

Policies for the Reduction of Slash Pile Burning in BC Forests

by

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Abstract

In British Columbia, it is a common practice for forest companies to pile the unwanted fibre after harvest and burn the piles. There are numerous reasons why companies do this, but the primary reason is to reduce the forest fire risk. However, slash burning produces greenhouse gas emissions and local air contaminants. BC has also seen a significant reduction in the timber supply in interior regions due to the mountain pine beetle devastation. Thus, government and the industry are looking for ways to reduce the negative impacts of slash burning while still addressing forest fire risk. I examine alternatives to slash burning, using evidence from other regions and stakeholder interviews to assess policy options.

Keywords: Slash pile burning; BC forestry; waste utilization

Executive Summary

In British Columbia, it is a common practice for forest companies to burn unwanted fibre after harvesting activities are carried out. While in the past this was seen as an efficient disposal mechanism, today it poses numerous problems for society including CO₂ emissions, fibre utilization issues with declining timber supply, and air pollution that could negatively affect human health. The following study will examine policy options that will reduce the amount of fibre that is burned in BC forests.

Background

There are a number of regulations that affect slash pile burning, but the primary reason that unwanted fibre is burned in BC is to remove the risk of forest fires. In the early 20th century it was recognized that the fibre posed a significant threat to the industry and neighboring communities. For this reason, foresters were required to mitigate the hazard. Although the requirement does not require that the waste fibre be burned, this has become the common practice because burning the fibre is the cheapest alternative.

Methodology

The primary method of research used in this report is in-depth interviews with industry, government, and eNGO stakeholders. The purpose of the interviews is to establish stakeholder views on the topic of logging residue burning and to delve deeper in the different values related to this policy area. In total, I carried out interviews with 16 contacts from the BC Government, Federal Government, industry, and the Pembina Institute.

The function of the government interviews is to shed light on the policy environment that slash pile burning exists in. Preliminary research has shown that many different branches and departments in the BC Government are interested in this topic. On top of this, they have divergent and competing views on slash burning. The interviews will establish the different priorities of the various groups within government in

order to find a path forward. Understanding the dynamic within the government is just as important as understanding the dynamic outside of government.

Options and Recommendations

In total I examine four policy alternatives designed to reduce the amount of fibre that is burned. They are:

- Attached a fee for all fibre burned
- Fibre based annual allowable cut
- Eliminate waste benchmarks and increase penalties for waste
- Increase the use of cruise based billing.

The policy options are analyzed using criteria of effectiveness, equity, sustainability, stakeholder acceptability, and negative externalities. After careful analysis both attaching a fee for all fibre burned and cruise based billing proved to be significantly better alternatives than the other two. For this reason I recommend that a burn fee be implemented in conjunction with an increase in cruise based billing. However, significant stakeholder engagement and additional analysis will need to be carried in order to determine the specific level of the fee and how it will be charged.

Dedication

For Morgan, Owen, and Leah.

Acknowledgements

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Table of Contents

Approval.....	ii
Partial Copyright Licence	iii
Abstract.....	iv
Executive Summary	v
Background	v
Methodology.....	v
Options and Recommendations	vi
Dedication	vii
Acknowledgements	viii
Table of Contents.....	ix
List of Tables.....	xi
List of Figures.....	xii
List of Acronyms.....	xiii
1. Introduction	1
2. Background	4
2.1. 1912-1943.....	4
2.2. 1943-1974	5
2.3. 1976-1991	7
2.4. 1992-Present.....	8
2.5. Slow Rate of Change in Industry – Regeneration	9
2.6. Current Policies Related to Post Harvest Debris.....	10
2.6.1. Fire hazard and fuel hazard risk.....	10
2.6.2. Smoke management.....	12
2.6.3. Annual allowable cut	13
2.6.4. Waste benchmarks	14
2.6.5. Regeneration requirements.....	14
2.6.6. Coarse woody debris guidelines	15
2.6.7. Soil nutrients and productivity	15
2.7. Summary.....	16
3. Methodology	17
3.1. Overview	17
4. Criteria and Measures	19
4.1. Effectiveness.....	19
4.2. Equity	19
4.3. Sustainability	20
4.4. Stakeholder Acceptability	20
4.4.1. B.C. Government	20
4.4.2. Industry.....	20
4.4.3. Environmental NGOs	21
4.5. Negative Externalities.....	21

5. Actions the Government is Already Taking	24
6. Linking Policy Options to Core Reasons for Slash Pile Burning	26
6.1. Fire Hazard Abatement	26
6.2. Limited Markets and Marginal Economics	26
6.3. Disincentives to Utilize in the Current System.....	27
7. Policy Options	28
7.1. Charge a Fee for all Fibre that is Burned	28
7.1.1. Refinements of the Policy	29
7.1.2. Goals	31
7.1.3. Drawbacks	32
7.2. Fibre Based Annual Allowable Cut	33
7.2.1. Goals	33
7.2.2. Drawbacks	34
7.3. Remove Waste Benchmarks – Increase Penalties for Waste	35
7.3.1. Goals	35
7.3.2. Drawbacks	35
7.4. Increase the Use of Cruise Based Billing.....	36
7.4.1. Goals	36
7.4.2. Drawbacks	37
8. Analysis.....	38
8.1. Charge a Fee for all Fibre that is Burned	38
8.2. Fibre Based AAC.....	40
8.3. Remove Benchmarks – Increase Penalties	41
8.4. Increase the Use of Cruise Based Billing.....	43
9. Recommendation	46
9.1. Implementation and Future Steps.....	47
9.2. Considerations	48
10. Conclusion.....	50
References.....	51
Appendices.....	54
Appendix A Interview Contacts.....	55

List of Tables

Table 1: Criteria and Measures	22
Table 2: Scoring Matrix	45

List of Figures

Figure 1: A slash pile after a burn has been carried out.....	11
Figure 2: A smoke plume created by slash pile burning.....	12
Figure 3: A small pile approximately 5 metres long	30
Figure 4: Flames from a single pile that is over 100 metres long	30

List of Acronyms

AAC	Annual Allowable Cut
CWD	Coarse Woody Debris
eNGO	Environmental Non-Governmental Organization
FLNRO	Ministry of Forests, Lands, and Natural Resource Operations
OSB	Oriented Strand Board

1. Introduction

If a BC forester from 1912 were transported to a 2012 harvest site there is a great deal of change that he would notice. For example the technology used to harvest trees would be completely different and the regeneration requirement would also be a foreign concept to him. However, one area where he would be quite familiar is the harvest residues left on-site and the practice of burning the residues. He would note a change from broadcast burns to pile burns, but would most likely recognize the change as being a result of the change in harvest technique that modern technology has allowed. Despite the great deal of change that has occurred in the industry over the last hundred years burning left over logging residues has persisted.

In 1912, burning of harvest residues, known as logging slash, was a normal part of forestry practice. The 19th century saw some of the biggest forest fires that BC has ever seen, and logging slash was thought to be a growing hazard to the industry. Up to this point foresters viewed the forest as so expansive that forest fires would not greatly reduce the amount of trees they could harvest. However, this view started to change and foresters started to worry that forest fires could substantially reduce the volume of harvestable timber. At that time there were technological barriers to increasing utilization of the discarded timber as industries that could use the harvest residues did not exist. The pulp industry in BC was in its infancy and primarily consumed saw mill residues.

Today, this is not the situation. We have the technology that makes increased utilization possible, and there are numerous industries that can use the fibre if the price warrants. In addition, we also are aware of the risks of CO₂ emissions. The mountain pine beetle epidemic, combined with slash burning has turned BC forests into a carbon source rather than a carbon sink. From 1912 to recent years slash burning was not seen as a problem, but today the public is concerned about climate change and realizes that our forests need to contribute to climate change mitigation rather than exacerbate it.

There are a number of barriers to increased utilization including concerns about woody debris for wildlife habitat and soil nutrient replenishment, but the main obstacle is economics. Simply put, currently there are very few consumers that are willing to pay the required price to utilize harvest residues. The customers that do exist typically can only afford to haul the fibre a short distance before the costs exceed the benefits. In addition, the industry has become more regionally concentrated which has reduced the area of the province that is within the economically feasible zone.

The mountain pine beetle in the interior of BC has killed a large portion of the pine forests. As a result of this destruction, it is predicted that over the next 10 to 15 years the overall provincial timber supply will be 20 percent below pre-mountain pine beetle levels. In some areas of the province this number will be much more than 20 percent (Rustad 2012). In response to this timber supply crisis, the province created a Special Committee on Timber Supply in order to find solutions to this falling supply. The committee focused much of its attention on marginally economic forest stands and on designing the harvest system to take all fibre demand into account. If these recommendations are successfully implemented, harvest residue utilization will be a major element of future forest practices.

Policy Problem: given the looming fibre shortage and the carbon impact of slash burning, too much fibre is being burned at harvest sites in BC. The goal of this report is to develop policy options that will reduce slash pile burning while not creating unintended consequences such as increasing fire risk.

While this issue has been around for the last hundred years, there is evidence that the policy window is opening. First of all, the mid-term timber supply shortfall presents an opportunity to increase fibre utilization. Forestry in BC has long had a saw log focus. This has resulted in the allowable cut being based on saw log harvest and utilization standards were geared toward saw logs. There is a desire within government and outside of government to move toward a fibre focus that will encourage broader utilization. On top of this utilization issue, there is a general trend to move towards a bio-economy. The bio-economy replaces products made from non-renewable sources with renewable biological based products. Simple examples include replacing gasoline with ethanol or replacing coal energy with bioenergy. If the bio-economy takes hold in BC,

this will further increase the demand for forest fibre. This should help to open the policy window on slash pile burning policy within the province.

Climate change has been recognized as the one of the largest challenges of our time. Typically, forests act as carbon sinks that help to mitigate climate change. However, as a result of the mountain pine beetle epidemic and to a lesser extent slash pile burning, BC forests are now net emitters of CO₂ emissions rather than a carbon sink. As climate change becomes more important to people's lives, there will likely be a desire to re-establish BC forests as carbon sinks. This will naturally lead to regeneration efforts in mountain pine beetle affected stands, and policies to limit slash pile burning.

2. Background

The last century of BC forestry practices can be roughly divided into four periods. Indicative of the importance of forestry in BC, each of these periods is separated by a royal commission on forestry. This section will briefly trace the views on slash burning through the previous century, ending with the current regulatory framework that surrounds slash pile burning.

2.1. 1912-1943

The Royal Commission of Inquiry on Timber and Forestry of 1909-1910 (Fulton 1910) led to the *Forest Act* in 1912. It was around this time that the government decided that crown land should not be transferred to private holders. The Forest Act established the Forest Branch and introduced ways for private companies to harvest timber from Crown land (Hagerman 2010).

Forest fires were seen as one of the main threats to the industry. The Commission noted how the view of forest fires in BC had evolved from being seen as a natural, sometimes positive, disturbance to a threat to private interests and public revenue (Fulton Commission 1910, 59). At this stage, preventing forest fires and fighting fires were a major priority of the industry and government. Logging residues were seen as a significant forest fire risk. In a speech during the second reading of The Forest Bill in 1912, the Minister of Lands stated that if logging slash were not disposed of it would “catch fire sooner or later, to the great menace of the valuable remainder (of timber)” (Ross 1912). This concern about forest fire mitigation caused the Fulton Commission to recommend:

In all logging operations upon timber lands in the Province of British Columbia the persons responsible shall dispose of the tops, branches and other debris, in such a way as to prevent, as far as possible, the

danger of fire; such disposal being made to the satisfaction of the officers of the Department of Forests (Fulton Commission 1910, 60).

The Forest Act did not require that loggers dispose of their slash through burning; in fact the Minister recognized that in some situations burning would not be appropriate (Ross 1912). However, the use of fire was becoming the preferred method of slash reduction in Western North America. The argument in favour of slash burning was that the slash was going to catch on fire anyway, and it was better for it to be a controlled fire (Ross 1912). The Forest Act of 1912 did not expressly require loggers to dispose of the slash, but the industry was convinced of the forest fire risk and undertook slash burning without further state compulsion. For this reason, slash burning became a common practice in BC forests.

Forest fires and the impact of slash were a major concern for the entire first half of the twentieth century. In 1930, slash disposal was seen as a national concern and was the considered the biggest threat to the industry. In a speech to all of the provincial chief foresters it was stated that, “I do not think there is any person in this audience who will deny that the presence of slash in forest regions constitutes the greatest menace to our forests and is the reason in 90 percent of all cases why forest fires get out of control” (Stevenson 1929). This attitude combines with burning being the most economical option explains how slash burning became a common practice.

2.2. 1943-1974

The 1945 Royal Commission marked the start of a new era in forestry in BC. The Sloan Commission introduced the idea of sustained yield in order to secure continuous forest production. This period saw major changes to the industry including a move toward close utilization standards and the birth of the pulp and paper industry in the interior of BC.

The Sloan Commission continued to view logging slash as a serious forest fire risk. In his discussion of logging waste utilization, he stated that the practice of leaving merchantable timber was an “uneconomical misuse of the forest resource and, in addition, this mass of material creates a dangerous fire-hazard” (Sloan 1945, 48). It is

important to note that Sloan did not view all logging residues as waste. He only viewed it as waste if the timber was of merchantable quality. He found four reasons why high quality timber would be left behind. They were:

(a) Sound logs, suitable for sawlogs, that have been left in the woods because either one or both ends have been broken (the bucking of 2 to 4 feet from the shattered end would convert them into good sawlogs); (b) short sections of sawlogs resulting from tree breakage during falling; (c) trees too small to make sawlogs that have been knocked down during logging; and (d) sawlogs that have been overlooked by the yarding crew (Sloan 1945, 43).

Sloan believed that the utilization of this waste was in the government interest. He therefore, recommended that the government take steps to bring about utilization of this material.

While Sloan felt that fire protection in BC was wholly inadequate, he was not as definitive on slash burning as the prior commission. In his hearings he heard many divergent opinions on slash burning. The opinions ranged from proponents who favoured slash burning in most circumstances to opponents who would entirely do away with slash burning. Sloan's conclusion was "that it is impossible to formulate any policy of general application in relation to slash-burning" (Sloan 1945, 135). He argued that slash disposal was so site specific that the province should not require burning as a blanket policy. Instead he felt that the minister should require slash burning on specific sites that he/she felt needed it.

In 1956 Sloan carried out a second Royal Commission. He found that fire protection had improved since 1945, but still was underfunded (Sloan 1956, 246). However, much of the focus of his two commissions when it comes to fire protection had to do with monitoring, funding and staffing levels of the forest service. Unlike the attitude of the previous period, logging slash was not considered the great evil that it previously was. Slash was still considered a fire hazard, but not to the same extent. It is not clear whether this change in focus was a result of a change in attitude toward logging slash, or whether slash burning had reduced the hazard from logging residues.

The public concern regarding forest practices and industry desire for tenure reform prompted the government to call a fourth Royal Commission. This commission marks the end of this period and the start of the next.

2.3. 1976-1991

While this period was one of transition and conflict, slash burning and forest fire mitigation seem to have receded into the background. The Royal Commission in 1976 and subsequent changes to the Forest Act in 1979 did not substantially change the status quo. The era ended with massive protest, mass arrests, international media attention, and a major shift in values (Hagerman 2010). Ecological concerns had become a primary issue in the international community. These concerns manifested themselves in BC through calls for increased protected areas and more actors demanding a voice in forest management decisions.

The Pearse Commission began in June of 1975; submitting its final report in September of 1976. The report did not directly discuss slash burning, but discussed the issues of waste and utilization standards more broadly. Pearse pointed out that “the general rule throughout the province today is the so-called close utilization standard, which requires that all trees, living or dead, with a diameter of 7.1 inches or larger in the Interior and 9.1 inches or larger on the Coast must be recovered. All of the stem between a stump 12 inches high and a 4 inch top must be utilized (Pearse 1976).” Pearse identified problems with the close utilization standard that still exist today. The main problem is that the close utilization standard required the removal of low quality logs that had high incremental harvest cost. Specifically he highlights that the high incremental cost of harvesting the low quality wood, and low incremental benefit of selling the wood, is hidden by average costs and revenue (Pearse 1976, 245). Pearse argued that utilization standards should be utilized to set standards that ensure the full economic value of the timber is realized (ibid).

This debate on utilization standards is just as heated today as it was in 1976. This debate about utilization is a major part of the slash pile burning question, because people who favour close utilization standards see slash pile burning as a waste of fibre,

while the other side sees it as an efficient waste disposal mechanism. In a way, the debate has not moved forward. With the projected fall down in timber harvest, the close utilization proponents will have a relatively new argument that may advance their cause. The mountain pine beetle epidemic has killed over 710 million cubic metres of timber in the province (Province of BC, 2012). This has created a timber supply crunch for the next 20-50 years. This supply crunch will require the industry to be more creative in how it utilizes the available fibre, or the only alternative will be for the industry to shrink.

This period ended with the Peel Royal Commission in 1991. This commission discussed the public concern regarding forest practices in BC, but that concern was not related to slash burning. The biggest public concern was the practice of clear-cutting. Clear-cutting was (and is) an emotional issue for people because of the drastic and sudden change that was brought to the landscape (Peel 1991, 87). The practice of clear-cutting could be connected to slash burning, because clear-cutting creates the waste that is burned; however, the commission did not make this connection. The commission focused on clear-cutting's role in deforestation rather than utilization standards.

2.4. 1992-Present

The major change that we have seen in this period is that environmental NGOs and Aboriginal groups joined industry and government as “perennial actors in the system” (Hagerman 2010). Environmental NGOs gained agency through international campaigns, while Aboriginal groups gain agency through the court system (Hagerman 2010). These added actors, make policy change when it comes to slash pile burning more complex, as there are more values that need to be taken into consideration.

Today there are many values when it comes to logging residues that the forest service must balance, including differing views within the BC government. For instance, “fire protection officers are concerned with fuel loading; forest ecosystem specialists are concerned with biodiversity; silviculture foresters are concerned with planting spots, harvesting foresters are concerned with logging costs, and scaling foresters are concerned with utilization standards” (Arsenault 2002). Another value not mentioned by

Arsenault, is climate change specialists are concerned with carbon emissions and carbon sequestration. All of these values have gained a voice within the forest policy network and make change very difficult.

2.5. Slow Rate of Change in Industry – Regeneration

Policy change within the forest sector in BC has been incremental in the past. In fact even when confronted with substantial evidence, change can be painfully slow. One example of this is the regeneration policy of the province. When the industry was in its infancy, artificial regeneration was not required. The Forest Service believed that natural regeneration was sufficient (Hagerman 2010). However, inventory reports produced by the Forest Service in 1926 and 1936 showed that natural regeneration was not working. In fact, the 1936 report stated that “the regeneration of logged lands on Vancouver Island and the adjacent Mainland constitutes the most urgent silvicultural problem facing the province” (Province of BC Department of Lands 1936). By the late 1930s it was generally accepted that the growing demand for trees would exhaust the coastal supply (Hagerman 2010). It was this concern that precipitated the Sloan Commission in 1945. Despite this evidence, it took 50 years for the government to make regeneration a contractual and financial obligation of tenure holders.

This resistance to change is very informative to the slash burning policy. Scientific evidence is not enough to drive policy. When it comes to slash burning there is no scientific certainty. This policy area is very much driven by values and interests rather than objective evidence. For this reason, it is important to keep in mind that the purpose of this project is not to reduce the uncertainty around slash burning. Simply reducing the uncertainty is not enough to drive policy change. As Hagerman et al state, “the reduction of ecological uncertainty (or perceived certainty) is not a requirement for policy change, and crucially, should not be expected as criteria for change” (Hagerman 2010).

2.6. Current Policies Related to Post Harvest Debris

There are numerous policies, regulations, and guidelines that impact the industry's production and handling of post harvest debris. As mentioned earlier, some of these policies and guidelines seem to encourage slash burning while others discourage it. When dealing with post harvest debris, professional foresters must strike a difficult balance between these different values.

2.6.1. Fire hazard and fuel hazard risk

The main regulatory burden that companies face regarding harvest residues is the *BC Wildfire Act* that requires companies to reduce the amount of fuel left on site after harvesting (BC Wildfire Act 2004). The act and the related regulations do not require that companies burn the debris; they simply require that the debris be removed in some way. In fact, the Wildfire Management Branch would prefer to see the debris taken off site and used for a productive purpose rather than burned on site. However, companies burn their debris in slash piles because it is not economical to take the fibre off site, and pile burning is the cheapest alternative.

The government regulation states that forestry companies must ensure that their logging activity does not increase the risk of a fire starting on the site, and does not increase the fire behaviour or fire suppression associated with a fire if it were to start (BC Wildfire Regulation 2005). This regulation is vague and does not provide clarity on when companies will be relieved of their liability. In practice the Wildfire Management Branch demands that the fuel hazard be abated to 4000 kW/m (kilowatts per metre). When the fuel load is greater than 4000 kW/m a fire is difficult if not impossible to control even with the support of water bombers (Kamloops Community Wildfire Protection Plan 2008).

The government depends on professional reliance to ensure that the abatement measures are carried out. In contrast to the past, the branch does not visit sites in order to ensure the fuel hazard has been abated. In practice the Wildfire Management Branch investigates wildfires after they have started and if they find that a company's activities increased the risk of a fire starting on the site, or increased the fire behaviour then the

companies will be held liable for the cost of fighting the forest fire. This cost is usually millions of dollars and companies often fight the penalties in court.

Figure 1: A slash pile after a burn has been carried out.



Photo Credit: Author's Photo

The Wildfire Management Branch has produced a guidance document that helps companies to assess their fuel hazard, but the guide is clear that each site is different and relying on the guide for the assessment may not be sufficient (Wildfire Management Branch 2012). The Wildfire Management Branch does not provide site specific advice to companies regarding what actions would reduce the hazard sufficiently. The reason that the branch does not provide this guidance is that this could relieve the liability of the companies and put the liability on government through official induced error. This has led to a situation where companies may be liable for millions of dollars of damage and the only way to avoid the liability is to remove debris from the cut block. Because companies cannot be assured that the volume of fibre they leave behind sufficiently abates the hazard, they are typically conservative in their abatement measures, and burn most piles on site, leaving as little fibre behind as possible. This is especially true in the high risks areas such as the southern interior.

2.6.2. Smoke management

The Open Burning Smoke Control Regulation within the *Environmental Management Act* works at cross purposes to the *Wildfire Act*. While the *Wildfire Act* compels companies to reduce the risk, usually done through burning, the smoke regulations severely limit when companies can burn their slash piles. Industry finds this regulation to be much more burdensome than the *Wildfire Act*. The Open Burning Smoke Control Regulations drastically reduce the number of days that companies can burn their slash. Often this results in numerous operators conducting their slash burning on the same day. This concentrates the smoke on a small number of days, and if a mistake was made on the venting index, then huge amounts of smoke could impact the surrounding communities.

Figure 2: A smoke plume created by slash pile burning



Photo Credit: Author's Photo

Slash pile burning is carried out in the fall and early winter because snow cover helps to prevent the fires from spreading. The Open Burning Smoke Control Regulation impacts companies because often there are few optimal venting days in this time period, so companies need to burn their slash on these days regardless of the weather conditions. This results in companies being forced to burn when there is heavy snow

cover on the piles, making the process much more labour intensive and costly. Some companies have complained that the smoke regulations have made it nearly impossible for them to burn the slash that they need to; as a result the fire hazard is not being properly mitigated (TimberWest 2005). Others within the industry go even further, and argue that the underlying goal of the Ministry of Environment is to reduce logging activity in the province. On the other hand, the Ministry argues that the smoke is a serious threat to human health and industry has found a way to operate within the regulations without having the detrimental impacts that industry predicted.

2.6.3. *Annual allowable cut*

A major regulation that impacts the utilization of slash is the annual allowable cut (AAC). The AAC grants companies a certain amount of volume that they are allowed to harvest in a year. In this case, harvest means take off of the block, not just cut down. Some people argue that because the companies want to maximize their revenue, they target the highest quality logs for harvest. If they harvest lower quality pulp logs then these logs will count against their AAC and they will not be able to bring in some higher quality saw logs. The result of this situation is that companies leave lower quality logs in the field because they want to maximize the number of saw logs that they harvest.

Some people in the industry argue that the situation is not so simple. They point out that the large integrated companies have a need for saw logs, pulp logs, and hog fuel. They contend that their logging operations attempt to balance the need for these different types of fibre. Their system requires that the three types of fibre remain in balance or else their production could be hindered by a lack of one of these classes of fibre. In the end there is probably truth in both arguments. The AAC mostly like does contribute to companies' lack of desire to bring in lower quality logs, even if they could make a slim profit on them at the initial harvest. However, correcting this issue is unlikely to result in large scale slash utilization because the companies only have a limited demand for the lower quality fibre.

2.6.4. Waste benchmarks

Currently, the government has waste benchmarks that allow companies to leave some useable logs in the field without having to pay any sort of penalty or stumpage for the waste. The benchmarks vary from 4 m³ per hectare to 35 m³ per hectare depending upon the biogeoclimatic zone and whether the stand is in a wet or dry zone (Timber Pricing Branch 2012). Some people argue that this encourages waste because companies have to pay stumpage if they take the logs out, but do not have to pay anything to leave the logs. They argue that utilization is at a competitive disadvantage to the cull pile. They claim that if the benchmarks were removed more of the marginal fibre would be brought in. Some people even argue that these waste benchmarks and the reduction of waste penalties are the sole reason why waste is created (Parfitt 2007). The following quote from Mike Kennedy of Ainsworth OSB illustrates these opinions.

... there is really no downside to throwing wood in the waste pile. It doesn't get counted against your allowable cut if it's a so-called dry grade 4 or a dry pulp log. They're not measured in any kind of waste survey or recognized at all. For all intents and purposes, that wood disappears on paper when it goes into the cull pile.

Second, a lesser issue, is that there are waste benchmarks in place right now that provide a stumpage-free allowance for sawlog material that's left in the cull pile. The combination of those two means that there really is no downside to throwing wood in there. There's no need to have to utilize it (Kennedy 2012).

Others argue that these waste benchmarks do not encourage more waste than normal. They argue that companies do not consider the waste benchmarks when they are operating in the field. They argue that they harvest all of the fibre that they can make a profit on, and leave the rest behind. Not paying stumpage on the fibre below the benchmarks allows them to be more competitive. They contend that removing the waste benchmarks will increase their costs and result in them being less competitive and hurt the whole industry in the long run.

2.6.5. Regeneration requirements

All harvesters are required to establish a free growing forest after their harvest activities. Companies are free to use natural regeneration or to plant nursery grown

seedlings, but the stand must be free growing after a certain timeframe. In some cases, when the post harvest debris load is heavy they need to clear the debris in order to free up some plantable spots for regeneration. While this need for plantable spots does not usually drive slash pile burning, it is one additional reason why companies burn their debris.

2.6.6. Coarse woody debris guidelines

The Chief Forester has recently released guidelines on the volume of coarse wood debris (CWD) that should be left on site after harvest operations (Chief Forester 2010). This guide outlines the reasons for CWD and also outlines the type and size of optimal CWD. The guide specifically states that when the fire risk is high leaving CWD may not be advisable. This reinforces the conclusion that wildfire mitigation is the dominant value when it comes to post harvest residues. When wildfire hazard mitigation works at cross purposes to other values such as CWD or soil productivity the hazard mitigation wins out. Some argue that fire mitigation does not play nearly as pivotal a role as it could. It was pointed out that in some jurisdictions fire hazard and fire behaviour impact where and when harvest activities can be carried out. In BC, fire hazard usually only comes into the picture after the harvest is complete.

2.6.7. Soil nutrients and productivity

The BC regulations are not prescriptive in general, and especially not prescriptive when it comes to site productivity in the future. Companies are required to ensure that the site remains productive, but they are not given guidance on how to do this. Most of the nutrients in trees are in the branches and small needles. For this reason, there is some concern about the nutrient impacts of whole tree harvesting. These pieces also represent the highest fuel hazard. These two values are in direct confrontation, and the fire management value has clearly 'won' this confrontation. That being said, direct experimental research has shown that whole tree harvesting (removing all the biomass) compared to stem only harvesting did not greatly impact the growth of seedlings (Fleming et al 2006). This could be because BC's soil is relatively young, and the impacts may be in the more distant future. In general soil nutrient specialists would like

to see a system where low productive sites are identified and whole tree harvested is not allowed because of the nutrient depletion issues.

2.7. Summary

The burning of logging slash has been carried out for a number of reasons over the past century. The various reasons for slash burning include:

- abating the fire hazard,
- removing debris that obstruct reforestation worker access,
- creating plantable spots,
- shortening the regeneration delay, and;
- reducing levels of competing vegetation (Parminter 1991).

This policy environment of multiple, sometimes conflicting, values and numerous reasons to continue slash burning make this issue resistant to change. It is this resistance to change that makes this policy a fruitful area of study for a report of this nature.

3. Methodology

3.1. Overview

The primary method of research is in-depth qualitative interviews with industry, government, and eNGO stakeholders. These interviews serve multiple functions. The first is to establish stakeholder views on the topic of logging residue burning. While this issue has been around for a long time, it is not an issue that garners much attention from the general public. For this reason, I conduct in-depth interviews with stakeholders, rather than an extensive survey. Interviews allow me to delve deeper into the complexities of this topic and get the stakeholder's views on slash burning, the barriers to change, and the elements that would facilitate change. In total, I carried out interviews with 16 contacts from the BC Government, Federal Government, industry, and the Pembina Institute. My interview with the Pembina Institute led me to a survey they had recently conducted on eNGO opinions regarding biomass harvesting. This survey was instrumental in gaining a broad range of opinions from a diverse group of eNGOs.

In order to change the policy on slash pile burning, it is critical to understand the different values and viewpoints that the various groups have. This is especially true of industry because they are the ones that carry out the slash pile burning (in order to comply with government regulation). Without industry buy-in, it will be very difficult for any policy change to occur. The study includes a site visit to see firsthand some of the issues that harvesters face when dealing with post-harvest debris. In addition, I visited a few facilities that could utilize post-harvest debris, in order to understand the issues they face and understand the barriers to utilizing harvest residues.

The function of the government interviews is to shed light on the policy environment that slash pile burning exists in. Preliminary research has shown that many different branches and departments in the BC Government are interested in this topic.

On top of this, they have divergent and competing views on slash burning. For example, the wildfire management group values slash pile burning for fuel reduction, the smoke management group limits the conditions in which slash burning can be carried out, people concerned with soil nutrients prefer fibre to be left on sight, the people concerned with wildlife habitat want larger, coarse woody debris (CWD) left on-site, and people who want as much value extracted from fibre felled in BC want the fibre to be taken off-site and utilized. The interviews will establish the different priorities of the various groups within government in order to find a path forward. Understanding the dynamic within the government is just as important as understanding the dynamic outside of government.

4. Criteria and Measures

The criteria used to evaluate the policy alternatives for this project are effectiveness, equity, stakeholder acceptability, and negative externalities. These criteria reflect broad societal goals when it comes to this issue. The measures used to evaluate the policy options are derived from a number of interviews with stakeholders along with an examination of the literature related to post-harvest debris. In this section I discuss each criterion separately and then summarize them in Table 1.

4.1. Effectiveness

This is the central criterion. This criterion is measured in the amount of slash pile burning that is carried out in the province. The goal of any of the policies examined is to reduce the slash pile burning that is carried out. I will not quantify the amount of slash pile burning in an absolute sense. The province does not currently measure how much fibre is burned, and while there are some reasonable estimations of the amount burned, it is very difficult to quantify the amount of burning that is reduced by a policy. This criterion will be measured through the interview process to gauge the likely reaction to the different policy options. The goal will be to reduce slash pile burning by the greatest amount possible without negatively impacting the other criteria.

4.2. Equity

This criterion will examine the horizontal equity issues within the industry and between different regions of the province. Horizontal equity is the idea that similar people or groups are treated equally. In this case, policy options will be examined to see if they treat similar companies within the industry in a fair way. In addition, I will examine the policy options to see if they treat the different regions of the province fairly. If a

policy option has disproportionate effects on one segment of the industry or one region of the province, then it would be difficult to accept that option.

4.3. Sustainability

This criterion will briefly examine the impact the various policy options have on soil fertility and wildlife habitat. I use the information from my interviews to get a general sense of the impact that the policy options have on these indicators. In general, I compare the policy options to the situation that exists today in order to determine if the policy options improve or degrade the natural environment.

4.4. Stakeholder Acceptability

There are three significant stakeholders that will be impacted by changes in forestry regulations. These are the B.C. government, industry, and environmental NGOs. Because the cost to industry and government are built into this criterion, I will give this criterion extra weight. All the other criteria are measured out of 6 while this one will be measured out of 9 (3 points for each stakeholder).

4.4.1. *B.C. Government*

This measure examines the impact that the various options will have on government revenue and the additional costs that the options will put upon the government. This measure involves both the revenue impact that options have and spending increases that some options call for.

4.4.2. *Industry*

This measure is the delivered wood cost that the industry must bear. In essence the industry must pay a certain price to harvest wood from the field and bring it to the mill. There are many costs that the industry must cover besides the basic cost of harvesting. These include road building, regeneration responsibility, and post harvest debris treatment. Currently, the industry piles and burns most of the debris because it is

the cheapest alternative. This measure will examine the impact the various policy options have on the delivered wood cost for industry, and measure the likely reaction to the policy option.

4.4.3. *Environmental NGOs*

Environmental NGOs have expressed concern with logging practice in BC. Over the last 25 years eNGOs have gain agency in BC forestry. For this reason, this measure will take into the likely reaction of eNGOs. The primary method of measuring eNGO opinions is through a recently published extensive report on eNGO opinions on biomass utilization and eNGO submissions to the Mid-term Timber Supply Review Committee. While the biomass utilization report was not specifically about slash pile burning, it does cover all of the pertinent issues when it comes be biomass including: biodiversity concerns, opinions on bioenergy, soil nutrient, and air quality issues.

4.5. Negative Externalities

With this criterion I will attempt to examine the likely reactions and consequences that may occur as a result of the policy options. There are numerous externalities that could result as a consequence to the policy chosen. Some of the environmental externalities include negative effects on soil nutrient levels, biodiversity, and wildlife habitat. Some other externalities include unintended market reactions to the policy. For example, if a policy results in an increase in low quality fibre and a decrease in high quality fibre, the market prices will decrease or increase respectively. However, if the policy choice does not allow the market players to react to these price changes then the producers may be forced to continue to harvest lower quality and unprofitable fibre at the expense of the higher quality fibre.

Table 1: Criteria and Measures

Criteria	Definition	Measure	Index	Source of Data
Effectiveness (6)	The amount of slash that is not burned as a result of the policy.	Will the policy successfully reduce the amount of slash that is piled and burned in BC?	2 – Slash pile burning will be negligibly reduced by the policy option. (less than 5% reduction) 4 – Slash pile burning will be moderately reduced by the policy option. (5-20 % reduction) 6 – Slash pile burning will be significantly reduced by the policy option. (greater than 20% reduction)	Stakeholder interviews.
Equity (6)	Horizontal equity within the industry.	Does the policy favor one segment of the industry over another?	1 – The option treats segments of the industry differently with no possible modifications to correct this. 2 – The option treats segments differently, but modifications to the policy can be made to correct this different treatment. 3 – The option does not treat segments of the industry differently.	Stakeholder interviews.
	Horizontal equity between regions of the province.	Does the policy favor one region of the province over another?	1 – The option treats regions of the province unfairly with no possible modifications to correct this. 2 – The option treats regions unfairly, but modifications to the policy can be made to correct this different treatment. 3 – The option does not treat regions of the province unfairly.	Stakeholder interviews.
Sustainability (6)	This will be measured by the impact on soil nutrient and coarse woody debris for wildlife habitat.	What impacts will the policy have on soil nutrients or coarse woody debris?	2 – There will be a negative impact, in comparison to the status quo, on soil nutrient and coarse woody debris for wildlife habitat. 4 – There will be negligible impact on soil nutrient and	Stakeholder interviews.

			coarse woody debris for wildlife habitat. 6 – There will be positive impacts on soil nutrient and coarse woody debris for wildlife habitat.	
Stakeholder Acceptability (9)	BC Government	Will the policy be acceptable to the BC government? Will the policy cost the government a significant amount of money?	1 – The policy is difficult and costly to implement. 2 – The policy is either costly or requires significant change required within the Ministry. 3 – The policy is not overly costly, nor difficult to implement.	Stakeholder interviews and published reports.
	Industry	Will the policy be acceptable to most industry participants? Will the policy increase the delivered wood cost?	1 – The policy significantly impacts the delivered wood cost. 2 – The policy does require some increased cost to the industry but not significantly more than today's system. (less than 10% increase) 3 – The policy does not impact the delivered wood cost.	Stakeholder interviews.
	Environmental NGOs	Will the policy be acceptable to most environmental NGOs?	1 – There will be significant opposition to the policy from eNGOs. 2 – There will be some, but not uniform, opposition to the policy from eNGOs. 3 – There will be very little opposition to the policy from eNGOs.	Stakeholder interviews and published reports.
Negative Externalities (6)	The likely impacts of the policy.	Will the policy have unintended environmental and/or pricing consequences that negatively impact the province?	2 – There will likely be significant negative impacts on other policy areas. 4 – There will likely be moderate negative impacts on other policy areas. 6 – There will likely be little negative impacts on other policy areas.	Stakeholder interviews.

5. Actions the Government is Already Taking

Last year the BC government initiated the BC Forest Sector Bio-Economy Transformation Council. This council was co-chaired by both industry and government. While the Council's goals were much broader than this capstone's, many of the initiatives that it looked at directly relate to slash pile burning. One of the six working groups was the Forestry and Fibre Work Group that examined the availability of biomass and how to increase the utilization of this biomass. Many actions are currently taking place, or are in the planning stages, that could increase the utilization of forest biomass in BC including biomass forest tenures that allow second harvesters to access biomass even if they cannot reach an agreement with the first harvester; although accessing the fibre through a business to business relationship is still the preferred method of the BC government. The following points regarding other actions the government is considering are taken from a speech Dave Peterson, BC's Chief Forester, gave to a Canadian Bioenergy Association National Conference. In this speech Dave Peterson outlined the actions the government is doing to try encourage the utilization of harvest residues including:

- increasing economic margins for the biomass;
- encouraging one-pass harvesting;
- reducing administrative cost of tracking and charging for this fibre, and;
- creating forest tenures that allow other users to access to the fibre (Peterson 2012).

In addition, the government has funded bioenergy projects around the province. Some of these projects have been larger scale projects through BC Hydro. BC Hydro's Bioenergy Phase 1 and 2 Calls have been granted to larger users such as pulp mills (BC Hydro 2011). The government has also supported the Green Heat Initiative which has funded small community bioenergy projects. These projects are smaller scale projects that provide heat to public buildings (Dubios 2011). The Green Heat Initiative attempts

to expand the demand for biomass to different regions of the province. These sort of projects certainly will be helpful in finding a user for the fibre that is currently burned in the field.

6. Linking Policy Options to Core Reasons for Slash Pile Burning

There are three broad factors that lead to slash piles being burned in BC. Each of the following policy options attempts to address at least one of the factors.

6.1. Fire Hazard Abatement

Slash pile burning creates a fire hazard risk that must be abated. Quite simply leaving the slash behind is not an option. On top of this there is also a visual element to this factor. Heavy slash loading is seen as blight on the landscape and is not acceptable to the population. Fire hazard reduction is the main factor that leads to slash piles being burned, but it does not explain why slash is created in the first place. The following two reasons are the primary factors that lead to post harvest logging debris in the province.

6.2. Limited Markets and Marginal Economics

The market for the material in the slash piles is limited. Currently, there are few facilities in BC that demand this low quality fibre. Over the last decade the pellet industry has emerged as a potential user of this fibre, but the market cannot support the price that is required to haul the material long distances. The furthest distance that these facilities can haul fibre is currently around 120 kilometres (Peterson 2012). This leaves a significant portion of the province that just does not have access to the markets to utilize the fibre. This problem is exacerbated by the regional concentration that has occurred within the industry over the last two decades. As mentioned in the previous section, the BC government is supporting bioenergy projects in order to increase the number of facilities that can use this fibre. These projects represent a good first step, but more work will still need to be done to encourage facilities to utilize this fibre.

Another related issue is that users of this fibre often cannot support the cost of transporting the fibre from the harvest site to their facility, even within this 120 kilometre zone. These users have built their business on utilizing cheap saw mill residues which are a fraction of the price of harvest residues. This problem is especially true for the bioenergy facilities mentioned previously. Energy is fairly cheap in BC, so these bioenergy facilities find it very difficult to compete if their feedstock is too expensive. These two factors present a two pronged challenge: the first is to encourage the creation of facilities that can use the fibre; the second is to ensure that these facilities are able to use the fibre and still remain profitable.

6.3. Disincentives to Utilize in the Current System

Finally, the last factor is the disincentives built into the system that make the fibre available for harvest. I discussed some of these disincentives in the background section; how the annual allowable cut is calculated, when the waste survey is carried out, and complications related to two separate harvesters. The combination of these disincentives and the marginal economics surrounds logging debris, make increased utilization a difficult policy area to tackle.

7. Policy Options

In this section I examine four different policy options for reducing the amount of waste that is piled and burned. I designed the first policy option myself, which is charging a fee on a per cubic metre basis to burn slash. The last three policy options are options that are fairly common within the forestry community. Most of these options are not mutually exclusive, and I will discuss the merits of proceeding with the highest scoring two options in the recommendation section.

7.1. Charge a Fee for all Fibre that is Burned

As I mentioned earlier, the government currently carries out a waste assessment survey after the harvest activities have been concluded. If there is waste above the benchmarks the companies are charged stumpage on that waste. Once the survey has been carried out and companies want to burn the piles for fuel hazard reduction, it is a fairly simple process of calling a phone number and getting a burn number. This policy would turn that system on its head. The government would do away with the waste assessment survey and waste penalties and replace it with a fee for burning fibre. When a company finished all of the harvest operations the government would carry out a survey to determine the volume of fibre that is intended to be burned and the government would charge a fee based on that volume. The general steps are listed below:

- Carry out harvest activities including chips and hog fuel.
- A burn survey would be carried out and fee charged for the volume of fibre that is going to be burned.
- Company pays the fee and carries out the burn when the conditions are suitable.

Some stakeholder engagement will need to be carried out in order to set the initial fee. However, the regulation should have a set timeframe for periodic review of

the fee. It should be clear that the intention of the fee is to reduce slash pile burning; therefore the fee will be adjusted if it is not having the desired effect. These adjustments will allow the fee to adapt in order to ensure that it is effective. It is important to stress that this policy would be in addition to stumpage, and if the policy were successful the revenue collected from the burn fee would dwindle. This should be interpreted as a successful policy, not as a reduction in revenue; the collection of revenue from forestry will still be primarily through stumpage.

7.1.1. *Refinements of the Policy*

When I had originally thought of the policy I proposed the burn fee be assessed on a per pile basis in order to make the assessment as simple as possible. However, when I went into the field it was clear that piles can be vastly different in size, and if the fee was based on a per pile basis the industry would start to make bigger and bigger piles to avoid the fee. The pictures below illustrate that it would be unfair and illogical to charge the same fee for the two piles. For this reason the assessment will need to be on a volume basis, even though the assessment may be more difficult to carry out.

Figure 3: A small pile approximately 5 metres long



Photo Credit: Author's Photo

Figure 4: Flames from a single pile that is over 100 metres long



Photo Credit: Author's Photo

Another refinement of the policy resulted from my discussion with people within the industry. I was told that they would find the fee extremely unfair if it were applied equally to cut blocks that are far away from a facility that could utilize the fibre. They argue that for these cut blocks that are many kilometres from a facility there are no other

options but to burn. In their view it is unacceptable for the government to charge a fee for fibre that is virtually impossible to utilize. There are many ways to get around this problem; the first is for the government to use the kilometres from a facility in the calculation of the fee. I illustrate with an example of an equation below; however, there are many different ways of calculating the fee to ensure that the fee decreases as the kilometers away from a facility increases. Using the equation below as an example; if the fee were set at \$1 per cubic metre and 1,000 cubic metres were burned, a site 10 kilometres from a facility would pay \$905 while a site 150 kilometres from a facility would pay \$225.

$$\text{Fee Charged} = \text{Fee} \times \text{m}^3 / 1.01^{\text{km}}$$

Alternatively, the government could establish different zones based on the distance from a facility and charge a different fee based on the zone. An example of possible zones is listed below. Please note that both the kilometres for each zone and the fee applied to the zones is for illustrative purposes only. The actual zones and fee levels would need to be determined after more thorough consultation with stakeholders and government departments. The downside of using a zone system is that there will be issues with locations that are on the border of two zones. Companies will complain that it is not fair that locations that are 150 kilometres from a facility pay twice as much as locations that are 151 kilometres away. This will result in a strong motivation for companies to manipulate that numbers in order to get into the furthest zone possible. For this reason, the zone system will not be as effective as a calculation similar to the one above.

- Zone 1 (0-50 km) = \$1 per m³ burned
- Zone 2 (>50-150 km) = \$.50 per m³ burned
- Zone 3 (>150-300 km) = \$.25 per m³ burned
- Zone 4 (>300 km) = \$.10 per m³ burned

7.1.2. Goals

This policy options has a number of goals. The first is to eliminate the assessment survey that currently acts as a barrier to efficient chip and hog fuel harvesting. This policy achieves this goal by ensuring the survey is carried out after all harvesting activities are finished. This allows companies to utilize the lower quality wood

when they already have the equipment and labour on site. This allows the first harvester to harvest lower quality fibre with at a lower marginal cost. Second harvesters on the other hand, have to bring the equipment and labour on site to harvest the chips and hog fuel, so they must recoup these costs in the sale of the chips and hog fuel.

The second goal is to attach an economic or ecological value to all fibre that is cut down in BC. This policy achieves this by charging a fee for all fibre that is wasted through burning, not just saw log quality wood. Fibre that is cut down but left on site for ecological purposes, such as coarse woody debris for wildlife or fine woody debris for soil nutrient, would not be charged under this system. Obviously, there will need to be a balance between the volume of fibre that is left on-site for ecological purposes and the wildfire hazard. In addition, the fibre left behind should serve a useful purpose, leaving large piles behind is not ecologically valuable. In fact, large piles take up more plantable spots; which negatively impacts regeneration. Some additional research will need to be carried out in order to determine the appropriate balance.

Essentially, this system changes the message that government is sending to industry. In the past, the government only charged stumpage on saw log quality waste, and did not measure the volume of lower quality wood in the waste assessment surveys; sending the signal that the government disapproves of saw log waste, but other waste is okay. This system changes the message; now the government is saying that they do not like wood of any quality being burned, however not all wood that is cut down must be utilized if an ecological purpose is being served. This message is more consistent with the values of the public and the government.

7.1.3. Drawbacks

This policy is a fairly major change in how the government charges companies for its waste. This change could have revenue implications for both the government and industry participants as well. While the fee could be set at a similar rate as the current waste assessment survey to ensure that government revenue remained the same, there would surely be winners and losers within the industry. This could create a certain amount of backlash to this policy.

Another drawback to this policy is that with no waste assessment survey, companies would be able to chip up saw log quality wood and pay significantly lower stumpage fees to the government. This could have negative revenue implications for the government. Industry participants do not feel that this is a reasonable fear because they claim that no one would chip up high quality logs. In reality there is probably truth in both sides of the argument. Companies do not normal chip up high quality logs, but they do leave behind timber that is graded as saw log quality. Once it is left behind the second harvester is likely to chip it up. With this policy option the harvester that chips up the higher quality wood would be charged the lower stumpage rate.

Finally, this policy option will need to be refined in order to ensure that excessive amounts fibre are not left behind. If companies were to leave large piles unburned, they would not only present a fire hazard but they would also take up valuable planting space for regeneration. As can be seen in Figure 4, piles can be very big and take up a lot of room. Therefore, even if the fire hazard was low in an area, the piles would still need to be removed. This policy may need to be refined in order to ensure that fibre that is exempt from the burn fee serves a useful ecological purpose.

7.2. Fibre Based Annual Allowable Cut

Currently, the annual allowable cut (AAC) is based on a saw log centric system. Companies are granted the right to harvest a certain volume of wood per year. Non-saw log quality wood that they cut down, but leave behind, does not count against their AAC. For this reason, some people within the industry argue that utilization would increase, and slash pile burning would decrease, if the AAC were fibre based rather than saw log based. With a fibre based AAC companies would be motivated to bring in any fibre that was economically feasible because the volume would be counted against their AAC regardless.

7.2.1. Goals

The goal of this policy option would be to eliminate the motivation for forest companies to leave marginally economic fibre in the field because they want to

maximize the value of their allotted AAC. Currently, companies can leave lower quality wood in the field and still have AAC available to harvest higher quality logs. With a fibre based AAC, their AAC would be reduced whether they utilized the fibre or not. This should ensure that companies will bring in all fibre that provides even a modest economic benefit.

Another goal of the policy is to attach a value to the fibre. Although stumpage would not necessarily be charged for all of the waste fibre that is left behind, the AAC implications would send a signal that the fibre is valuable. This would act as a first step to ensuring that all wood cut down in BC has an economic or ecological value.

7.2.2. Drawbacks

The major drawback to this system is that it does not guarantee a significant reduction in the amount of fibre that is burned in BC. This system should ensure that the marginally economic fibre is utilized, but the majority of fibre that is burned is uneconomic, so this fibre would continue to be left in the field and burned for fuel hazard reduction. Theoretically, this volume should be reduced if more marginally economic timber is harvested, but this policy lever does not specifically demand a reduction in slash pile burning.

Another drawback to this system is that the fibre balance could become skewed. Industry currently strikes a balance between the amount of sawlogs, pulp logs, and hog fuel that they produce. If an increase in lower quality wood enters the system without a proportional increase in higher quality wood, the system would become unbalanced. Market prices would adjust to this new fibre balance, but the industry would find it very difficult to adjust the supply level in order to react to the new market conditions. This would result in an excess supply of pulp logs and hog fuel without a proportional increase in demand for this fibre. The reason this is the case is that the only way they could bring in the higher quality fibre without also bringing in the lower quality fibre is if they completely changed their harvest practices: selectively cutting down the good fibre and leaving the lower quality wood. This would significantly increase the industry's costs which they argue, and the Ministry is sympathetic, they cannot afford. This fibre imbalance is a concern on a province-wide basis and on a company-wide basis.

Companies would be very concerned that this system would increase the volume of low quality wood by decreasing the volume of higher quality wood that they can harvest. This issue could be overcome if tenure holders were given a higher AAC with the assumption that their utilization standard would go up. However, there are rules within the *Forest Act* that make it difficult to apportion new AAC in this way.

7.3. Remove Waste Benchmarks – Increase Penalties for Waste

This policy option would eliminate the allowable waste that companies are currently allowed to leave behind without paying stumpage. The policy option could also increase the penalty from regular stumpage to one and a half times the stumpage. This policy would not apply to all fibre as the previous policy option did; it would only apply to saw log quality wood that is left behind.

7.3.1. Goals

The goal of this policy option is to add a cost to leaving fibre behind. Some members of the industry argue that because companies can leave logs behind for free or utilize the logs and pay stumpage, the cull pile has an unfair advantage. This policy would send a signal to the industry that the public values the timber and wants to see as much of it utilized as possible.

7.3.2. Drawbacks

Other members of the industry argue that this policy would unduly raise the delivered wood cost and hurt the industry in general, without resulting in the intended utilization increase. They argue that the reason that they do not utilize some of the fibre is the delivered wood cost is higher than the price they can sell the fibre for. As mentioned above, one way to get around this problem is to change their harvesting techniques so they do not cut down the lower quality fibre in the first place. However, this could increase industry costs more than the penalties would. Industry contends that if you increase the penalties you would simply increase the delivered wood cost without

increasing the price they can sell the fibre for. This could result in even less utilization. In the end it is unclear how much additional fibre would be utilized as a result of this policy.

This policy options is quite similar to the policy in BC in the past. As mentioned in previous sections of this paper, slash burning was prevalent in the past. In other words, this policy did not curb slash burning in the past, so it must be questioned whether this policy would reduce burning today. In addition, industry would bring up the same issue regarding distance from a facility that they did with option one. It would be necessary to design a system that takes into account the distance from a facility.

7.4. Increase the Use of Cruise Based Billing

Cruised based billing is when a “cruise” of an area is done before harvesting activities are carried out. The value of the timber on site is calculated and companies pay stumpage based on this value, regardless of what they actually harvest. They then carry out their harvest activities and do not have to go through scaling or waste assessment because they have already paid stumpage for the entire cut block. Cruise based billing should increase utilization because the companies pay the same stumpage whether they utilize the wood or not. Therefore, they should utilize all of the fibre that is economically viable.

7.4.1. Goals

The goal of this policy is to remove any barriers that the AAC has on utilization. This policy would ensure that companies would harvest right up to where the marginal cost meets the marginal benefit. Using a cruised based billing system will allow for the elimination of the waste assessment survey because the companies have paid the full stumpage whether they make a lot of waste or no waste at all. The elimination of the waste assessment survey allows the first harvester to harvest wood chips and hog fuel at the same time as the primary harvest. With the scaling system the first harvester cannot do that because they have to wait for a waste assessment survey to be carried out before they can harvest chips and hog fuel. This has created a system where a

second harvester must come into the cut block after the first and take chips and hog fuel out. This does not allow for efficient use of machinery on site at the first harvest, and creates many difficulties in setting up a deal between the first and second harvester.

7.4.2. Drawbacks

The major drawback to this policy option is that the stumpage collected by the government is dependent on the quality of the cruise carried out before the harvest. For some stands the cruise will be fairly accurate, but for other mixed stands the cruise may be inaccurate. This would create a situation where industry could be paying much more or much less than they should. This is the main reason that the government only used this system for beetle killed stands in the interior. These stands were fairly easy to cruise, so there was not as much risk of inaccurate stumpage charges. In order to correct this situation a system could be set up where the stumpage is double checked based on how much was actually harvested. This would require scaling to be carried out, which would lose the efficiency benefits to this system. In addition, the cost of carrying out the cruise may be just as costly as scaling so that benefit may be nullified even if scaling were eliminated. For this reason some people within industry that I spoke to had a lukewarm reaction to cruise based billing. I should mention that others within industry were more enthusiastic about cruise based billing. They felt that the cruise could be carried out accurately without having to scale the volume to double check. Unfortunately, it is unclear what impact cruise based billing has had on utilization rates up to this point because the province does not have scaling data or waste assessment data on the areas that have used cruised based billing. This presents a fairly significant knowledge gap that should be filled.

8. Analysis

In this section I describe the analysis and how each of the options scored on the various criteria. I conclude the section with Table 2 that provides a summary of the scores for each option.

8.1. Charge a Fee for all Fibre that is Burned

- This option effectively attaches an economic or ecological value to all fibre that is cut down in BC, although it does not specifically demand a reduction in slash pile burning. For this reason, this option scored 4 out of 6 on the effectiveness criterion.
- This option scores very well on the equity criterion, because it treats all segments of the industry equally. This option (along with most of the other options) has the issue of penalizing regions of the province that are far away from a processing facility. However, this problem can be overcome by including the distance from a process facility into the equation. For this reason it scores 2 out of 3 on the regional equity question.
- In terms of sustainability this option scores quite well because it provides a direct motivation for companies to reduce their slash pile burning. In addition, this policy option also rewards companies that find ecologically valuable uses for the slash: likely having a positive impact on coarse woody debris and soil nutrients. As I mentioned earlier, the fire hazard would need to continue to be removed from the site. If the result of this policy is that companies leave a lot more slash on site simply to avoid the burn fee, this would increase the risk of forest fire and the sustainability score would need to be lowered to zero.

- In terms of stakeholder acceptability this option received 2 out of 3 for government and eNGOs and 1 out of 3 for industry. For government and industry this is largely a result of this option being a major change. Both industry and government would be concerned that the program would have negative unintended consequences and would also fear the revenue implications. I have given industry acceptability a lower score than government acceptability because industry would be skeptical of the motivations of the government. Industry is already skeptical of the Ministry of Environment's intentions when it comes to the smoke control regulations. This burn fee would likely be met with a similar reaction. Despite this initial fear, it is possible that this option could gain support if the fee was set at a reasonable level and took into consideration the distance from a processing facility. However, if the burn fee was set too low then the new policy would likely have little impact on industry practices on the ground. Additional, research will need to be done in order to determine the proper fee. The fee will need to be high enough that it provides motivation for companies to find alternatives to burning, but not so high that it causes a reduction in forestry in BC.

Environmental NGOs are split when it comes to biomass harvesting for bioenergy. Some NGOs support bioenergy while others are quite opposed to it. In addition some eNGOs fear the slippery slope of biomass harvesting. They fear that if an economic value for the fibre were to emerge too much of the fibre would be harvested causing detrimental impacts on forest health (Dagg et al, 2011). Because of this split within the various eNGOs this policy received 2 out of 3.

- Finally, when it comes to negative externalities there are not too many concerns with this policy option. This biggest concern is that the forest fire hazard will increase if companies do not follow the guidelines that are set out. However, given the harsh penalties that face companies after a fire has occurred and industry agreement to the nature of the hazard it is likely that this externality can be guarded against.

8.2. Fibre Based AAC

This option received the second lowest score, largely because of the impacts on industry and the negative externalities.

- The option received 4 out of 6 for effectiveness because it does attach a value to the fibre that is currently burned in slash piles. As with the previous option it does not require the reduction in slash pile burning, but it does remove a major impediment to fibre utilization, so it received a relatively high score.
- This option scored very low on equity within the industry because it favours the producers that can use the lower quality fibre to the detriment of saw mills and other mills that require the higher quality fibre. For this reason it scored 1 out of 3 on industry equity. Regionally, the equity issue is the same as the previous option. Locations that are far away from a processing facility will argue that it is not possible for them to harvest the lower quality fibre. It is possible for the government to design the system to correct for this issue.
- For the sustainability criterion, this option received 4 out of 6 because it removes a barrier to increased utilization, but creates other issues that make it difficult to predict what the industry reaction will be. Given this uncertainty, it is unlikely that this policy will greatly impact coarse woody debris or soil nutrient levels, therefore it received 4 out of 6.
- This policy received the lowest score for stakeholder acceptability for a number of reasons. The reason that it received a low score for industry is because this policy has the potential to significantly disrupt the fibre balance in the province and on a company level basis. Without changing the level of the AAC companies will not be able to harvest as many saw logs as they currently do. Therefore the increase in lower quality utilization will be at the expense of the high quality logs. This will make the industry less competitive and less profitable.

A way for the government to avoid this problem would be to increase the AAC with the assumption that greater utilization will occur, not greater harvesting levels. However, this leads to some substantial issues. Traditionally, there has

not been a connection between AAC and utilization.¹ The public would likely object to the increased AAC. This is especially true now, after the mid-term timber supply review, when one of the options that was made public was logging in previously protected areas. The public will most likely interpret an increase in the AAC as an increase in harvesting in these protected areas, and strongly oppose such an increase. In fact some eNGOs insisted that “any additional harvesting for biomass is part of the current AAC and does not increase the AAC” (Dagg et al 2011). This policy option received a 1.5 for eNGOs because they could support a fibre based AAC, but not an increase in the AAC.

- The low negative externalities score is related to this problem. This policy option will either reduce the saw log quality wood harvest in BC or it would require an increase in the AAC. An increase in the AAC could easily lead to environmental groups’ opposition along with First Nations’ demands for consultation and a greater share of the AAC. Considering the government does not actually intend to increase the level of harvesting in BC this public relations battle seems to be a cost that they would not be willing to bear.

8.3. Remove Benchmarks – Increase Penalties

This is the lowest scoring option of the four. It scores low because it will likely not be very effective and there will be negative unintended consequences and negative reaction from the industry. The reason I have included this option in the analysis is that it is a fairly common suggestion within the forestry community in BC. An analysis of slash pile burning would not be complete without this option.

- This option scored low on the effectiveness criteria because it is unclear what the industry reaction to the increased penalties would be. Some within the industry argue that by raising the delivered wood cost the policy would make the industry less competitive, resulting in even further high-grading. Others argue that the

¹ There is a long history of debate over the role of AACs in forestry practices. For a more thorough discussion of this issue, chapters 17-20 and appendix D of the Sloan Report (1976) is a good place to start.

increased penalties will motivate companies to bring in fibre that is marginally economic in order to avoid the penalties. It is likely that there will be a combination of both of these reactions within the industry. Finally, this policy option only applies to wasted fibre that is saw log quality. It does not impact how industry deals with lower quality logs. For these reasons the policy scored low on effectiveness.

- This option scored 5 out of 6 on the equity criterion because it treats all industry sectors equally, but has the same issue as the previous options regarding distance from a processing facility. In order to overcome this issue the government would have to find a way to modify the penalties to account for the distance from a processing facility. Since this is not an insurmountable problem the option scored 2 out of 3 on regional equity.
- This option scored poorly for sustainability for a couple of reasons. The main reason that this policy option scores poorly on sustainability is that it does not account for ecological values of the slash. The penalty applies to all waste regardless of whether it is burned or left to serve as coarse woody debris. A strong policy option will distinguish between waste that is burned and fibre that serves an ecological purpose. There is some concern within the environmental community that coarse woody debris and soil productivity will not be protected if a large economic value is attached to the fibre. This policy places an economic value on the fibre without attempting to protect the ecological value.
- This option scored particularly poorly in the stakeholder acceptability criterion. There is some support for this policy option within all three stakeholder groups but there is fierce opposition to this policy option within each group as well. There is some support for this policy option within the segments of the industry that use the lower quality, such as OSB producers. That being said, the majority of traditional logging companies oppose the elimination of waste benchmarks and increased waste penalties. There is a similar opinion within the government: some support the policy because of a feeling that it is right to penalize waste, while others oppose the policy because they feel it will hurt an already vulnerable industry. There is some support for this option within the environmental

community for the same reason that some people within the government support it: that penalizing waste is the right thing to do. That being said, if this policy successfully increased utilization, some people within the environmental community would be concerned that the other ecological values are not being protected by this policy.

- This option scores quite low on the externalities criterion for a couple of reasons. First of all, it is unclear how industry will react to the new penalties. It is possible that the penalties could make marginal stands uneconomic. This would reduce logging in the province, which would have negative impacts on local economies and government revenue. If this were to happen, this policy option could result in extremely negative results for rural workers in BC and for government revenue.

8.4. Increase the Use of Cruise Based Billing

This option is one of the highest scoring options of the four with a balance of fairly high scores throughout the analysis.

- This option scored 4 out of 6 on the effectiveness criterion because it effectively removes barriers to utilizing marginally economic fibre. As with the other options, it does not directly prevent slash pile burning, but it theoretically ensures that companies will utilize all the fibre until the marginal benefit equals the marginal cost.
- This option scored 3 out of 3 for equity within industry but only 1 out of 3 for regional equity. The reason it scored so poorly for regional equity is that in areas of the province that have more heterogeneous forests the cruise could be quite costly, while other parts of the province the cruise may be a significant savings over the current system. This results in a 1 instead of 2 because the regional differences are largely a result of biogeoclimatic differences; therefore the government will find it difficult to mitigate the regional disparities. That being said, some argue that inequality as a result of geography is not unfair. It is pointed out that geographic conditions often change the harvesting cost.

- This option scored 4 out of 6 on the sustainability criterion because it should be moderately effective in reducing slash pile burning without harming biological diversity or soil productivity.
- In terms of stakeholder acceptability, this scored 2 out of 3 for all stakeholder groups. Cruise based billing is already happening in some parts of the province so it is understandable that this option is somewhat well received because it is familiar. From the government perspective, there is some concern about the revenue impacts that might occur because of inaccurate cruises in mixed stands. While some members of the industry did not believe that cruise based billing would be effective in reducing slash pile burning, there was not vigour objections to the increase in cruise based billing. Environmental groups did not seem to have vigorous objections to cruise based billing as well. However, there is some concern within the environmental community about attempts to increase fibre utilization. They fear that these policies will lead to over harvesting and harming forest health.
- Finally, this option scored fairly well for negative externalities. There are not a great number of negative externalities that are of concern. The biggest negative consequence of this policy is related to lengthy and costly cruises. This would add unpredictability to the system, which both industry and government would want to avoid. However, over time the length and cost of the cruise would be more predictable; reducing the uncertainty.

Table 2: Scoring Matrix

	Burn Fee	Fibre Based AAC	Increase Waste Penalties	Cruise Based Billing
Effectiveness	4/6	4/6	2/6	4/6
Industry Equity	3	1	3	3
Regional Equity	2	2	2	1
Total Equity	5/6	3/6	5/6	4/6
Sustainability	4/6	4/6	2/6	4/6
Government Acceptability	2	1.5	1.5	2
Industry Acceptability	1	1.5	1.5	2
Environmental NGOs Acceptability	2	1.5	2	2
Total Stakeholder Acceptability	5/9	4.5/9	5/9	6/9
Negative Externalities	4/6	2/6	2/6	4/6
Total	22/33	17.5/33	16/33	22/33

9. Recommendation

The analysis clearly leaves two superior options; implementing a burn fee and/or expanding the use of cruise based billing. Both options attempt to remove disincentives to utilization and allow one pass harvesting. These two options are not mutually exclusive. In fact since there is already some cruise based billing happening in the province a move toward a burn fee would occur along side cruise based billing in those regions.

After considering all of the options, I recommend that the BC government begin the process of replacing the waste assessment penalties with a fee to burn the wasted biomass alongside an increase in the use of cruise based billing. Cruise based billing may not be appropriate in all areas of the province, but where appropriate cruise based billing provides significant benefits to both industry and government. My reasons for this recommendation are:

- These are the highest scoring options.
- The burn fee attaches an economic or an ecological value to all fibre that is cut down in BC. This differs from the other options that still focus on saw log quality logs.
- While this option is a major change from the current system it could use the current waste assessment survey. This makes this option much easier to implement from the government's perspective.
- Using cruise based billing alongside the burn fee eliminates the risk to government revenue of eliminating the waste assessment survey. If the burn fee is instituted without cruise based billing there is a chance that industry will chip up some saw log quality timber and pay significantly less stumpage. Cruise based billing ensures that the proper stumpage is paid for the entire stand.
- Finally, the other two options are fairly standard options that have been discussed many times over the last decade or so. Despite this attention, none of the options have gained much popularity and it seems unlikely that they will suddenly be accepted. Cruise based billing is already an accepted practice in parts of the province. In addition, a new burn fee instead of waste assessment fees is a novel concept that may have a chance to catch the attention of industry participants.

A significant result of this policy recommendation is that the government would gain more accurate data on how much fibre is currently burned in BC. The current system does not measure the waste that is burned unless it is charged stumpage. This leaves a lot of fibre unaccounted for. This policy would begin to fill in the knowledge gap that currently exists. This knowledge gap makes it difficult to measure the effectiveness of the policy in the beginning because we do not have historical data to compare to. However, it should be possible to gain a sense of the success based on the volume of lower quality fibre being utilized in addition to comparisons to historical burn number applications. In addition, I believe the government would be well served in examining its fire policy in conjunction with this policy change. Industry would appreciate more clarity on the appropriate balance between fire protection and other ecological values. Ultimately, the government will need to define the optimum balance: finding tradeoffs between fire protection, fibre utilization, and ecosystem protection.

9.1. Implementation and Future Steps

This option is going to require a period of time and effort to develop support across the stakeholder groups. New policy ideas do not get accepted right away. It is only after a policy community becomes accustomed to an idea that they will accept that new idea (Kingdon 1995). The Chief Forester has already started the process of educating and promoting the idea to industry that all fibre must serve an economic or ecologic purpose. This certainly helps this new policy, but this policy will need to be specifically discussed with industry and environmental groups. The government should start the following steps as soon as possible:

- Carry out discussion with stakeholders regarding their concerns about this option and how to best mitigate those concerns.
- Take steps to ensure that the wildfire hazard is properly mitigated with this policy option. It is important that companies do not ignore the fire hazard in order to avoid the fees. Therefore, the fire hazard mitigation will need to be built into the new rules. The current system of charging companies the cost of fighting the fire if their site is found to have contributed to the starting or spreading of a wildfire is probably enough of a penalty to ensure compliance. However, if the government is worried that companies may be leaving too much slash behind they could institute a system of spot checks to ensure that companies are satisfactorily mitigating the risk.

- The government should lay down set guidelines on the minimum amount of fibre that needs to be left behind for ecological purposes. These guidelines should ensure biomass is not over-harvested if market conditions change and the fibre becomes more valuable. The guidelines will require the government explicitly strike a balance between the forest fire hazard and other ecological values.
- The government should investigate ways to encourage fibre utilization in more remote areas. The government has already done some of this with its bioenergy strategy, but more work could be done on this front. If more facilities capable of utilizing the fibre were to open in different areas of BC the issue of distance would be significantly mitigated.
- The government should also work to incorporate non-timber values into the cruise. Currently, fibre that is left behind is considered waste because it does not serve an economic purpose. However, this fibre does serve an ecological purpose that is valuable to the province. It would be helpful to have a way to quantify this value in the system.

9.2. Considerations

In this report I have not gone into great depths on the market conditions surrounding the fibre that is currently burned in piles. Currently, the facilities that can utilize the fibre are unable to support the price needed to transport the harvest debris to their facilities. Some studies have produced some reliable estimates on how much it will cost to bring the fibre to the mills, but an economic forecast into the future price of the products that use the fibre would be useful. In my interview with a pellet company the contact stated that currently harvest debris makes up 5% of their fibre supply; he predicted this number would increase to 20% or 30% over the next ten years. My interview with an integrated logging company stated that he believed that the price of hog fuel would increase over the next two years to the point where utilization would be feasible. While the market has been an insufficient mechanism to produce the utilization that the government desires for the last 50 years, it is possible that the market could be on the verge of driving increased utilization without extra government intervention. That being said, it is possible that this market change could be temporary, thus pushing the problem down the road rather than solving the problem permanently.

In my opinion this report's recommendations would still be valuable even if the market started to utilize more of the fibre. My reason for this opinion is that there is value in changing the message that government sends to industry. By more closely

aligning the policies to the values that the government has regarding utilization and slash pile burning, the government will ensure that industry has the incentives to adjust their practices in the way government wants. In addition, there is value in filling the knowledge gap about the amount of fibre that is burned. However, before the government can go forward with these recommendations they will need to carry out much more intensive consultation with the relevant stakeholders. There are a number of issues that need to be clarified before these recommendations can proceed. These issues include: where cruise based billing would not be appropriate, the level of fee for burning and how distance to a facility should be factored into the system, and the mechanisms need to ensure that the wildfire risk is properly mitigated. The biggest communications challenge that will face the burn fee is that it may be seen as a simple policy “stick”, similar to the waste penalties in option 3. However, the burn fee would replace the waste assessment survey and fees. Therefore, this is not necessarily a new burden for the industry; rather it is a shift in priority.

10. Conclusion

Slash pile burning began as a fairly attractive waste disposal mechanism for the industry, but today it has turned into an intractable problem. The cost of harvesting the slash and the lack of demand within the market has made burning the only viable option for disposing of this fibre. That being said, there are some other barriers that have also hindered increased utilization.

In this study I have examined four different policy options with the aim of reducing the level of slash pile burning within the province. In addition to these four options the government has already started to encourage the utilization of this fibre. All four policy options attempted to address a specific cause of slash pile burning. The fibre based AAC removed the disincentive to utilization that currently exists within the provinces method of calculating the AAC. Removing the waste benchmarks and increasing the penalties for waste attempt to correct the problem by increasing the cost of waste, therefore making utilization a more attractive option. Cruise based billing removes some of the issues with scaling and waste assessments that prevent one pass harvesting. Replacing the waste penalties with a penalty to burn the fibre attaches a value to all the fibre, not just saw log quality wood, and removes the barriers to one pass harvesting. In the end, I recommend that the government move to a system of charging a fee for burning fibre in BC in conjunction with increased cruise based billing where appropriate, because that is the option that is most consistent with the long term goal of the province.

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Appendices

Appendix A

Interview Contacts

Interview	Position and Organization
Dave Peterson	Chief Forester and Assistant Deputy Minister – BC Ministry of Forests, Lands, and Natural Resource Operations
Nancy Densmore	Biodiversity Specialist – BC Ministry of Forests, Lands, and Natural Resource Operations
John McClarnon	Forest Investment Planning Officer – BC Ministry of Forests, Lands, and Natural Resource Operations
J. Marty Kranabetter	Ecologist – BC Ministry of Forests, Lands, and Natural Resource Operations
Rebecca Freedman	Environmental Management Analyst – BC Ministry of Environment
Greg Anderson	Manager Ecosystem Restoration – BC Ministry of Forests, Lands, and Natural Resource Operations
Representative of the Wildfire Management Branch	BC Ministry of Forests, Lands, and Natural Resource Operations
District Fire Centre Manager	BC Ministry of Forests, Lands, and Natural Resource Operations
Judi Beck	Director, Forest Innovation & Dynamics – Canadian Forest Service
Brian Titus	Research Scientist – Canadian Forest Service
Industry Representative	Integrated Forest Company
Industry Representative	Pellet Producer
Industry Representative	Oriented Strand Board Producer
Stu Lebeck	West Fraser Timber Co.
Alan Waters	Former FLNRO Staff and current Industry Contractor
Representative of Pembina Institute	Pembina Institute