately 77% of NS land area is forest covered (DNR, 2008), some stakeholders have expressed concern about the sustainability of this natural resource. The integration of a new market into the forest-products sector is cause for concern to stakeholders such as environmental non-government organizations (ENGOS), and excitement and hope for others.

This controversial topic inspired an investigation into the attitudes towards forest biomass held by one stakeholder group—the private woodland owners. 69% of the forested area in NS is privately owned and 51% is owned by small-woodland owners. These small-woodland owners will play an integral role in the future of NS's forest economy and sustainability. How these stakeholders feel about the forests, the alternative uses for forest biomass, and its use in large-scale energy production could have a significant impact on the future of forest biomass use - particularly for energy - in NS. This research seeks to understand the factors that may influence the acceptability of using biomass such as: a) the source of the biomass b) the harvest

method, or c) the end-product. The research also highlights the barriers and drivers as perceived by the woodland owners as they relate to the possibility of using more biomass for energy in the future.

To understand the context within which NS woodland owners live and form their opinions, the paper will first discuss three key areas: a) the current state of Nova Scotia's forest biomass energy supply; b) the forest economy, ownership and management practices; and c) the attitudes of five key stakeholder groups. These stakeholder groups are: government agencies; environmental non-governmental organizations (ENGO); industrial woodland owners; energy companies; and small-woodland owners. Following that, literature on the perceived benefits and barriers associated with increasing the use of forest biomass energy is summarized. Finally, the survey approach is delineated, survey results are analyzed, and a discussion of the key findings are related to and contrasted with themes in recent literature.

2.2. Background

NS, a province located on the eastern coast of Canada, is facing major challenges in meeting its energy security needs. Energy security, as stated by the International Energy Agency (IEA) (2004), is the ability to have an available supply of energy at an affordable price. The World Bank lists three key pillars of energy security: energy efficiency, diversification of energy supplies, and being able to manage price volatility (World Bank, 2005). When analyzed on all three pillars, NS falls quite short (Hughes, 2007).

Being a peninsular land mass, the province is virtually surrounded by the Atlantic Ocean. It has abundant wind (NS Department of Energy, 2011b), tidal (Fundy Ocean Research Centre for Energy, 2011) and solar (NRCan, 2011d) potential, as well as abundant forests for potential biomass production. Currently, however, 88% of NS's energy resources are based on imported fossil-fuel resources (Hughes, 2007; Adams & Wheeler, 2009), making NS energy insecure. The Government of NS is taking steps to improve its energy security by improving its renewable energy portfolio and, more specifically of interest to this research, its renewable electricity supply.

To meet the challenge of increasing renewable electricity generation from 12% to 25% by 2015, and to 40% by 2020, the Government of NS commissioned Dalhousie University to hold stakeholder consultations to explore a new renewable energy strategy for Nova Scotia (Adams & Wheeler, 2009). In the final report, biomass was included as an integral part of the new renewable energy mix. However, the report, and others, recognized the need for further research to ensure that sustainability concerns centred on biodiversity, conservation and existing forest management practices, such as clear-cutting, are properly addressed (Adams & Wheeler, 2009). So, while a market for biomass does exist, it was noted that the sustainability of the biomass supply and the acceptability of using forest resources for energy need further research.

In Canada, biomass energy is the second most prominent renewable energy source (second to hydro-electricity) reported at 6% of the total energy mix (NRCan, 2011b). Within industry, biomass is used to generate heat and electricity as well as to

produce ethanol. Large quantities of biomass are also used at the residential level for home heating, but are not currently measured in the NRCan data. In NS biomass provides: firewood for over 100,000 homes; fuel for biomass electrical co-generation facilities; fuel for heat energy systems within pulp and paper plants and two sawmills; raw material for pellet manufacturing; and as fuel for other wood-related industries to power their facilities (waste wood/production waste) (NS Department of Energy, 2010a). There are also several institutional users, including some in the planning and development stages. Most of the biomass being used in Nova Scotia for energy is *forest* biomass, and will be referred to simply as biomass for the remainder of the paper.

While many institutions are dedicated biomass users, other groups are opposed to using forest resources in this way. For example, one of many anti-biomass newspaper headlines reads: “Biomass project means big risks” (Brighton, 2010), and on April 13th, 2011 there was a press conference and rally organized by the Ecology Action Centre (EAC), a local ENGO, to oppose large-scale biomass operations (EAC, 2011). It is problematic for government and policy-makers trying to move forward with new technology and policy development when stakeholders have limited consensus about timber harvesting and forest management practices (Sanderson, Colborne & Beesley, 2000).

Since 2009, in conjunction with the legislation for new renewable energy targets, there has been an increasing amount of local media attention on the topic of using biomass for energy. Through the media, several stakeholder groups have expressed different opinions on the appropriateness of using biomass for electricity

generation at a larger scale (see Section 2.3). However, one stakeholder group, the small-woodland owners, had limited representation by any of the more vocal stakeholder groups. Sanderson et al. (2000) found, for example, that over 50% of the respondents to a province-wide survey targeting small-woodland owners had never really expressed their views on the use of Nova Scotia's forests in any active way. When discussed, it was not an action-centred engagement, but involved talking with friends, neighbours or other landowners about their concerns (Sanderson et al., 2000). As such, this study endeavors to address the gap; determining the views of small-woodland owners, highlighting both the discrepancies and agreements within that stakeholder group, thus revealing what they perceive to be the benefits of and barriers to pursuing a biomass energy agenda in NS.

2.3. Current Situation

2.3.1. Biomass Energy in Nova Scotia

Electricity from biomass is currently produced independently and either purchased by a monopoly private sector utility, Nova Scotia Power Inc. (NSPI), or used inside the industrial facility where it is generated. Currently it makes a minimal contribution to the grid, equivalent to the energy needed to power 7500 homes (NSPI, 2011). This is less than 1% of the total energy demand in NS and barely 2% of total electricity generation. Of the total renewable electricity generation in NS, biomass makes up about 13% of the 1690 GWh produced annually.

In comparison to another historically coal-dependent Canadian jurisdiction, the province of Ontario is attempting to phase out all coal-fired electricity plants by

2014 and is increasing the use of biomass and biofuels to achieve this goal. In 2009, Ontario produced 78% of its renewable energy generation (114 TWh) with biomass and is well on the way to achieving a coal-free electricity supply (Centre for Energy, 2011). While Ontario covers a vast area (107.6 million hectares) and is nearly two thirds forest (Ontario Ministry of Natural Resources, 2011), other parts of the world with a lot less forest or agricultural land are also increasing their use of biomass energy. In Denmark, which has only 11% of the total land forested, biomass currently fuels nearly 70% of renewable energy generation (Danish Energy Agency, 2011), and in Sweden (55% forest covered), biofuels, including peat, organic wastes and forest materials, represent approximately 65% of renewable energy supplies (Swedish Energy Agency, 2011).

Considering the abundance of forest resources available in NS (77% of the land is forested) a comparatively small amount of biomass energy is currently being used in the province. Other jurisdictions are clearly using biomass in a much more aggressive manner than is NS and meeting a large part of their energy supply needs with multiple biomass sources. Given NS's large available supply of biomass, if one considers the extensive manner in which other jurisdictions have been able to incorporate biomass into their energy portfolios, it seems that there should be room to further incorporate biomass as one alternative to coal-fired electricity generation.

2.3.2. Nova Scotia's Forests

NS has 4.3 million hectares of forested land and in 2009 and ownership of this land can be divided four ways: 3% federal, 29% provincial, 18% industrial private

and 51% small private (for a combined total of 69% private ownership) (NRC, 2011). There are more than 30,000 small private woodland owners in NS, defined as individuals owning between 2 and 2000 hectares of land (NS Royal Commission on Forestry, 1984). Given that private owners, in particular small-woodland owners, account for such a significant portion of the land in NS, they are of significant interest. Small-woodland owners can have influence at both the community and provincial level as the supply chain for biomass would rely heavily on their decisions to supply materials from their forests (Joshi & Mehmood, 2011).

Many industries in NS rely on forest products and forest-derived resources. In order of financial significance, this includes: the paper-and-pulp industry; the saw-timber industry; the wood-pellet industry; and the Christmas-tree and maple-syrup industries (categorized as “other” industries in Table 2). There are also significant numbers of wood exporting businesses in NS (Table 2).

Table 2 – Number of operational businesses		
Business Type	2009	% of total wood harvest
Firewood Sales	14	0.4%
Other	12	2.4%
Pulp/Paper Mill	3	41.0%
Sawmill	185	51.3%
Wood Export	27	4.9%
Total	241	100.0%

(Source: Registry of Buyers, DNR, 2010)

Wildlife and land conservation are becoming increasingly important for preserving biodiversity and protecting at-risk species, therefore influencing the industrial management of forests (DNR, 2011). Stricter regulations are being demanded of the forest industry in terms of land management and harvest practices,

such as limiting the amount of clear-cutting to no more than 50% (DNR, 2011). In NS, clear-cutting has been a long-running concern for ENGOs such as the EAC whose “Forest biomass energy position statement” asks for strict limitations on clear-cutting (EAC, 2011b). However, what is less clear is whether attitudes towards using biomass for energy are separate from feelings towards clear-cutting and other timber-harvest practices. Separating these issues is part of the challenge of understanding public and woodland owners’ attitudes towards using biomass for energy.

2.3.3. Stakeholders

As previously mentioned, the stakeholder groups at play in this debate number at least five: government agencies; ENGOs; industrial woodland owners; energy companies; and small-woodland owners. They are considered key actors due to their ability to either influence policy outcomes or to be affected by them.

Government:

In Canada, provincial governments manage most natural resources and have authority over them. However, at the federal level, Canada is attempting, under the Kyoto Protocol, to reduce GHG emissions by 5% of 1990 levels over the period 2008-2012 (United Nations Framework Convention on Climate Change, 2011). The Kyoto agreement was a catalyst for the provincial government of NS to focus on developing new energy policies. Within the Government of NS, three departments are integral to energy decision-making: the Department of Environment; the Department of Energy; and the Department of Natural Resources. To support this decision making, there are two primary pieces of legislation. In 2009, the Government of NS

developed the Climate Change Action Plan (Government of NS, 2009) and then developed the Environmental Goals and Sustainable Prosperity Act (EGSPA) in 2010 (Government of NS, 2010).

The Climate Change Action Plan lists three actions (actions 15, 16 & 17) which are directly linked to future biomass potential production. The intent of the actions is to: develop a bio-resource strategy; provide funds for future feasibility studies of biomass for energy generation; and support development of other uses of biomass (Government of NS, 2009). The intent of the actions will help redefine what is acceptable in terms of using biomass for energy. EGSPA, on the other hand, defines the legal limits and obligations of NS to meet climate change mitigation strategies. Limits on GHG emissions, guarantees of land protection (12% by 2015), and renewable energy targets are all significant influencing factors when considering the addition of more biomass-based generation facilities to the electricity grid of NS (Government of NS, 2009).

The NS Department of Energy's most recent and significant plan, which overlaps with the work of the Department of Environment, is the Renewable Electricity Plan 2010 (NS Department of Energy, 2010). The plan reiterates the dedication of the Government of NS to reduce GHG emissions and significantly increase the renewable energy portfolio of the province by developing a more diversified renewable electricity generation plan.

Finally, the NS DNR released a new Natural Resources Strategy (NRS) in August 2011, which impacts biomass development rules and regulations. This strategy prohibits whole-tree harvesting, limits annual harvest amounts, and sets in

motion regulations to reduce clear-cutting from 96% to 50% over a five-year period (DNR, 2011). These new regulations might alter the biomass supply chain, therefore affecting future biomass energy developments. This may also affect people's attitudes towards using biomass for energy production if they are indeed linked to clear-cutting or other timber-harvest methods. Considering the inclusion of biomass-specific actions in NS's climate-change mitigation plans, and a high level of interest in using biomass for energy among all three government departments, it can be stated that the Government of NS is fully invested in the potential exploration and development of using more biomass for energy in NS.

ENGOS:

While many ENGOS have expressed interest in and/or concern for the biomass issue, the EAC is recognized as being the voice of interest groups either concerned with or opposed to biomass energy developments. For example, in April 2011, a rally organized by the EAC to oppose large-scale biomass for electricity operations was reportedly supported by 54 independent environmental, conservation and interest groups across the province (EAC, 2011). These ENGOS were looking for a commitment from the government to follow through on promises to reduce clear-cutting by 50%, put an end to whole-tree harvesting, and put a cap on the annual allowable cut. However, even if the government does follow through on its promises, it is not clear whether the ENGOS will be wholly satisfied as the opposition to using biomass for energy runs deep for many groups. For example, some members of the EAC hold the stance that biomass for electricity is neither sustainable in the long term nor is it carbon-neutral (EAC, 2011). Therefore these types of issues will need to be

clearly addressed before they will support moving forward with biomass energy projects.

Industrial Woodland Owners:

The industrial woodland owners control 18% of the forest land in NS. NewPage, a US-based company with a pulp-and-paper facility located in Port Hawkesbury NS, has received significant media attention due to the construction of a CHP plant at that location. In partnership with NSPI, NewPage is installing a 60 MW (525.6 GWh annual production capacity) CHP facility; the sale of its electricity back to the grid was recently approved by the Utility and Review Board (UARB, 2010). NewPage states that this project will contribute an additional 3% to NS's electricity supply (NewPage, 2011), which would bring the total amount of biomass-based generation up to 746.6 GWh annually, increasing biomass's contribution to renewable electricity generation from 13% to 34%.² The NewPage project is an example of the capacity of industry to move forward with biomass projects in the future and their interest and dedication to the idea.

Energy Companies:

NSPI, a branch of Emera Company, is responsible for 95% of NS's electricity generation, transmission and distribution (NSPI, 2011). As an integral stakeholder in the biomass debate, it is primarily concerned with meeting the renewable energy targets mandated by the Government of NS. NSPI has taken guidance from a stakeholder engagement process completed in 2009. This process focused on developing a better understanding of the expectations and desires of Nova Scotians in

² NewPage pulp-and-paper facility recently released information about a pending shut-down which would affect the development of the new CHP plant.

relation to meeting the intended renewable energy targets set at 25% by 2015 and 40% by 2020 (Adams & Wheeler, 2009). The process involved over 400 stakeholders across the province and concluded that NSPI should pursue a low-risk, low-cost strategy. This would include increasing its wind-power generation at both industrial and community scales, as well as introducing feed-in tariffs and net-metering strategies (Adams & Wheeler, 2009). The recommendations suggested integrating more biomass into the energy mix – including co-firing with coal in existing thermal generation stations – at a level of generation up to 500GWh, if it could be done sustainably (Adams & Wheeler, 2009). NSPI has a vested interest in increasing its renewable energy portfolio (with or without biomass) relatively quickly to avoid penalty from the government for failing to meet both renewable energy generation targets as well as GHG emission reduction requirements.

Small-Woodland Owners:

The challenge of capturing the attitudes of small-woodland owners is their large number; complicated by their predominantly rural location it makes them difficult to engage with. Small-woodland owners account for a significant portion of woodland ownership in NS—and given that research suggests they are unlikely to take action to adequately express their views on NS forests (Sanderson et al., 2000)—it is essential that a suitable method of engagement is found that sufficiently captures their input. While some small-woodland owners might be represented by other agencies or find themselves affiliated with either industry or ENGO's, as a separate cohort they have not been given independent representation.

2.4. Perceived Benefits and Barriers to using Forest Biomass for Energy

In the literature, the perceived benefits and barriers of using biomass for energy can normally be categorized as environmental, economic, social or political issues (Table 3). For example, carbon sequestration from the growth of forest biomass is seen as a benefit (McKay, 2006), while carbon emissions released from forest biomass processing are seen as a barrier to its use (Monroe & Oxarart, 2011). The carbon status of forest products depends on multiple factors such as the nature of the harvest material, or whether the forest is being regenerated naturally or otherwise (Johnson, 2009). Whether burning biomass is viewed as a sink or a source is complicated—each case needs independent calculation (Johnson, 2009).

	Environmental	Economic	Social	Political
Benefits	Reduced GHG emissions Replacement of fossil fuel- dependence Carbon sequestration	Creation of a new market for low-value products Eligibility for renewable energy subsidies Emissions trading opportunities	Rural development Decline in fuel-poverty Rural job opportunities	Ability to meet GHG emission targets Ability to meet renewable energy targets Improved energy security
Barriers	Maintaining a sustainable forest ³ Ecosystem destruction and biodiversity loss ³ Increased carbon emissions ³	Transportation and infrastructure costs ³ Unsustainable supply-chain ³ Inefficient processing and conversion technologies ⁷	Controversies over biomass plant citings ⁴ Lack of education on biomass and bioenergy ⁶ Fear and mistrust of industry and government ⁴	Harvest regulations that are too strict or too lenient ⁵ Anti-biomass propaganda efforts ⁷ Biomass energy generation caps that are too low or too high ⁸

Benefits -- McKay, 2006

³ Monroe & Oxarart, 2011

⁴ Upreti & van der Horst, 2004

⁵ NSDNR, 2011

⁶ Upreti, 2004

⁷ Gautam, Pulkki, Shahi & Leitch, 2010

⁸ NS DOE, 2011

Similarly, while maintaining forest sustainability is viewed by many as a significant barrier to using biomass for energy (Monroe & Oxarart, 2011), others see using biomass as a way to restore unhealthy forests (Noss et al., 2011). Improved energy security has been cited as one of the benefits of incorporating more biomass into the energy mix in other jurisdictions (McKay, 2006), but this too is not straight forward. The Asia Pacific Energy Research Centre (APEREC, 2007) uses a framework listing four “A’s” by which to measure energy security—accessibility; availability; affordability; and acceptability. This fourth “A” in the framework interferes with the successful integration of biomass energy in NS.

Acceptability has been a significant barrier for the continued use of several other types of energy, particularly fossil fuels. As coal is becoming less acceptable due to growing concerns about emission-related health issues and the impacts of GHG emissions (Jardine et al., 2007), renewable resources are increasing in popularity, demand and use (BP, 2010). The rising popularity of renewable resources has resulted in new research into the acceptability of technologies such as wind energy (Cass & Walker, 2009) and agriculturally derived bio-fuels (Selfa et al., 2009). However attitudes towards other renewable energies are not necessarily transferable to biomass energy projects and developments.

While there is only a small and very new body of research on attitudes towards forest biomass energy specifically, recent research has measured woodland owners’ attitudes towards biomass, their knowledge on the subject, and their willingness to supply wood to produce energy from biomass (Monroe & Oxarart,

2011; Joshi & Mehmood, 2011). What is missing from those projects are queries about the impact of different harvest methods, source selections and end uses. Opinions and attitudes about biomass use may be much more embedded in the harvest practices or source selections than in the end use (such as energy). So far this has been a gap in the literature on the topic.

2.5. Methods

2.5.1. Surveys

Mail-out surveys were sent out, with pre-paid return postage, to 2937 small-woodland owners in three select counties: Annapolis, Antigonish and Colchester. Small-woodland owners are defined as anyone owning between 2 and 2000 hectares of land (NS Royal Commission on Forestry, 1984). The DNR landowner database was used to acquire the names and addresses of all applicable woodland owners in the three counties and a stratified sample was taken from each cohort. The three counties were chosen (out of 18) to represent the eastern, central and western forestry regions in the province (Table 4). They were also selected to examine the differences in attitudes between counties that have either more industrial harvest activity (Annapolis), more small-woodland owner harvest activity (Colchester), or marginal activity at both levels (Antigonish).

Table 4 – Percentage of total provincial harvest by county in 2009					
County Name	Forestry Region	Crown Land	Private Land	Industrial Land	Total Harvest
Annapolis	Eastern	1%	3%	21%	6%
Antigonish	Western	2%	2%	<1%	2%
Colchester	Central	4%	17%	3%	12%

(Source: Registry of Buyers, DNR, 2010)

The survey was divided into three sections to obtain data about the following:

1. Land ownership and management
2. Woodland owner attitudes (e.g. towards biomass for energy, harvest practices, end-uses of forest products; benefits and barriers)
3. Demographics

Where appropriate, a Likert scale (1 to 5) was used to measure participant responses to questions related to factors such as the acceptability or significance of each item in the question. Otherwise, space was provided for written responses to questions. The survey generally followed Dillman's method; however, due to budget constraints, reminder post-cards were not sent. It is expected that this influenced the response rate (Dillman, Smythe & Cristian, 2008). Of the total number of surveys sent to the three counties, 238 surveys came back as "return to sender", while 489 completed surveys (190 from Annapolis, 92 from Antigonish and 207 from Colchester) were returned in the allocated time-frame of eight weeks. Fifteen surveys were received after the allocated time-frame and were not analyzed. The average response rate was 18% for the total cohort, not including the "return to sender" mail.

2.5.2. Focus Groups

In addition to the surveys, focus groups were conducted in the same counties chosen for the mail-out surveys. The intent was to provide additional insight and context to the information gathered from surveys. In total, fourteen participants took part in three, two-hour discussions about the best uses of forest products and the

benefits and barriers to using community-owned electricity generation stations that use forest biomass. Participants were recruited with the help of the local Regional Development Authority in each county. While participants were required to be interested in the topic of biomass for energy, they did not need to have specific expertise in this topic area. The intent was to capture the knowledge and opinions of rural community members on the subject.

2.6. Survey Results and Analysis

Both Microsoft Excel (Liengme, 2009) and Minitab 16 (Bryman & Cramer 1996) were used for basic descriptive statistics while Minitab 16 was used to perform two non-parametric tests, the Mann-Whitney and Spearman's Rho. The Mann-Whitney confidence interval and test procedure was used to make inferences about the differences between medians, and Spearman's Rho was used to measure the association between variables based on the ranks of the data values (Bryman & Cramer, 1996).

2.6.1. Analysis of Descriptive Statistics

The majority of survey respondents were male (80% Annapolis, 93% Antigonish and 83% Colchester) and over the age of 60 (Figure 1). About a third of respondents were either college or university graduates (26%, 37%, & 33% respectively), or had some post-secondary study.

These demographic results are consistent with other survey results from NS (Sanderson et al., 2000) and in other jurisdictions (Joshi & Mehmood, 2011), and there was little variation between all three counties. Joshi and Mehmood (2011)

surveyed non-industrial private forest landowners (NIPF) in three southern US states (Arkansas, Florida and Virginia) and found that the majority of respondents were between the ages 45 and 65, followed closely by those over 65. Approximately half of their participants were retirees, and had similar levels of college or university education.

The age and education of the participants is particularly important for policy-makers and planners. A better understanding of this demographic will influence how interests groups communicate, educate and connect with private woodland owners in the province, thereby, theoretically, facilitating quicker and more effective policy planning and implementation.

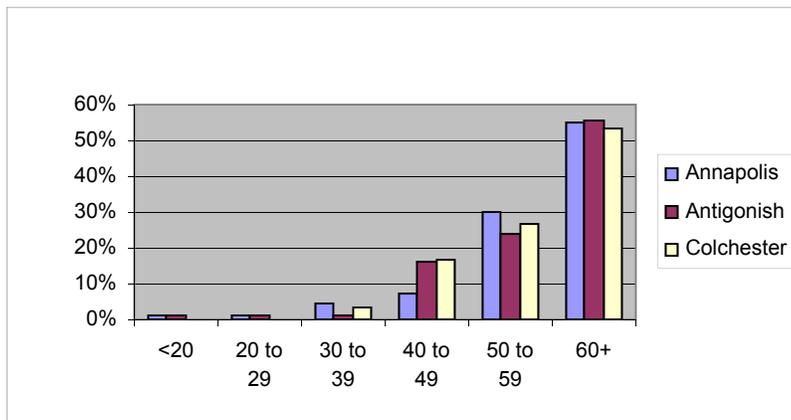


Figure 1: Age of respondents

2.6.2. Analysis of Woodland Ownership and Management Statistics

Land ownership was reported in acres, converted into hectares and then assigned to one of four categories (0-19, 20-39, 40-80 and >80 hectares) for each respondent. Results did not vary significantly among cohorts and are presented in

aggregate. The total amount of land owned by the survey participants was 27,512 hectares. The majority of participants owned less than 20 hectares of land, but that land only represents 5% of total reported land ownership.

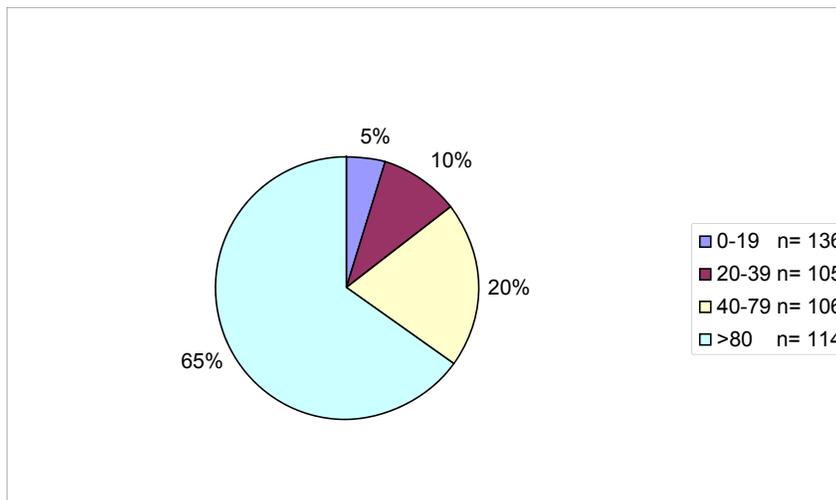


Figure 2: Land ownership in hectares

The majority of participants either lived on their property (48%, 47% and 34%) or within 10 km (21%, 29% and 27%). While only a small number of participants said that their woodland was their primary source of income (4%, 1% and 7%), a number of participants suggested that they do extract some level of income from the commercial harvesting of their property (45%, 60% and 52%).

It was identified using the Mann-Whitney test that participants in Annapolis reported the income from their woodlands at a significantly lower level of importance ($\alpha = .05$) than woodland owners in both Antigonish and Colchester. So while there is a greater amount of industrial forest harvesting taking place in Annapolis (table 3), the small-woodland owners in this region do not appear to be reaping the financial

benefits, or have more frequently chosen other occupations to generate income since this group did have the highest number of university graduates.

Most participants have harvested timber from their woodland for personal use (68%, 67% and 62%), listing firewood/home-heating (n=217), lumber (n=79), fencing (n=11), Christmas trees (n=10), or salvage (n=6) as the reasons for that harvest. In Annapolis, fewer participants said they harvested wood for sale than for personal use (44%). However, in the other two counties, at least an equal number of participants (or more) stated that they harvested wood for sale more so than for personal use (70% and 62%). There is a significant difference ($\alpha = .05$) between how many participants in Annapolis harvest wood for commercial use than in both Antigonish and Colchester.

When wood was harvested for commercial use, most participants stated either lumber or pulp and paper as the primary uses of the product harvested. However, there were more than a few participants who responded that they did not know the primary use. No one selected biomass.

The proportion of participants with written forest management plans varied by county (20%, 40% and 30%) and on average these plans were written in the mid-1990s. This average (30%) is just slightly higher than results from 1990 where 27% of woodland owners had written management plans (Sanderson et al., 2000). The majority of participants who had a management plan did use it to guide management (83%, 82% and 78%). One factor which could be contributing to the low incidence of written management plans in Annapolis (20%) is the lower levels of income from forest land. These two factors are moderately related ($r=.37$) when analyzed using

Spearman's Rho, indicating that if woodland owners report higher levels of income, they are more likely to have a written forest management plan, and vice versa. This appears to be the case for Annapolis (see section 6.4 for further discussion of Spearman's Rho analysis).

2.6.3. Analysis of Woodland Owners' Attitudes

A Likert scale was used to assess the attitudes of woodland owners regarding a number of issues about harvesting techniques, biomass sources and end-uses. With one exception, the results did not significantly vary among cohorts. The one question that produced a significant difference between counties was the acceptability of clear-cutting. While the median was the same for all three cohorts (1- unacceptable), when using the Mann-Whitney test there is a significantly larger proportion of participants who chose 1 in Annapolis ($\alpha = .01$) than in the other two counties. The rest of the results are presented in aggregate.

Participants were first asked to answer how acceptable it would be to use different biomass sources (Table 5). Whole trees were selected as the least acceptable source, followed by tree stems only. In contrast, using dead or dying trees, as well as trees subject to insect infestations, were rated as the most acceptable. This question was of special importance since feelings on this topic have not been previously measured or addressed in the literature.

Some participants are opposed to using wood for energy no matter what the source of the biomass (n=45 participants responded 1 in all categories). However, while some people appear diametrically opposed to using biomass for energy, the

results suggest that if the biomass source were waste material or deadwood, then using biomass for energy appears to be more acceptable (Table 5).

It was originally hypothesized that different end uses of biomass will likely vary in acceptability. This research measures differences in opinion on: a) how woodland owners feel about the *end uses* of forest biomass; and b) why the end use may matter, regardless of the source. This differentiation could help policy-makers directly address the issues which are of most importance to woodland owners.

Table 5 - Survey respondents' ratings of the acceptability of using the following products for biomass energy		
	Median	n
Whole trees	1	428
Tree stems only	2	397
Over-mature hardwood	3	437
Branches, stumps and tops	3	439
Slash or harvest residue	3	426
Short rotation woody crops	3	386
Over-mature softwood	4	438
Thinning residue	4	433
Low-quality wood	4	439
Process residue	4	394
Dead or dying trees	5	455
Trees affected by insect infestations	5	456
1 = completely unacceptable 5 = completely acceptable		

The acceptability of different end uses for forest products varied greatly (Table 6). Converting wood into ethanol or other liquid fuel was the least acceptable option, but many participants also either did not answer the question or responded that they did not know (as indicated by the low n=383). This suggests a lack of knowledge on the subject of biomass or of new technologies in general.

Table 6 - Survey respondents' ratings of the acceptability of different end-uses for wood harvests		
	Median	n
Converted into ethanol or other liquid fuel	2	383
Made into pellets and shipped abroad	3	452
Burned in an industrial plant for electricity only	3	452
Burned in an industrial plant for heat and electricity	3	453
Burned in a community plant for heat and electricity	4	452
Made into pellets and used locally for home heating	5	465
For pulp and paper	5	460
As fire-wood	5	463
For lumber	5	465
1 = completely unacceptable 5 = completely acceptable		

Another point worth noting is that 'burning wood in a plant for electricity only' has the same median as 'being burned in an industrial plant for heat and electricity' (both median = 3). Again this indicates either a lack of knowledge about the efficiency and application of new technologies combining both heat and electricity, or an ambivalence towards efficiency. Further emphasizing the ambivalence towards the possible uses of biomass is that a number of woodland owners who sell wood commercially do not know where it goes after harvest (5%).

There were also significant differences in opinion on the acceptability of different forest management and harvest practices (Table 7). Clear-cutting and old-growth harvests were the least acceptable, while selection harvesting and commercial thinning were the most acceptable. These results are consistent with NS woodland owner survey results from the year 2000 where many participants thought clear-cutting should be banned, but found it was acceptable in dead or dying stands, or in other special circumstances. Selection harvesting or partial cutting were also the

avored practices by the majority of survey respondents in the report from 2000 (Sanderson et al., 2000).

Table 7 - Survey respondents' ratings of the acceptability of harvest and management practices for biomass production		
	Median	n
Clear-cutting	1	457
Old growth harvest	1	445
Whole-tree harvest	2	421
Short rotation biomass plantations	3	419
Stem-only harvest	3	400
Commercial thinning harvest	4	441
Selection harvesting	5	458
1 = completely unacceptable 5 = completely acceptable		

Survey respondents were also asked to rate a list of barriers to using more biomass (Table 8). Maintaining a sustainable forest was the number-one barrier, yet all other barriers were also rated as moderate or strong. There was little difference between responses to this question as every option was seen as at least somewhat of a barrier to using more biomass. Soil degradation, erosion, and biodiversity loss were also mentioned by several survey respondents as additional barriers and are all related to maintaining a sustainable forest. These additional comments re-emphasize the importance of forest sustainability. These results are similar to those found in Monroe and Oxarart (2011), where survey respondents selected loss of local forests as their biggest concern on the matter. This is an issue that will need to be thoroughly addressed by biomass for energy advocates and policy-makers.

Table 8 - Survey respondents ratings of barriers to using biomass for energy		
	Median	n
Transportation costs	2	394
Maintaining a sustainable forest	1	412
Transportation distance to commercial plants	2	399
Available supply of forest products	2	403
Public acceptance	2	401
Commercial value of other forest products	2	384
Harvest costs	2	387
1 = Strong barrier 5 = Not a barrier		

2.6.4. Analysis of Results from Spearman's Rho

Using Spearman's Rho to measure correlations between respondent's answers to the various questions resulted in several important observations. Any results below .32 are rated as a weak relationship, and are not discussed in this paper. An outcome between .33 and .65 is rated as a moderate relationship, the most significant of which are noted and discussed. Anything above .66, which is considered a strong relationship, is discussed at the end of this section.

Results show that the more woodland the participants owned, the higher they rated the importance of income ($r = .50$). This also increased the likelihood that they had sold wood for commercial sale ($r = .41$) and it was more likely that they had a written forest management plan ($r = .40$). Further, higher acceptance of clear-cutting was moderately related to an increased importance of income from woodland ($r = .34$) and an increased likelihood of selling wood commercially ($r = .35$). The relationship between clear-cutting, income and commercial selling is not surprising as 96% of all NS lands are harvested by clearcutting (DNR, 2011).

The acceptability of burning wood in an industrial plant for heat and electricity was strongly related to two other variables: burning wood in an industrial plant for heat only ($r = .90$), and being burned in a community plant for heat and electricity ($r = .83$). The relationship between these variables is rather strong and this reinforces the idea that participants either believe these options to be similar, or they do not care or know the differences of the relative efficiencies of the technologies.

There were also strong relationships between the acceptability of using different sources for biomass. Using thinning residue, process residue, and slash or harvest residue were all strongly positively related to one another ($r = .73, .75$ and $.75$). This result could be an indication that participants view these options as all very similar to one another. On the contrary, participants might believe that using left-overs from any harvest or process is equally acceptable.

Removal of 'whole-trees' from forest sites will possibly be prohibited in NS (excluding Christmas trees) in order to maintain soil quality and biodiversity. According the latest Natural Resources Strategy the rules for whole tree harvesting will be part of ongoing legislative review and policy engagement (DNR, 2011). This means that branches, stumps and tops may have to be left on the forest floor to conserve nutrients. Therefore, it is somewhat surprising that woodland owners would rank using slash or harvest residue so similarly to thinning and process residue when it is considered bad for the forest environment. This result is inconsistent with the fears many participants had about maintaining forest sustainability.

2.6.5. Focus Group Analysis and Discussion

Better communication between government, industry, woodland owners and the general public will facilitate more-cooperative and -effective action. Focus-group results show a similar need for education and clearer communication. Focus-group participants were asked to give their individual definitions of forest biomass. There were many different definitions and it was difficult for anyone to articulate one in just a few sentences. Most participants included concepts such as living or organic matter, but other participants described it as ‘unmerchantable wood’ or a ‘comodifiable substance’.

In a survey by Tagashira and Senda (2011), in metropolitan Tokyo Japan, out of 1631 participants 66% selected the correct definition for biomass only—‘resources derived from living things such as animals and plants (excluding fossil fuels)’. These participants who answered correctly were also asked to select whether biomass was a technology (response rate = 42%) or a resource (58%). This suggests widespread confusion on the topic which needs to be addressed, primarily by the governments as they are the bodies making the legislation around biomass energy. In the words of one focus group participant, ‘it is important to agree on a definition and the government needs to take the lead; there need to be rules and laws that are clear for everyone to understand’.

To better understand how woodland owners and community members understand some of the available biomass technologies, focus-group participants were asked an open-ended scenario-based question: ‘If given the opportunity to have a community-based biomass plant for converting wood to electricity only, how would

this opportunity impact their community’? Most participants thought it would be good for their community, good for jobs, and good for the economy. When asked if there was a better option, multiple participants stated that using wood for electricity only was not a good idea, although this was not reflected within the survey participants.. CHP was mentioned by one group as a better option, if done at the community level. It was also mentioned in one group that other energy sources, such as wind or tidal, would make more sense altogether. These responses do reinforce the idea that there are widely different levels of knowledge about biomass technologies and opportunities, and many different points of view on the topic.

Another theme which appeared from the question about end uses was preference for keeping both the resources (i.e. wood) and the products created from them (i.e. electricity, heat, pellets etc.) local. This is evident from survey respondents’ preferential rating of using pellets locally (median = 5) rather than shipping them abroad (median = 3). Focus-group participants were also asked how they felt about exporting biomass resources such as pellets. Most participants said they did not like it, and one participant plainly said that it was “stupid”. Others recognized biomass exports as a good starting point, or conceded that wood should go to the best market available. However the general consensus was a preference for the resources to stay in the communities or regions. High transportation costs and a need to boost local economies were two primary reasons.

Dwivedi and Alavalapati (2009) conducted research in the Southern U.S. on the threats associated with a biomass energy future. They found that competition from other renewable energy sources and competition with the conventional forest-

products industry were seen as major threats, while damaging forest ecosystems was not (Dwivedi & Alavalapati, 2009). So while this research shows that concern for forest sustainability is a strong barrier, there is other research that shows this to be a non-issue among stakeholder groups. Dwivedi and Alavalapati (2009) concluded that all stakeholder groups were generally in favour of forest biomass energy development (this included NGOs). So while small-woodland owners and the general public in NS have mixed feelings on the subject, other regions view biomass energy as more mainstream and acceptable.

2.7. Conclusions

Multiple factors influence people's attitudes towards using forest biomass and forest products for energy and other uses. The survey of small-woodland owners provided a better understanding of the major concerns about using biomass for energy such as forest sustainability and provided insight into potential opportunities. Results from the focus groups provided more in-depth information than the surveys could offer. Both methods highlighted the importance of local resource use to Nova Scotians, and both the surveys and focus groups drew insight into the level—or lack of—knowledge about biomass technologies and opportunities.

A closer look at the significant differences found between regions is an area for future research. Do areas with higher industrial capacity and a greater degree of industrial forestry correlate with more-negative attitudes towards clear-cutting and industrial scale biomass-to-energy facilities, and if so, why? The individual sample size of each county was too small to indicate any powerful relationships between

attitude variables and further research with a larger sample size would be necessary to make any conclusive statements on the nature of significant differences between counties.

It can be concluded that there needs to be more dialogue and agreement on the language and the terminology used among the forest sector, energy sector and public domains to foster more robust discussions and better understanding among parties. For example, the word “biomass” itself has multiple understandings, and the use of that term can be misleading for people unless clearly defined. Opportunities, benefits and barriers cannot be discussed properly if no one is sure they are talking about the same thing.

Further, forest sustainability was raised as an issue and barrier for the development of biomass projects by the majority of both survey respondents and focus group participants. However, forest sustainability is yet another term which can mean many different things to different people. In research by Urquhart (2008), woodland owners were classified according to their ownership values and on their responses to questions about different factors associated with forest sustainability and forest management. Four types of woodland owners were found and are categorized as: the multifunctional owner, the self-interested owner, the hobby conservationist and the custodian (Urquhart, 2008). While this research did not use Urquhart’s classification system, future research might find that depending which category a woodland owner belongs to, it might influence their responses to many of the questions about attitudes towards using biomass for energy.

To conclude, there are many areas for future research with small-woodland owners and rural community members on the topic of biomass energy. Also, both small-woodland owners and rural community members need to be informed not just on the benefits and opportunities for biomass energy, but on many of the obstacles and fears of their peers. Open and honest dialogue, including an update on current technologies and lessons on efficiency, will help facilitate better communication between all parties for more effective policy development.

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CHAPTER 3 ENGAGING STAKEHOLDERS ON FOREST BIOMASS – INFORMATION GAPS AND VALUED COMMUNICATION CHANNELS

3.1. Introduction

Forest biomass is one of the oldest natural resources which humans have learned to use to meet their basic energy needs for reasons such as cooking food, and providing heat for comfortable shelter. In recent decades, society has become better able to manipulate the utility of forest biomass, changing its form and function to suit shifting societal needs and demands (Klass, 1998). With increased demand for energy and electricity, forest biomass is being included in energy portfolios at a greater scale both in form and function (Beyond Petroleum, 2010) being converted into different energy forms primarily through thermo-chemical means (Balat et al., 2009). The thermal generation sector has the largest capacity of all biomass energy generation sectors and is forecast to have the quickest development and growth (Knight & Westwood, 2004).

With new technologies being developed and renewable energy becoming a bigger priority for many jurisdictions (International Energy Agency, 2011), the discussion around biomass energy research (not just forest biomass) has increased dramatically in academic literature over the last three decades (Table 9). Media attention to the topic has risen dramatically as well (Monroe & Oxarart, 2011). As illustrated by using the online database Factiva, in 2010 alone, 83,809 articles were found to contain the keywords biomass, biofuel or bioenergy (Table 9). This is nearly seven times the number found between the years 1990 and 1999. However, rising interest in biomass energy does not mean it is actually rising in popularity; much

conflict and debate on the topic have ensued, facilitating the rapid growth in the volume of both academic and grey literature (Table 9).

Table 9 - Number of articles found using the search terms: biomass, biofuel and bioenergy				
	1980-1989	1990-1999	2000-2009	2010
Sciencedirect*				
biomass	2,731	8,492	18,941	3,211
biofuel	24	197	1,404	622
bioenergy	22	333	857	183
total	2,777	9,022	21,202	4,016
Factiva				
biomass	858	11,258	117,614	53,628
biofuel	25	643	70,273	21,480
bioenergy	22	555	19,149	8,701
total	905	12,456	207,036	83,809
*the search performed using science direct was for keywords, abstracts and titles only				

Source: Sciencedirect academic journal database & Factiva news and media search engine

Given the increased interest and dialogue around biomass, this research focuses on developing a better understanding of the ways information is shared, exchanged or even misunderstood. This research explores the nature of communication and information on the topic of forest biomass (henceforth referred to simply as biomass) for energy, using Nova Scotia (NS) as the research study area. NS is the ideal research area for several reasons:

- multiple stakeholder engagement processes have recently taken place in NS on the topics of renewable energy and natural resources and both incorporate biomass objectives;
- there have recently been major changes in renewable energy and biomass policies and targets;

- there is rising media attention on forest biomass issues;
- there is an increasing volume of both academic and industrial interest and research;
- there appear to exist vocal opposition groups to biomass energy developments in NS; and
- both the forest and energy industries play a major role in the NS economy.

Such a dynamic context suggests that there are many lessons to be learned from understanding the successes and failures in communication and information transfer between interested stakeholder groups.

There are two important factors to consider when determining who the stakeholders are: a) what individuals, groups or organizations have the ability to affect actions; and b) who might be affected by any resulting policy changes (Reed et al., 2009). Whether or not some stakeholders have an interest in the outcome from policy development processes, if they have the power to influence what happens during or after a political decision process, then they must be consulted during stakeholder engagement processes (Reed et al., 2009).

One integral stakeholder group in the development of biomass policy is the small-woodland owners. Currently 51% of forest land in NS is owned by small-woodland owners (defined as anyone owning between 2 and 2000 hectares) (NS Royal Commission on Forestry, 1984). Whether they have an interest in the subject of biomass energy or not small-woodland owners have the power to affect decisions and to be affected by political outcomes. According to prior research, the majority of

respondents to a survey of small-woodland owners from NS had never taken any action to discuss their opinions on the use of Nova Scotia's forests in any capacity (Sanderson, Beesley & Colborne, 2000).

Recent research in other jurisdictions measured concerns about using biomass for energy within single-family home-owners from Alachua County (north-central Florida). In order of highest ranking, their concerns were: loss of local forests, increased air pollution, higher costs of electricity, increased traffic from wood delivery, increased competition for wood and increased noise from plant operations (Monroe & Oxarart, 2011).

Recent research on forest biomass is beginning to focus on some of the social issues around public concern, knowledge and public participation however there are still some missing key components. Opinions and attitudes may be much more embedded in the harvest practices or source selections than in the end-uses (such as for energy) themselves or vice-versa, but so far this has not been measured in the literature.

Of further concern is not only the lack of knowledge in the general public but the knowledge of the woodland owners themselves. In NS, small-woodland owners and rural community members may have contributed to stakeholder engagement opportunities yet their attitudes towards biomass and knowledge level on the subject have not been measured by formal research methods.

Another driving factor in this research was concern from Nova Scotia Power Inc (NSPI), the primary electricity provider in NS (Nova Scotia Power, 2011), that the small-woodland owners were not being represented during stakeholder

engagement sessions. NSPI can be directly impacted by the policy decisions made around biomass as it influences the options around renewable energy developments. As such, NSPI provided support for university-led research of small-woodland owners, to garner critical information on the topic. This interest and concern from NSPI coupled with an evident gap in the literature, was strong reason to pursue this research agenda.

By reviewing the outcomes of the various stakeholder engagement processes, concurrent media news around this topic, recent academic literature and results from a survey of small-woodland owners and community focus groups, the value of various communication channels are explored. The culmination is a better understanding of what small-woodland owners and rural community members view as the most important issues to address in terms of integrating more biomass into energy policies. Further, this research gives insight into how these groups of citizens seek information and respond to engagement on forest biomass for energy.

3.2. Stakeholder Engagement

Stakeholder engagement, public participation and community involvement – these are just a few names for similar approaches in policy development processes that aim to counteract or mitigate for traditional ‘top-down’ bureaucratic approaches (Beierle & Cayford, 2002). By whichever name, the desired outcome is essentially the same—to incorporate multiple stakeholders or ‘publics’ input in the policy-making process. Historically, the primary purpose of participation processes was to make governments accountable for their decision making: “to ensure that government

agencies were acting in the public interest” (Beierle & Cayford, 2002, p. 5). However this process has evolved and is no longer just about accountability but requires stakeholder participants to fully contribute to the development and substance of policies (Beierle & Cayford, 2002). The process can improve trust between actors (Rayner, 2010; Ricci, Bellaby & Flynn, 2010) and can improve transparency and accountability of not just the government agency but of the stakeholder participants as well (Zoellner, Schweizer-Ries, & Wenheuer, 2008; Mendonca, Lacey & Hvelplund, 2009).

Stakeholder engagement processes are becoming more main-stream and are growing in importance (Beierle & Cayford, 2002). However, according to Owens and Driffill (2008), when it comes to energy policies, there is still a “need for more interactive, deliberative communication between decision-makers, technical experts, other stakeholder and the public” (p. 4414). Further, even when these processes take place, there is often concern about the quality of the decisions being made as a result (Beierle, 2002). However, in a “case survey” which reviewed 239 case studies that involved stakeholders in environmental decision making processes, it was found that 76% of the cases had stakeholders contributing useful/new information and innovative ideas, many of which contributed to quality decision making (Beierle, 2002).

Engaging with the public about controversial topics (e.g. biomass use) is essential in policy development processes. However, when background knowledge about issues is low, if given the opportunity, under-informed citizens can potentially influence policy decisions in unhelpful ways (Monroe & Oxarart, 2011). For

example, despite lack of knowledge (less than 5% of respondents to the Monroe and Oxarart study considered themselves to be very knowledgeable about biomass energy and over half considered themselves to be not at all knowledgeable on the subject) most of the participants were still eager to be part of planning and development processes (Monroe & Oxarart, 2011). Therefore, in the case of biomass policy, it is important to know where stakeholders get their information from, how knowledgeable they are and their level of education and interest on the topic.

3.2.1. Stakeholder Engagement in Nova Scotia

The government of NS has recently used stakeholder engagement processes to guide and inform policy changes—for the Energy Efficiency Strategy (EES), the Renewable Energy Strategy (RES), and the Natural Resources Strategy (NRS). The EES process focused on improving the efficiency of all forms of energy, such as transportation and household heating. This process indirectly affected recommendations for integrating more biomass into an energy plan by framing the larger energy picture and paving the way towards a more energy secure and efficient future in NS.

The RES, however, focused on developing a plan that would increase the renewable energy portfolio in NS, particularly in terms of renewable electricity, to be able to meet both short- and long-term renewable electricity targets (Adams & Wheeler, 2009). The RES also had a significant influence on biomass energy policy. In the RES, it was suggested that 500 GWh of energy generation could come from biomass by 2015 (Adams & Wheeler, 2009). It also recommended that a community

feed-in tariff (COMFIT) system be implemented for medium and small-scale biomass ventures (Adams & Wheeler, 2009).

The recommendations from the RES were for the most part directly integrated into the NS government's New Renewable Electricity Plan in 2010 (NS Department of Energy, 2010). The plan capped new electricity generation from biomass amounts to ~600-700 GWh or 500,000 dry tonnes (slightly above the recommendations), until a post-2015 review (NS Department of Energy, 2010), using a "proceed with caution" principle highlighted in the original RES report.

The NRS, on the other hand, does not directly affect the development and implementation of new biomass projects but could have effects on biomass supply sources and availability. The NRS has implications for how businesses and industries are able to meet the new biomass energy targets because it includes recommendations for major changes in forest harvest regulations which could impact the availability and supply of biomass resources. For example clear-cutting, which now makes up 96% of current harvest practices will be lowered to 50% over a five year period (DNR, 2011). Furthermore, the NRS set a lower cap for the generation of new energy from biomass at 350,000 dry tonnes, and standards for biomass will soon be incorporated into the Code of Forest Practices (DNR, 2011).

In the final evaluation of both the EES and the RES, Adams, Wheeler and Woolston (2011) concluded that the results from the first two engagement processes would be both resilient and adaptive, even through changes in political priorities, because of the inclusion of such dynamic stakeholder groups and the satisfaction indicated by the participant stakeholders. The NRS was not evaluated in the same

manner but was also fairly complex and involved a large number of stakeholders (in phase one alone over 2000 Nova Scotians attended public meetings or workshops) (Government of NS, 2010). Without feedback from participants on their satisfaction with the process, their participation, and the outcomes from that process, it is difficult to make conclusive statements about the overall effectiveness of the process.

However, one can conclude that involving stakeholders in the policy decision making process is better than not getting their input at all and would have had a positive influence on the outcome (Beierle, 1999).

Compared to other jurisdictions, the policies related to biomass that have been implemented in NS are relatively few and somewhat conservative. For example, in a review of policy initiatives in the US, 370 bioenergy policy initiatives were identified in 50 states, and 15 states had 10 or more initiatives identified (Becker, Moseley & Lee, 2011). These initiatives ranged from tax incentives to procurement and technical assistance. Further, while an increase of 600-700 GWh of new energy from biomass is a significant increase from the ~180 GWh of annual production now taking place in NS, compared to other Canadian jurisdictions, this cap is low. For example, in Ontario, in 2009, 114 TWh of electricity were produced from biomass (600 times more than NS). And while Ontario has nearly 13 times the number of residents and nearly 20 times the amount of forest land, this is still a large difference between capacities.

The recommendations which resulted from NS stakeholder engagement processes for biomass use are judged to be fairly conservative, and the regulations around supply are becoming more stringent in order to protect the sustainability of

NS's forests. Despite this, certain Nova Scotians are still dissatisfied with these results. They have made their opinions heard through media sources such as local newspapers and radio, and on April 13th 2011, a press-conference and rally to oppose large-scale biomass operations was organized by the Ecology Action Centre (EAC, 2011), a local environmental non-government organization (ENGO). As such, it is important to understand if these anti-biomass proponents are outliers or if there were other factors to consider such as whether the engagement process was incomplete, or if the topic is simply too controversial to allow for consensus. If the process was incomplete this has "the potential to marginalise important groups, bias results and jeopardise long-term viability and support for the process" (Reed et al., 2009, p. 1933). An outcome such as this would not be in the best interest of either the government of NS or the citizens of the province.

Conflict resolution, net-working and social learning are some of the other purposes of stakeholder engagement (Beierle, 1999). In this case however it is clear that not all conflicts were resolved through any of the processes. Further knowledge about attitudes towards biomass could help policy makers and stakeholder engagement facilitators resolve this conflict.

3.2.2. Alternative Stakeholder Engagement Methods

There are alternative methods that governments or other proponents can engage with stakeholders that do not follow the typical governmental process. If trying to reach consensus on a specific topic (e.g. the amount of biomass to be incorporated into the renewable energy plan), the Delphi method of consensus

building is a valuable tool (Gomm, 2009). However, this method is often conducted with experts only, therefore excluding the majority of potential stakeholders. It can also be very time-consuming, as consensus is usually very difficult to reach. For example, Beierle and Cayford discuss one case-study where interest groups had to work together regularly for two years to reach consensus (2002). Therefore, depending on the nature of the discussion, consensus building processes may just take too long, or be too exclusive.

If looking for information from experts and non-experts alike, focus groups are another option. They are often used in exploratory research, or to make 'generalizable' assumptions (David & Sutton, 2004). If trying to reach a larger or much broader group of participants, then mail-out or internet-based surveys can be the best option (Dillman, Smythe & Cristian, 2008). Surveys often lack the depth of other methods such as focus groups or interviews, so sometimes a mixed-methods approach is necessary, incorporating multiple methods which ask the same or similar questions.

There are also less-formal ways of engaging with the public, such as through the use of media sources like television and newspapers, by personal communications or community forums. These mediums allow for two-way communication as well, where the proponent and stakeholders can contribute equally to the dialogue. However during exchanges such as these, without a facilitator or moderator, the dialogue is even more likely to be one-sided or biased in favour of a particular point of view.

The popular media in particular is a powerful tool; it can amplify and facilitate public concern (or support) for events and situations (Altheide, 2002). Unfortunately, the media can be guilty of amplifying risks, giving incomplete information, or perpetuating misunderstanding about controversial topics (Upreti & van der Horst, 2004). Regarding the discussion around biomass, news related to this topic is becoming more prominent in NS. Much of the attention in NS has focused on the controversies or glamorizes opportunities. Take, for example, these two Chronicle Herald headlines: “Biomass project means big risks” (Brighton, 2010) and “Biomass benefits NS environment and economy” (Stewart, 2009). These headlines represent the two most prominent points of view represented in the media, those strongly opposed and those strongly in favour of biomass use.

The delivery of objective, fact-based information on biomass was found to be a problem in the U.S. Wright and Reid (2011) analyzed the media framing of the U.S. biofuel movement and found that biofuel opportunities were often exaggerated. They suggested that contentious discourse would need to cease in order to advance with the implementation of policy and energy systems (Wright & Reid, 2011). Litigious communication can facilitate either a prolonged policy development process or increase the likelihood of having poorly made policy decisions based on input from ill-informed stakeholder engagement participants. Those who are ill-informed should still be given the opportunity to express themselves, but then education should become a larger part of the stakeholder engagement process.

While many vocal interest groups and powerful industries actively use sources like the media to make sure that their voices heard (e.g. the EAC), other groups do not

engage in the same manner. Over half of the respondents to a NS woodland owner survey in 2000 had never taken any action to express their views on the use of Nova Scotia's forests. For those who had, they reportedly discussed concerns with friends, neighbours, coworkers or other landowners (Sanderson et al., 2000).

Small-woodland owners have not been previously surveyed as an independent cohort on the subject of biomass energy, nor are they inclined to take independent action to express their views. Since there is clearly still conflict over some of the issues connected with using biomass as an energy source, perhaps the small-woodland owners will be able to narrow down the issues and concerns to more specific sources such as harvest methods, or forest practices. Having a better understanding of the concerns of small-woodland owners and rural community members towards using biomass for energy might be helpful in resolving conflicts in the future.

3.3. Methods

3.3.1. Mail-out Surveys

Mail-out surveys were sent out with pre-paid return postage, to 2937 small-woodland owners in three NS select counties: Antigonish, Annapolis and Colchester. These counties were chosen (out of eighteen) to represent eastern, central and western forestry regions in the province. They were also selected in order to compare differences in attitudes between counties that have: a) more industrial harvest activity (Annapolis); b) more small-woodland owner harvest activity (Colchester); or c) marginal activity at both levels (Antigonish). The DNR landowner database was used

to acquire the names and addresses of all small-woodland owners in the three counties and a stratified sample was taken from each cohort.

The survey was divided into three sections to obtain data about the following: 1) land ownership and management; 2) woodland owner attitudes (e.g. towards biomass for energy, harvest practices and end-uses of forest products); and 3) demographics. In section two, there were also two ‘stand-alone’ questions regarding information sources and attitudes towards biomass-to-energy issues. The first question asked participants to rate the relative level of importance of eight information sources used to inform their opinions about biomass. The second asked them to rate how important they felt the topic of the biomass energy was to them.

Where appropriate, a Likert scale (1 to 5) was used to measure participant responses to questions, as they relate to factors such as the acceptability or significance of each item in the question. Otherwise space was provided for written responses to questions. The survey generally followed Dillman’s method (Dillman et al., 2008).

Of the total number of surveys sent to the three counties, 238 surveys came back as “return to sender”, while 489 completed surveys were returned in the allocated time-frame of eight weeks. The average response rate was 18% for the total cohort, not including the “return to sender” mail. While response rate was low, the sample is still large enough to show significant differences between cohorts, and across categories when applicable.

3.3.2. Focus Groups

Focus groups were conducted in the same counties chosen for the mail-out surveys and took place during the eight-week period allotted for the return of the mail-out surveys. The intent was to provide additional data and context to the information gathered from the surveys. In total, fourteen participants (four-Colchester, four-Antigonish and six-Annapolis) took part in three separate, two-hour discussions. All participants were recruited with the help of the respective local Regional Development Authorities (RDAs) in each county. While participants were required to be interested in the topic of biomass for energy, they did not need to own woodland nor did they have to have specific expertise on the topic of biomass—the intent was to capture the general knowledge and opinions of rural community members on the subject.

The focus-group questions were also divided into three parts. Part one focused on finding out how participants defined biomass (and forest biomass) and included a general discussion about feelings towards using biomass for energy. Part two allowed for a more in-depth discussion about the acceptability of using different harvest practices and different sources for biomass and whether those issues mattered. During part two, there was also a discussion on the end uses of forest products to determine if they mattered, and why.

Part three began with a scenario-based question which asked: ‘if your community were to develop and own an electricity generating station, powered by forest biomass, how would this impact the community?’ This question was followed by ‘is there a better or alternative option (to the previous question)?’ Part three

concluded with questions about the benefits and barriers to using biomass for energy, and participants were asked to name their primary concerns about potentially using more biomass for energy.

At the end of the focus group, participants were given pens and paper to write any additional thoughts or comments. They were also asked to provide a written answer to the question: ‘Of the many sources available to inform your opinions about biomass for energy, (e.g. television, newspapers, journals etc.), what are the most important to you?’ This question was included in writing because the answers were essential for the research, but a group discussion was not necessary or feasible in the allocated time-frame.

3.4. Results

For the survey analysis, both Microsoft Excel (Liengme, 2009) and Minitab 16 (Bryman & Cramer, 1996) were used for basic descriptive statistics while Minitab 16 was used to perform one non-parametric test, the Mann-Whitney. The Mann-Whitney confidence interval test procedure was used to make inferences about the differences between medians (Bryman & Cramer, 1996). In this chapter, all results are presented in aggregate for the surveys. The intent is to capture the most resonant feelings and themes from all cohorts, and there were no significant differences between cohorts on the subjects discussed in this chapter.

For the focus groups, Microsoft Excel (Liengme, 2009) was used to analyze the responses. A note-taker was present during the focus groups and typed out the responses to the various questions. The focus groups were also audio-recorded so the

primary investigator could later transcribe the recording and cross-check with the note-takers outputs. Once all detail from the focus groups were included in a Word document, the themes, keywords, contradictions and other points of interest were thematically coded and entered into an Excel document. This made comparisons between focus groups more accessible and the most salient themes and/or discrepancies were identified. Responses were not linked to individual focus-group participants in any way, and no direct indication of which responses came from which county is mentioned either.

3.4.1. Survey Analysis

Demographics:

The majority of survey respondents were male (84%) and over the age of 60 (54%). A third were either college or university graduates (31%), or had some post-secondary study (21%). These demographic results are consistent with other survey results from NS (Sanderson et al., 2000) and in other jurisdictions (e.g., Joshi & Mehmood, 2011).

Respondents' occupations were divided into four categories, following the methods used in prior research by Kraxner, Yang and Yamagata (2009). The categories are: a) foresters (includes all forestry related occupations such as Christmas tree farmers or tree harvesters); b) farmers; c) company workers; and d) retirees⁹. Company workers are defined as anyone who does not work closely with their own

⁹ Category d) *retirees* is titled *unemployed* in the original research of Kraxner, Yang and Yamagata (2009). It was changed for the purposes of this research to accurately represent survey respondents in this category who were almost entirely retirees.

land (Kraxner et al., 2009), for example health care workers and teachers. Company workers make up the largest percentage of respondents (40%) clearly because so many occupations are incorporated into one category. However, retirees number close in size as well (38%) followed by foresters (12%), and then farmers (9%).

Land ownership and management:

Land ownership was reported in acres and converted into hectares, then results were grouped according to categories (0-19, 20-39, 40-80, >80). There was little difference across categories but one third of the participants owned between 0-19 hectares of land (31%). However, because the parcels of land are so small, they only own 5% of the total reported land amount (27,512 hectares). The majority of the land (65%) was owned by those owning more than 80 hectares.

Most participants either lived on their property (42%) or within 10 km (25%). While only a small number of participants said that their woodland was their primary source of income (5%), a number of participants indicated that they do extract some level of income (secondary or minor source of income) from the commercial harvesting of their property (48%).

The majority of participants have harvested from their woodland for personal use (65%), listing firewood/home-heating (n=217), lumber (n=79), fencing (n=11), Christmas trees (n=10), or salvage (n=6), as the reasons for that harvest. More than half of the participants harvested wood for commercial sale (58%) and selected either lumber or pulp and paper as the primary end use of the products harvested. However, there were a few participants who did not know what the primary end use was (6%) and no one selected biomass.

Information sources:

The question on information sources asked:

‘Many different sources are available to inform people’s opinions about biomass.

What sources are most important to you?’ Please rate on a scale from 1 to 5 (1 being not important and 5 being very important) (Table 10).

Table 10 – Respondents’ rating of the importance of information sources		
	Median	n
Newsletters, magazines or newspapers	4	429
Publications, books or pamphlets	4	412
Television or radio programs	4	428
Talking with other woodland owners	4	425
Talking with natural resource professionals	4	422
Conferences or Workshops	3	400
Internet/web	3	403
Landowner organization	3	420
1 = not important 5 = very important		

Four information sources showed similar trends across all categories of responses and were rated as very important by most participants. These were: talking with other woodland owners; television or radio programs; newsletters, magazines or newspapers; and publications, books or pamphlets. Of the top four, newsletters, magazines or newspapers were selected most often (38% selected *very important* and 29% selected *important*).

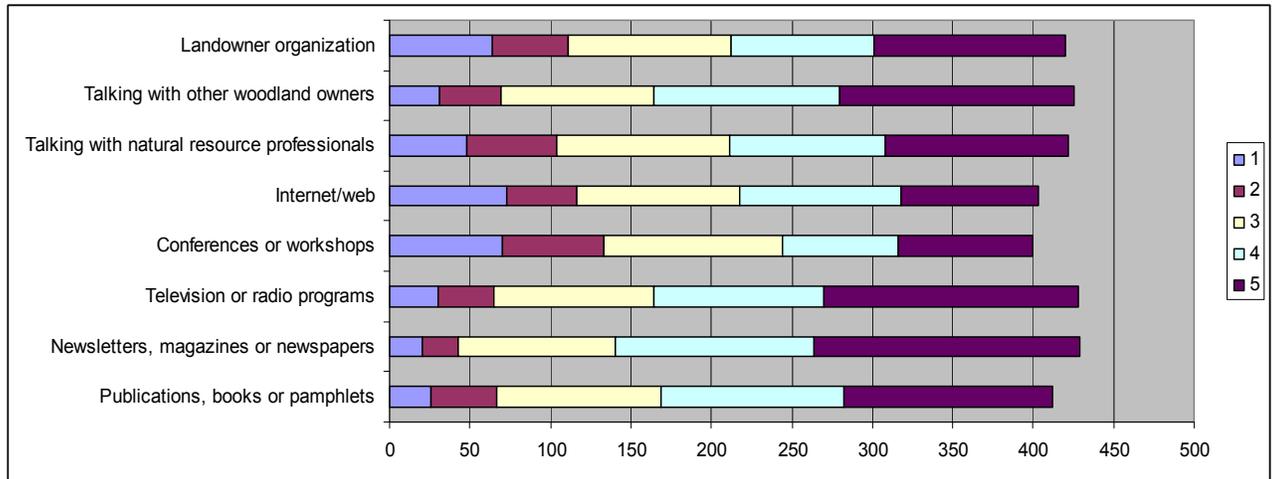


Figure 3: Respondents' ratings of the importance of different information sources.

1 = not important 5 = very important.

Using the Mann-Whitney test, with a 95% confidence interval, it was found that the importance of newsletters, magazines and newspapers was rated significantly higher than all other options, except for television and radio programs ($\alpha = .05$). Further, the top four information sources shown in Figure 3 are rated significantly higher than any other options ($\alpha = .05$). Both conferences/workshops and the internet/web were given a rating of three (middle of the spectrum rating, being neither important nor unimportant) by the majority of participants.

Importance of the topic of biomass:

When asking participants about the importance of the topic of biomass energy, it was found that nearly half of the respondents selected either important or very important (Figure 4). However many participants also gave the importance of the topic of biomass an ambiguous or neutral rating of three, yet there were significantly fewer participants who felt it was either not important or just somewhat important.

None of the demographic variables such as occupation or age, influenced how respondents felt about the importance of the topic of biomass.

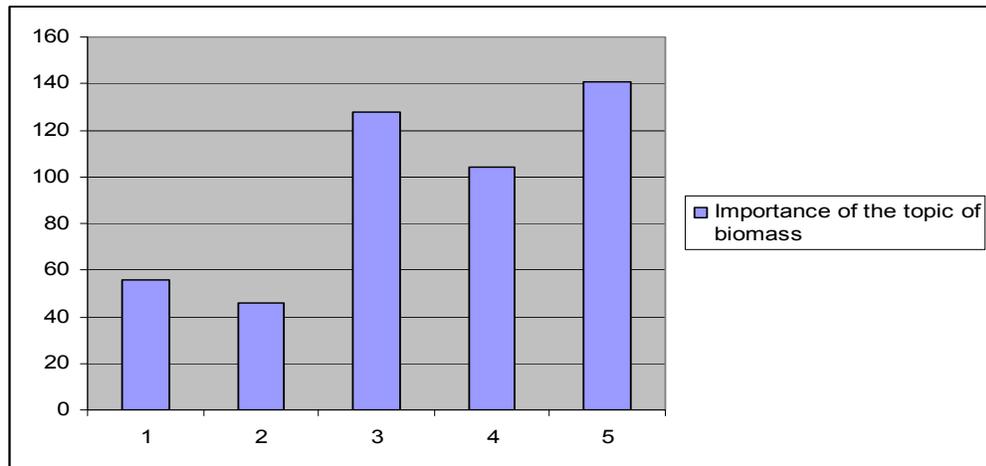


Figure 4: Respondents ratings of the importance of the topic of biomass energy.

1 = not important, 5 = very important.

3.4.2. Focus Group Results

The focus-group demographics and land-ownership/management variables were not measured. However, it was observed that twelve out of fourteen participants were male (85%) and that the majority of participants were middle-aged. Participants were not required to give any personal information, but could give a first name or alias as an introduction to create an informal and relaxed atmosphere during the session.

Four questions posed in the focus groups were of special importance for this research focus. These questions are examined individually yet in culmination they all

unearthed themes of misinformation, fear, lack of information, and a need for more education on the topic of biomass energy.

Question 1.

- a) How would you define biomass?
- b) How would you define *forest* biomass?
- c) Do you feel there is agreement on a definition and should there be?

Each of the 14 participants was asked to give definitions for biomass. Many participants used phrases like ‘organic or once living matter’, yet some participants chose immediately to define biomass in term of forest resources, e.g. ‘harvest left-overs’. In the follow-up question (1b) on *forest* biomass specifically, many different opinions were given (Table 11).

Table 11 – Participant responses’ to question 1b (short-form)
What does forest biomass mean to you?
Harvestable stuff
Everything (x2)
Absorbent umbrella term
The entire forest
Everything that’s left after harvest
Unmerchantable wood
The left-overs
The whole tree
There is a divergence of thinking
Education is needed

In response to question 1c, participants from all groups felt that there was little agreement on a definition of biomass and that definitions were subjective. However, they felt that there should be agreement, especially in legislation, but noted that a blanket definition for policy might not be a good idea since in forestry ‘one-size does not fit all’. One participant held the opinion that it was up to the government to take

the lead in defining what biomass is, and there was a general consensus among all groups that there needs to be more education on the topic for both the general public and woodland owners.

Question 2.

- a) If your community were to build a wood-fired biomass plant, producing electricity only, how do you think this would impact the community?
- b) Do you think there is a better option for your community and what would it be?

Responses to question 2a were fairly similar across all groups. Participants felt that a community-based biomass plant would be beneficial, creating jobs and new markets for wood products. It was also mentioned that there needed to be strict guidelines regarding where the wood was coming from, and that forest sustainability and soil quality needed to be maintained. In part 2b of the question, responses varied widely. One group shifted away from biomass completely and discussed using other forms of energy such as wind, tidal and hydro or a mixture. The second group suggested using wood for heat instead of electricity, or that selling the wood to another market made more sense. The third group, however, discussed using cogeneration and mentioned that using wood for electricity only was a bad idea and not efficient enough. They also mentioned the possibility of net-metering electricity flows if independent producers were starting to produce more electricity onto the grid.

Question 3.

- a) What are the benefits to using more biomass for energy?
- b) What are the barriers to using more biomass for energy?

For question 3a, each focus group had at least one person mention jobs or economic reasons as the major benefit of using more biomass for energy. Other benefits mentioned included improving the environment and providing an alternative to coal. However, groups were also concerned with looking at the long-term benefits such as encouraging younger generations to stay in the area through the creation of more jobs.

Question 3b generated a robust discussion about many barriers which need to be addressed. Issues of economy and sustainability were apparent across all three groups, but it was also mentioned that public attitude, fear and lack of education were also barriers. Legal issues and barriers in policy were voiced and one group also mentioned that there was a lack of incentives and capital available for projects, and that this hindered their ability to move forward with projects.

Question 4.

What would be your number-one concern if more forest biomass was going to be used for energy in NS?

Many concerns were expressed by all three groups about using more biomass for energy in NS. However, their concerns were mostly expressed by talking about solutions to problems, not the actual problems or concerns themselves. Having a solid plan or a better vision of how biomass would be used in the long term was one suggestion. Having better regulation of harvesting, with a clear definition of forest sustainability, was another solution.

Some participants were concerned about the amount of forest it would take to provide the necessary biomass, and others were concerned with misguided policy that could lead to either destruction (of forests and ecosystems) or depression (of economic opportunities). Another concern was that there is a lack of education and information on the topic of biomass for energy among both the general public and small-woodland owners.

Additional notes from participants:

Most participants (eight out of twelve) did not include any additional notes or comments on the sheets provided at the end of the focus groups. This could suggest they were satisfied with their contribution and participation in the focus group itself. The message from two of the additional notes was about education and the need to inform both the public and the younger generation by visiting schools and through public demonstration. The other two expressed or reiterated the excitement that the participants felt about the opportunities for biomass. One respondent was optimistic about using biomass as part of the ‘solution’ towards a shift to more renewable energy sources, and the other participant was excited about the economic opportunities that could happen locally within the community.

Information sources:

All twelve participants mentioned at least one information source that they use to inform themselves about biomass, yet most participants listed multiple sources (Table 12). The most frequently mentioned information source was woodland owners or woodland owner associations. It was difficult to differentiate between the two choices from the written responses, so they were made into one category. Newspapers

followed by forest sector publications such as Atlantic Forestry were the second most frequent responses.

Table 12 – Frequency of written responses about the information sources participants use to inform themselves about biomass	
Information sources	Frequency
woodland owners/woodland associations	8
newspapers	5
forest sector publications	5
television	4
DNR	3
scientific articles/reports	3
internet	2
foresters	1
conferences/workshops	1
friends/neighbours	1
employer	1

3.5. Discussion

According to Stidham and Simon-Brown (2011), the most frequently made recommendations from stakeholders in recent research regarding how best to incorporate biomass projects into a region are: a) improve collaboration between parties; b) establish pilot projects; c) improve public education; and d) design projects with an ecological view. These recommendations are further supported by the findings of this research, with particular emphasis on collaboration, education and ecological project design.

Focus-group results indicate that collaboration is a necessary component in two areas. First, there needs to be collaboration on a better definition of biomass. As one participant suggested, this collaboration needs to involve the general public, industry, foresters and energy producers. While it was indicated that government needs to take the lead, they need to collaborate with other parties to determine the

best definition for all. Second, results indicate that government, industries and communities need to better support one another (e.g. publicly or financially) to facilitate smoother transitions from using old, well-known, technologies to new, less well-known technological territory.

The need for more education was another dominant theme derived from the focus-group results. Participants believed that fear (from lack of understanding) was one of the strongest barriers to moving forward with any biomass energy projects. It was suggested that education about forest resources, and the opportunities associated with those resources, should be started in schools and that this would help keep future generations interested in forests and biomass.

Lastly, designing projects with an ecological mind-frame was a strong theme found in both the survey results and focus groups. Participants were mostly concerned about maintaining sustainable forests and having stronger regulation of forest industry practices. Only a few participants (focus groups only) discussed efficiency rates of the various biomass technologies, whereas survey participants did not show a preferential rating of more efficient technologies, only for different harvest methods. Therefore, the outcome from this research shows an ecological focus that is directed at the protection of forest resources, and less on the efficiency of resource use.

3.5.1. Stakeholder Engagement: Alternatives to the Political Process

Multiple stakeholder engagement sessions took place in NS to discuss the potential of biomass as an energy source. However, despite the rigour taken in those processes, and the general effectiveness attributed to such approaches (Beierle, 2002),

it has been suggested that sometimes it takes a new approach or a combination of methods to effectively identify and reach important stakeholders (Reed et al., 2009). Further, even if some stakeholders are not interested in contributing to the dialogue around future biomass policies, it is still essential to get their input (Reed et al., 2009). Many small-woodland owners do not find the topic of biomass to be that important (Figure 4), nor have they actively voiced their opinions on forest matters in the past (Sanderson et al, 2000), yet all small-woodland owners' input matters since they can be directly affected by policy-making outcomes.

By using mail-out surveys and focus groups to engage with small-woodland owners and rural community members, this research has revealed some important factors about their lives—who they are, what is important to them, how they source information, and how they would like to be engaged. The majority of survey respondents are: a) older; b) retired; c) live either directly on their woodland or very close to it; d) use their woodland for personal uses; and e) rely on their woodland for at least some of their income. This suggests a strong, multi-faceted relationship between small-woodland owners and their woodlands.

The survey results suggest that both the age and rural location of many woodland owners influences the likelihood that they will use resources such as the internet. It also suggests that they are less likely to attend workshops and conferences. The survey results indicate a preference to read newspapers and watch television to stay informed. Similarly, focus-group participants also indicated a moderate preference for using newspapers as an information source (Table 9), or forestry publications.

While many participants in this research use the media (local newspapers in particular) to inform their opinions about biomass, other literature has shown that it is not necessarily the most trusted source. Upreti (2004) surveyed 196 people living near a proposed biomass site in the UK about trusted information sources. The most trusted source was ENGOs (37%), whereas only 12% of participants selected local newspapers.

Monroe and Oxarart (2011) also measured level of trust towards different information sources to provide accurate information on biomass. Trust was measured using a scale from 1 (not at all), to 3 (very much). They found that local foresters, followed closely by environmental groups, were ranked highest (with average scores of 2.26 and 2.18 respectively). Local newspapers ranked only fifth out of the ten options, with an average score of 1.82.

Survey results indicate a significant preference for the use of newspapers and other media for information on biomass. However, other research suggests that these sources are not completely trusted and should be backed up by other sources of information such as foresters or environmental groups. So while a solid media campaign could help inform the public, for the information to be deemed more trustworthy it should be provided by local foresters or environmental groups (Monroe & Oxarart, 2011).

However, the results do indicate that participants must have some level of trust and reliance on the media to have selected it as the most important information source for them. Unfortunately as exemplified by responses from the survey and focus group participants, many people do not have any foundational knowledge on

biomass energy, interfering with their ability to critically assess what they are presented in the media. As such, biases presented in the media are not always identified. Results from the focus groups demonstrate how knowledge levels vary. For example, one participant was not aware that NS already has pellet manufacturing facilities exporting pellets internationally, believing it to be a ‘stupid’ idea. Alternately, there were some highly informed participants exhibiting knowledge about current uses of biomass energy in NS, demonstrating a basic or even advanced understanding of the efficiency of different technologies.

In other research, small-woodland owners complained that their role in any decision-making process was too complex because they had never been taught basic information about forest ecosystems or management (Dragoi, Popa & Blujdea, 2011). The focus-group participants in this research agreed that there was a need for more information and education on the topic. One participant repeatedly said she did not know anything about the topic but contributed whole-heartedly to the discussion just the same. The danger associated with engaging with an uninformed population is that citizens might then be asked to participate in a formal stakeholder engagement process aimed at making policy changes, despite a clear lack of knowledge on the subject. While one of the goals of stakeholder engagement processes is often education (Beierle, 1999), this outcome is not always achievable when also trying to mitigate for conflict or reach consensus on a topic. Perhaps more importantly, is that any consensus that is reached could be based on incomplete or incorrect information thus misinforming any policy development emerging from the process.

3.5.2. The Value of Keeping Resource Use Local

The focus-group results revealed how strongly participants feel about keeping forest resources ‘as close to home as possible’, and the excitement about the opportunities. Forest restoration, renewable energy generation and rural community revitalization have previously been linked together as opportune ways for regions with ample forest resources to have multiple parties benefit from biomass utilization (Stidham & Simon-Brown, 2011). This possibility of rural economic growth contributes to the positive attitude within rural communities about biomass.

3.6. Conclusions and Recommendations

In summary, the issues that were found to be most important to small-woodland owners and rural community members are collaboration, education, forest sustainability and keeping resources local. In order to address the concern expressed towards these issues I would make the following recommendations:

- Governments, industry and communities should work more closely together to form strategies for using biomass that address the fears of small-woodland owners and rural community members.
- To mitigate for miscommunication and help collaboration, a comprehensive definition of biomass needs to be agreed upon and shared with communities all across the province.
- Care and maintenance of local resources (the forests of NS) needs to be seen as a priority for government and industry.

- More educational material should be made available to rural communities and small-woodland owners on the topic of biomass energy. Educational materials should also be a collaborative effort between the most trusted information sources such as, ENGO's and local foresters.

Results also revealed that small-woodland owners and rural community members seek out information primarily through media sources. While the media can be used to amplify risks or perpetuate misunderstanding (Upreti & van der Horst, 2004), it can also be used to educate and inform, or be a platform from which honest dialogue can take place. In terms of using the media as a tool for communication and education I would make the following set of recommendations:

- Government should use the media to educate and engage with small-woodland owners and rural community members about biomass energy by using information that is unbiased and includes both the benefits and barriers to any biomass developments.
- Educational materials and programs need to include information about new technologies, efficiency rates, forest management practices and harvest regulations.

Further research should explore the nature of stakeholder engagement for renewable energy developments in NS. A survey of small-woodland owners and rural community members on their engagement preferences, their current level of activity in engagement processes and their feelings towards such processes would help the

government of NS implement the most effective stakeholder engagement processes in the future.

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CHAPTER 4 CONCLUSION

4.1. Conclusion

As has been noted, there has been considerable debate on the topic of using forest biomass as an energy source in NS. While it has been incorporated into plans for increasing the renewable energy generation capacity of NS (NS Department of Energy, 2010), some stakeholders (e.g. EAC, 2011) disagree with this decision. For example, the Ecology Action Centre (EAC) has expressed great concern about using biomass in large-scale operations (EAC, 2011). However, other parties have expressed excitement about using more forest biomass for energy such as energy companies (e.g. Nova Scotia Power Inc.), university researchers, and forestry industries. While these differences in opinion were given the opportunity to be resolved during various stakeholder engagement sessions, they were not, and the conflict and debate continues. For government and industry to better address public concerns both now and in the future, a more thorough understanding of the issues associated with using biomass energy needed further research.

To generate such improved understanding, the opinions of one particular stakeholder group, the small-woodland owners, were sought to assess their particular attitudes towards using biomass for energy. Rural community members from the same regions were subsequently asked to participate in focus groups to discuss the same topic.

It was found that multiple factors influence people's attitudes towards using forest biomass for energy and other uses. Using forest biomass for pulp and paper, firewood, lumber or locally made and used pellets were considered acceptable uses by

the majority of small-woodland owners, whereas converting wood into ethanol or other liquid fuels was the least acceptable option. Focus group results indicated similar preferences, with an especially high preference by all participants to keep resource use local. It was also found that the majority of respondents' rated both clear-cutting and old-growth forest harvesting as completely unacceptable harvest methods for biomass energy purposes. However, selection harvesting was rated as very acceptable by the majority of respondents.

These results suggest that the concern about using forest biomass for energy is directed at specific issues and not just biomass use in general. Both the harvest method and the end-uses are extremely important. To address these concerns, governments and industry need to be more specific and forthcoming with information about biomass energy development plans. They must acknowledge the specific concerns of small-woodland owners and rural community members and communicate better on the manner in which they plan to address those concerns. The concerns of participants are rooted in uncertainty around forest sustainability and loss of local resources. From the perspective of the small-woodland owners and rural community members, local resources are lost during: ineffective or unsustainable forest management, when biomass products are exported for use overseas or when biomass is used in ways which are unfamiliar or completely unknown to them. To begin to address these concerns, governments and industry need to explicitly communicate the following: where exactly will the wood come from, how will it be harvested and how will it ultimately be used and why. This may not change the opinion of many anti-

biomass proponents but it will eliminate fears associated with the unknown, or at least diminish misplaced or misguided apprehensions.

Results from both the surveys and focus group analysis also provided insight into the level of knowledge small-woodland owners and rural community member have about biomass technologies and opportunities. This is important because survey respondents' ratings of the acceptability of using different biomass technologies did not reflect an ability to differentiate between more or less efficient technologies. Also, survey respondents did not differentiate between the acceptability of using different harvest by-products like harvest slash compared to milling wastes. For example, using slash or harvest residue, which is not allowed in NS, was given the same rating as using mill or process residue.

Another conclusion which can be drawn from both survey and focus-group analysis is that there needs to be more dialogue and agreement on the language and the terminology used among the forest sector, energy sector and public domains to foster more-robust discussions and better understanding among parties. For example, the word "biomass" has multiple understandings, and use of that term can be misleading for some unless clearly defined. Without clarity it is difficult to discuss opportunities, benefits and barriers if no one is sure they are talking about the same thing,

I suggest that the Government of NS takes the lead on fostering better communication immediately so that future policy and legislation developments are not hindered by communication issues. Both the general public and woodland owners need to be informed not just on the benefits and opportunities for biomass energy, but

on the potential obstacles as well as the concerns of their peers. Open and honest dialogue, including an update on current technologies and lessons on efficiency, will help facilitate more effective policy development.

Results of this research suggest that there are multiple ways in which to communicate and engage with stakeholders. The small-woodland owners and rural community members who participated in this study seek information primarily through media sources. While the media can be used to amplify risks or perpetuate misunderstanding (Upreti & van der Horst, 2004), it can also be used to educate and inform, or be a platform from which honest dialogue can take place. Perhaps proponents could use the media to educate the public about biomass technologies and opportunities.

In summary, it was found that the issues which are most important to small-woodland owners and rural community members are collaboration, education, forest sustainability, and keeping resources local. To ensure that these issues are understood and addressed, I make the following recommendations:

- 1) Governments, industry and communities should work more closely together to form strategies for using biomass that address the fears of small-woodland owners and rural community members.
- 2) A comprehensive definition of biomass needs to be agreed upon and shared with communities all across the province.
- 3) Government should use the media (in combination with other outreach sources) to educate and engage with small-woodland owners and rural community members about biomass energy.

- 4) Educational materials and programs need to include information about new technologies, efficiency rates, forest management practices and harvest regulations.

4.2. Research Directions

This research chose a specific segment of society to survey but it would have been useful to compare the attitudes of industrial-woodland owners with those of the small-woodland owners. The intent would be to explore whether industrial-woodland owners have the same or similar concerns and if completely different, why. Further research on the attitudes of non-woodland owners would be useful as well. Research of this nature would be more generalizable to the general public.

A closer look at the significant differences found between regions is also another area for future research. Do areas with higher industrial capacity and a greater degree of industrial forestry correlate with more-negative attitudes towards clear-cutting and industrial scale biomass-to-energy facilities, and if so, why? Or do stakeholder groups in regions with markedly different policy developments have different opinions towards using biomass for energy?

The nature of stakeholder engagement for renewable energy developments in NS could also be further explored. A survey of small-woodland owners and rural community members on their engagement preferences, their current level of activity in engagement processes, and their feelings towards such processes could help the government of NS design and implement the most effective stakeholder engagement processes in the future.

4.3. Final Thoughts

The value of our world's forests is immeasurable. We can count the number of trees in a stand; we can measure their height, volume and density. We can even calculate the amount of carbon they capture or their worth as different products in a global market place. However, none of these factors capture the value placed on the physical and emotional connection many people have to forests and trees. There will always be people who feel that the best use of our forests is to leave them completely alone.

Fear of wasting and destroying our forests and their surrounding ecosystems has caused many people to balk against the idea of using biomass as an energy source. Through this research I have discovered the root of many of those fears, some of which have resulted from the perception that using biomass could cause a greater loss of local resources. This has been further amplified by a general fear of unknown and unfamiliar technologies. To mitigate and overcome the challenges associated with addressing these concerns, maintaining and caring for local resources (the forests of NS) should be at the top of the agenda for all proponents wanting to develop a biomass project.

The process of engaging with small-woodland owners and rural community members was personally enlightening. Many people feel strongly opposed to using biomass for energy, yet just as many feel strongly in favour or are apathetic towards its use. I think if we can improve communication among the various stakeholders, provide sufficient education to minimize misinformation being promulgated as fact,

and ensure that stakeholder engagement processes adequately incorporate the view of all stakeholder groups, then we might see less conflict on the topic and resolve some of the prevalent disconnects.

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APPENDIX A



Woodland Owner Survey Attitudes towards Forest Biomass for Energy

Thank you for completing the enclosed questionnaire. It will only take about 20 minutes of your time. *Forest biomass* can be defined as a natural resource which comes from trees and tree-parts which is used to create energy through a conversion process. *Forest biomass* will be referred to simply as *biomass* for the duration of this survey. To better understand this natural resource, we are surveying select woodland owners in three Counties in Nova Scotia, representing the Eastern, Central and Western forest regions. As a member of (name of county) and as an individual owning more than 2 hectares of woodland you are being invited to participate in this survey. Your timely response will help create a greater understanding of how woodland owners in Nova Scotia feel about using biomass for energy generation.

Your participation in the survey is completely voluntary. Individual responses are kept in strictest confidence, and the results are presented only on a group basis. We understand that not everyone who owns woodland is an expert in forestry or energy but your input is still extremely important. If you find any particular question a problem in some way, please feel free to skip it and go on to the next. We encourage you to write additional comments on any aspect of the survey. If you have any questions about the survey or about your role in participating please do not hesitate to contact Margo MacGregor by telephone at (902) 494-1365 or by email at margo.macgregor@dal.ca. We would like to thank you in advance for your thoughtful consideration of the questions and for your quick return of the questionnaire. This research is being done as part of graduate research project, in partnership with Nova Scotia Power Inc.



SECTION 1: Woodland Owning Specifics

Please check the appropriate box or fill in the blank provided.

1. Approximately how much woodland do you or your company own in (Name of County)?

_____ acres

2. Do you own woodland outside of (name of County)?

Yes	
No	

If yes, approximately how much?

_____ acres

3. Where do you live in relation to your woodlot in (name of County)? (Check only ONE)

On my property	
Within 10 km	
11 to 100 km from it	
More than 100 km from it	

4. How important is any income you receive from your woodland

A primary source of income	
A secondary source of income	
A minor source of income	
Not a source of income	

5. Do you have a written forest management plan?

Yes	
No	

If yes, approximately when was it written _____

AND

If yes, do you use the plan to manage/operate your woodlot?

Yes	
No	

6. In the past ten years have you harvested timber from your land for personal use?

Yes	
No	

If yes, for what purpose?

7. In the past ten years have you harvested trees from your woodland with the purpose of selling them?

Yes	
No	

If YES please answer questions 8 and 9; if NO, please skip to SECTION 2

8. What is the main reason for commercially harvesting timber from your woodland?
(Check only ONE)

High product prices	
Over-mature forest stands	
Salvage due to disturbance	
Needed the income	
Other (please specify below)	

Other _____

9. What is the main commercial product that was/is created from your harvest? (Check only ONE)

Lumber	
Pulp and paper	
Christmas trees	
Firewood	
Biomass	
I don't know	
Other (please specify below)	

Other _____

SECTION 2: Attitudes towards biomass for energy in Nova Scotia. For the following questions please check the most appropriate box or fill in the space provided.

10. How **acceptable** would you rate using the following products for biomass energy on a scale from 1 to 5 (1 being completely unacceptable and 5 being completely acceptable)?

	Unacceptable.....Acceptable					Unsure
	1	2	3	4	5	
Slash or harvest residue						
Thinning residue						
Process residue						
Over-mature hardwood						
Over-mature softwood						
Dead or dying trees						

Trees affected by insect infestations						
Whole trees						
Tree stems only						
Branches, stumps and tops						
Short rotation woody crops						
Low-quality wood						

11. How **acceptable** would you rate the following harvest practices on a scale from 1 to 5 (1 being completely unacceptable and 5 being completely acceptable)?

	Unacceptable.....Acceptable					Unsure
	1	2	3	4	5	
Selection harvesting						
Commercial thinning harvest						
Clear-cutting						

12. How **acceptable** would you rate the following uses for wood harvested from the forest (1 being completely unacceptable and 5 being completely acceptable)?

	Unacceptable.....Acceptable					Unsure
	1	2	3	4	5	
Converted into ethanol or other liquid fuel						
For lumber						
Made into pellets and shipped abroad						
Burned in an industrial plant for heat and power						
As fire-wood						
For pulp and paper						
Burned in a community based heat and power plant						
Made into pellets and used locally for home heating						

13. How **acceptable** would you rate the following growing options for biomass production on a scale from 1 to 5 (1 being completely unacceptable and 5 being completely acceptable)?

	Unacceptable.....Acceptable					Unsure
	1	2	3	4	5	
Short-rotation biomass plantations						
Old growth harvest						

14. How **acceptable** would you rate the following harvest choices on a scale from 1 to 5 (1 being completely unacceptable and 5 being completely acceptable)?

	Unacceptable.....Acceptable					Unsure
	1	2	3	4	5	
Stem-only harvest						
Whole-tree harvest						

15. Please indicate whether or not you feel any of the following are potential **barriers** to the production of energy from biomass on a scale from 1 to 5 (1 being a strong barrier and 5 being not a barrier).

	Strong.....Not a Barrier					Unsure
	1	2	3	4	5	
Transportation distance to commercial plants						
Transportation costs						
Public acceptance						
Harvest costs						
Commercial value of other forest products						
Available supply of forest products						
Maintaining a sustainable forest						
Other						
Other						
Other						

16. Are there any other issues that should be considered regarding biomass as an energy resource that were not addressed in this survey?

17. Do you perceive there to be any personal **benefits** to you from using biomass for energy use?

Yes	
No	

If you answered yes to question 17, please explain or list these personal benefits.

18. Do you think there are other (such as societal, environmental or industrial) **benefits** to using forest biomass for energy use?

Yes	
No	

If yes, please explain or list these benefits.

19. There are many different sources which are available to inform our opinions about biomass. What sources are most important to you? Please rate on a scale from 1 to 5 (1 being not important and 5 being very important).

	Not.....Very Important Important				
	1	2	3	4	5
Publications, books or pamphlets					
Newsletters, magazines, or newspapers					
Television or radio programs					
Conferences or workshops					
Internet/web					
Talking with natural resource professionals					
Talking with other woodland owners					
Landowner organization					

20. How **important** to you is the topic of biomass for energy on a scale from 1 to 5 (1 being not important and 5 being very important)?

	Not.....Very Important Important				
	1	2	3	4	5
The topic of biomass for energy					

SECTION 3: Demographic information

For the following questions please check the appropriate box or fill in the blank space provided.

21. What is your age?

<20		20 to 29	
30 to 39		40 to 49	
50 to 59		60 +	

22. What is your gender?

Male	
Female	

23. What is your completed level of education?

Some high-school or less	
High school diploma	
Some post-secondary study	
College or university graduate	
Post-graduate study	

24. What is your occupation?

Thank you for your time and participation. We appreciate your thorough attention and detailed response. Your input is vital to the research project. Once you have completed the survey to the best of your ability, please place the completed survey in the pre-paid envelope provided to you and return to sender.

APPENDIX B
Focus Group Questions

1. What does biomass mean to you in general?
2. Do you feel there is agreement on this definition?
3. Should there be agreement on a definition?
4. What does forest biomass mean to you?
5. How do you feel about producing energy from trees?
6. Does it make a difference which harvest practices are used? (prompts: clearcutting, selection harvesting, etc)
7. Are different tree parts more or less acceptable (slash or residue/different types of trees/different parts of trees)
8. Do you feel using wood for energy is any more or less acceptable than other uses of wood?
9. If using wood for energy, does it make a difference how this energy is produced? (prompts: co-firing, fire-wood, electricity vs electricity and heat etc)
10. In your opinion, for Nova Scotia as a whole, is there one best use of our forest or are there many? Explain
11. How do you feel about exporting biomass resources (such as pellets)?
12. If your community were to build a wood-fired biomass plant, producing electricity only how do you think this would impact the community?
13. Is there a better option for the community if they had a choice? (Different kind of biomass plant or other renewable energy option)
14. Do you see any benefits to increasing biomass production?
15. Do you see any barriers to increasing biomass production?
16. What is your number one concern about using more forest biomass?