Social concerns, risk and the acceptability of forest vegetation management alternatives: Insights for managers

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ABSTRACT

Although public opinion and social issues have significant influence on policy-making, research on forest vegetation management (FVM) in Canada has a strong focus on biological aspects, with less attention being paid to social concerns. This paper reviews the social context in which FVM occurs. Individual views about FVM reflect a combination of values, beliefs, and attitude while also including differing perceptions of risks. Public views and the broader social acceptability of management decisions can be linked to five key factors: context, risk, aesthetics, trust, and knowledge. Judgements about acceptability will usually change over time and across specific situations and various segments of a population could make opposing judgements. We identify a variety of public concerns related to FVM in Canada, synthesizing research that can help resource managers consider the social impacts of their choices. We also note particular concerns related to Aboriginal peoples and the FVM workforce. Information about the benefits and disadvantages of FVM options can help resolve public concerns, but using technical information to convince the public is rarely successful. Forest management agencies and resource managers need access to reliable information about social values and concerns to make management decisions that will be socially acceptable.

Key words: social acceptability, vegetation management, silviculture, forest policy, public participation, forest values, risk management, scenic values

RÉSUMÉ

Bien que l'opinion publique et les enjeux sociaux exercent une influence significative sur l'élaboration des politiques, la plupart des travaux de recherche sur le contrôle de la végétation en forêt au Canada ont été consacrés aux aspects biologiques et ont négligé les considérations sociales. Cet article fait la synthèse du contexte social dans lequel s'inscrit le contrôle de la végétation. Les perceptions individuelles du contrôle de la végétation sont le reflet d'une combinaison de valeurs, de croyances et d'attitudes et de perceptions différentes des risques encourus. Les perceptions publiques et, de manière plus large, l'acceptabilité sociale des choix d'aménagement, sont liées à cinq facteurs fondamentaux : le contexte, les risques, l'esthétique, la confiance et les connaissances. Les jugements sur l'acceptabilité vont généralement évoluer dans le temps en fonction des situations. De même, différents groupes dans la population pourront avoir des jugements opposés. Nous identifions une série de préoccupations sociales associées au contrôle de la végétation, sur la base d'une synthèse des travaux de recherche susceptibles d'aider les gestionnaires dans la prise en compte des impacts sociaux de leurs choix. Nous notons également des enjeux particuliers associés aux Premières Nations et à la main-d'œuvre en contrôle de la végétation. L'information au sujet des bénéfices et des désavantages de différentes approches en contrôle de la végétation peut aider à répondre aux préoccupations du public. Cependant, le recours à une information technique pour convaincre la population est rarement gage de succès. Les organismes et gestionnaires forestiers ont besoin d'informations fiables concernant les valeurs et les préoccupations sociales afin de prendre des décisions d'aménagement qui seront socialement acceptables.

Mots-clés : acceptabilité sociale, contrôle de la végétation, sylviculture, politique forestière, participation du public, valeurs forestières, gestion du risque, valeurs esthétiques

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Introduction

Forest vegetation management (FVM) is usually understood as a series of treatments directed at reducing competition for site resources in order to achieve silvicultural objectives for desired tree species (Wagner *et al*. 2006). Bell *et al.* (2011; this issue) further suggest to expand the definition so that FVM also includes managing the course and rate of forest vegetation succession to achieve forest management objectives. Accordingly, research has focused upon biological aspects and effectiveness of these treatments, with less attention being paid to social issues. However, as public debate about the role of herbicides in Quebec's 1994 Forest Protection Strategy (Fortier *et al*. 2005, Thiffault and Roy 2011) shows, for topics such as vegetation management, public opinion and social issues can influence policy-making more so than professional views and scientific information. The importance of considering public views about FVM planning was also highlighted in Ontario's *Vegetation Management Alternatives Program* (VMAP) (Wagner *et al*. 1998a,b). Thus, when the time came to produce an update on vegetation management in Ontario, it seemed appropriate to consider changes in social concerns. However, aside from the VMAP study, managers and researchers find that information about the social aspects of vegetation management is either dated or reflects other contexts. Using this information to provide insights to forest managers in 2011 remains a challenge.

In this paper, we take up that challenge and investigate the social circumstances in which FVM occurs, maintaining the Ontario context, but not being limited by it. We describe a range of issues deemed relevant to resource managers. In particular, we situate our review in the broad context of the changing social environment for Canadian resource managers that includes industry restructuring, demographic shifts, climate change, and the continual evolution of public values, risk perceptions, and public opinions. Although this paper addresses vegetation management, we recognize that the general public and stakeholder groups see this issue in relationship to a much broader set of forest management issues. This broad perspective can be unsettling for resource managers since it expands the discussion into areas of increasing complexity and uncertainty—from silvicultural treatments to management philosophies. However, the evaluation of vegetation management options and the related decision-making processes occur within the policy and social context established by harvesting and management of forest resources, and in accordance with provincial legislation. In the past, vegetation management has been associated with the search for higher timber productivity and a large-scale industrial forest model (Walstad and Kuch 1987). Thus, public views of vegetation management will likely be influenced by their concerns about this approach to forestry.

Our analysis begins by outlining the fundamental concepts involved in understanding the nature of social values, attitudes and social acceptability in forestry. This approach is rooted in research on public values about forest environments, in perceptions of risks to these values, and in the resulting social acceptability of choices made by managers. Hence, we do not simply summarize work that relates to public reactions to individual vegetation management practices. Instead, we review main public concerns about vegetation management and consider how these could influence choices in various situations. These concerns are situated within the broader context of forest decision-making and also reflect particular consideration for the forest workforce. Our goal here is to assist resource managers to identify potential social concerns that could arise from choices about forest vegetation management.

Concepts of Value and Social Acceptability in Forest Management

Understanding how and why humans respond to decisions about FVM draws notably upon research in environmental sociology and in social psychology, particularly in relation to environmental values, to risk and to the social acceptability of management options.

Environmental values, beliefs, and attitudes

People relate to the natural environment in complex ways. Here we adopt an approach, rooted in social psychology, which suggests that environmental concerns comprise both cognitive and behavioural dimensions (Stern and Dietz 1994, Kennedy *et al.* 2009a). The cognitive dimension relates to understanding how people think about the environment; their values, beliefs, and attitudes (see Box 1). These affect the behavioural dimension or actions that affect the environment.

Information in the published literature suggests a hierarchy in these concepts: values determine beliefs, which in turn inform attitudes, and subsequently affect behaviour (McFarlane and Boxall 2003, Tarrant *et al*. 2003). Researchers therefore argue that resource managers need a better understanding of people's values (Bengston 1994, Tarrant *et al*. 2003, Allen *et al*. 2009). Values, beliefs, and attitudes are all likely to change through time, although not at the same pace or in the same way for different groups. Clearly, this poses a challenge to decision-makers, and researchers have tried to understand what values, attitudes, or beliefs may be held by different groups and how this could influence their reaction to a particular issue. In forestry, many authors have demonstrated that knowing the values that people associate with forests can help to harmonize competing needs and interests (Bengston 1994). Also, if this information can be collected for a representative group, it will reflect the diversity of values and can help to mitigate potential conflicts related to land use, forest resources management (Beckley *et al.* 1999, Tarrant *et al.* 2003, Allen *et al*. 2009), or vegetation management.

Box 1: Distinguishing between Values, Beliefs, and Attitudes

Values: relatively enduring conception about important principles in life, such as what is good or bad, desirable or undesirable.

Beliefs: judgement about what is true or false; they can be based on scientific information, feelings, and intuitions or cultural norms.

Attitudes: learned tendencies to react favourably or unfavourably to a situation, individual, object, or concepts; they are often articulated around support or opposition for a course of action or a specific activity.

(Allen *et al.* 2009)

Social acceptability

In recent years, the term *social acceptability* has been increasingly used in forest management in Canada as an approach to evaluating the willingness of the general public to accept or tolerate certain forest management options. However, despite frequent mention in the literature, no rigorous definition exists for social acceptability nor is there a universal theoretical framework within which to articulate a definition.

Many agree that acceptability of forest practices arises from a cognitive hierarchical process based on personal and social values, norms, and beliefs (McFarlane and Boxall 2000b, Stankey and Shindler 2006). According to Brunson (1996), *acceptability* results from an individual judgement process, implying that a person makes a decision about whether or not they approve of an action, based on their own values, beliefs, and attitudes. *Social acceptability* refers to aggregate public or group consent when an identifiable segment of the population is found to share the same judgement, which can be inferred through the presence or absence of behaviours. For example, in North America clearcutting was a long accepted forest practice until its environmental effects were questioned in the 1970s and 1980s. A behavioural change occurred as small groups initially protested this practice, subsequently gaining greater support as evidenced by larger public protests and increased membership of environmental organizations. Eventually, opposition to clearcutting became the symbol of opposition to an industrial, utilitarian model of forestry (Bliss 2000).

Monitoring social acceptability remains challenging for several reasons. In particular, social psychologists wrestle with the problem of consistency between attitudes and behaviours, as people's attitudes do not always translate to action (Kennedy *et al.* 2009b). Researchers also need to better understand how values, attitudes, and behaviour are related to one another and to external factors such as socio-demographics and cultural background. A judgement of acceptability is also highly variable, evolving in response to multiple factors that are not consistent among situations (Brunson 1996, Shindler *et al.* 2002). For example, in Ontario social acceptability of FVM practices such as thinning might differ in each forest region (deciduous, Great Lakes – St. Lawrence, boreal). This is not only because the forests differ but because the population density, demographics, economic structure, and forest uses vary. Stankey and Shindler (2006) propose five key factors that affect social acceptability in forest management. Fig. 1 illustrates these factors, relating them to the various concerns and issues identified and discussed in this paper.

Thus, social acceptability is time- and place-specific (Clausen and Schroeder 2004), possibly providing mixed verdicts reflecting different judgements within the population. Shindler *et al.* (2004: 155) conclude that judgements of acceptability "are the products of interactions between citizens and management organizations over time, reflecting the trust levels, and beliefs that citizens hold about those responsible for the stewardship of resources". It is also useful to consider the existence of *social refutation*, a situation that could occur when a segment of the public makes a judgement against a certain action. Given a variety of values and attitudes within the Canadian public, it is not unlikely that one segment of the population could accept a practice, while another rejects the same practice, and a third is not sufficiently concerned to commit either way. McFarlane and Hunt (2006) surveyed residents in Ontario and demonstrated that engagement in environmental activism was the culmination of a variety of influences. They distinguished between three groups of effects: social psychological (values, attitudes and knowledge); socio-cultural (gender and membership of an environmental organisation); and contextual (residence).

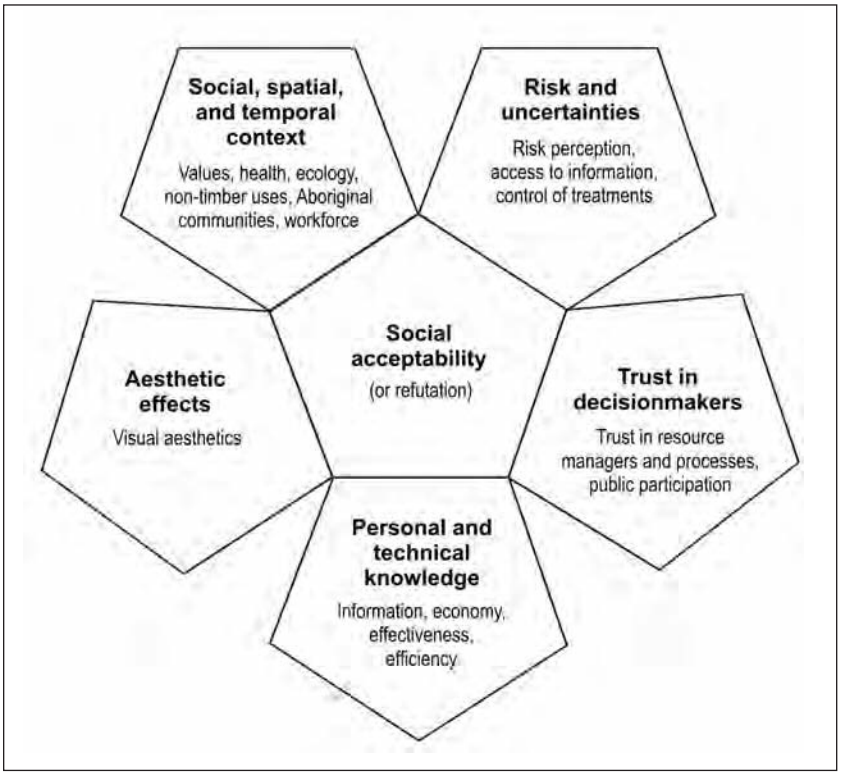

Fig. 1. Key factors, concerns and issues influencing the social acceptability of forest vegetation management treatments (based on Stankey and Schindler 2006).

It is possible to design institutions and processes to facilitate interaction among citizens and management organizations to help articulate social acceptability of forest management in general or of specific forest practices. Some of these institutions and processes are short-lived and designed to address a specific issue, while others are more permanent. The citizen round tables established under the *Lands for Life* consultation process in Ontario are an example of temporary institutions established to fulfill a specific role. Despite their short life span, these round tables provided means for more than 15 000 individuals to express their views about the strategic direction of the Ontario Ministry of Natural Resources (OMNR 1999). In Quebec the *Bureau des Audiences Publiques sur l'Environnement* (BAPE) is an example of a permanent institution. This agency was established

in the late 1970s following the adoption of Quebec's first environmental legislation, with a mandate is to hold public hearings on projects with potential environmental effects (Baril 2006). Since the first forestry-related hearings in 1982, these hearings have provided forestry experts and the public opportunities to discuss a range of opinions about what are/are not socially acceptable forest management practices (BAPE 1983b, 1991, 1994, 1997, 2006). While the BAPE hearings were initially designed to address specific proposals, they have elicited a broader discussion of forest issues, including those related to public health, as well as goods and services provided by the forests.

Values Associated with Forest and Vegetation Management

In recent years, forest management has undergone a paradigm shift that reflects changes in environmental and forest-related values. In North America, sustained timber yield has been replaced as the dominant forest management paradigm by sustainable forest management (SFM). SFM is responsive to a wider range of values and benefits than simply timber. According to Bengston (1994), the sustainable development paradigm is also characterized by harmony with nature, scepticism toward scientific and technological fixes, finite natural resources, limits to substitution, and a strong emphasis on public involvement in decision-making. This change in public values has challenged traditional forestry practices such as vegetation management, which were developed primarily to support timber production.

Public values and attitudes about forests and forest management have been documented through sporadic surveys and research over the years (for example: Decision Research 1995, Wagner *et al.* 1998a, Hunt and McFarlane 2002). Attempting to understand diversity in public values and attitudes towards forests often leads researchers to propose various typologies. For example, the Decision Research survey (1995) considers the level of support that different groups hold for various management goals. Most research now focuses on identifying two major types of values: anthropocentric or human-centered values focus on what forests can provide for humans, whereas biocentric values relate to the inherent worth of nature regardless of its usefulness to humans (Bengston 1994, Steel *et al.* 1994, McFarlane and Boxall 2000a). As noted by McFarlane and Boxall (2000b), in many studies the biocentric–anthropocentric dichotomy has been used to explain issues of social acceptability, to assess preferences and beliefs about forest management, as well as to categorize stakeholders. For example, in a comparative study of Ontario's local citizen's committee (LCC) members and southern and northern residents, the LCC members were more likely, southern Ontarians were less likely, and northern Ontarians were in the middle in terms of supporting human uses of natural resources (Hunt and McFarlane 2002).

Although support for environmental values is growing, support for economic values and concerns remains strong (Decision Research 1995; Hunt and McFarlane 2002; BAPE 1983a,b, 1994, 1997, 2006), especially those related to community benefits such as job creation. A recent study in New Brunswick indicated a similar duality between the support for environmental and economic values (Nadeau *et al.* 2008, McFarlane *et al.* 2011). However, contrary to popular opinion, results from this study indicated that the forest values held by rural and urban residents were quite similar overall. This confirms the need to verify popular assumptions made about forest values and who held what types of values.

In Canada, as forest management relies heavily on forest professionals, it seems important to understand how well their values are aligned with those of the public. This is particularly important given the increasing role of advisory committees and of stakeholders from outside the forestry profession. Results of studies by, for example, McFarlane and Boxall (2000b) and Decision Research (1995) show that, at the time these surveys were conducted, the public supported the inherent rights of nature, environmental values, and more "natural" forest management. On the other hand, professionals were more likely to support economic goals and human uses in general. Forestry professionals were also more supportive of forest practices such as clearcutting and herbicide use. If FVM actions are to be accepted by the public then resource managers need to consider plans that account for these values and concepts.

Changes in social values related to forests can be interpreted from information other than surveys. Membership of environmental organizations, support for forest certification programs, and expanding recreational use of forest lands also demonstrate interest in forests and their management. Perhaps the most important conclusion is not that the public has a set of values that can be determined by a survey, or even that trends for particular groups can be identified based on social, demographic, or cultural factors. Instead, it seems that people's value systems are complex and are articulated through a broad set of environmental, economic, and social concerns. These concerns are discussed in more detail below.

Perceptions of Risks Associated with Vegetation Management Options

In recent decades, the utilization of herbicides and associated perceived risks for human and ecosystem health has fuelled social debates about FVM in Canada. Most studies of the toxicity of glyphosate and 2,4-D, two common forestry herbicides, have shown that they are relatively safe (i.e., non-toxic) (see Lautenschlager and Sullivan 2002, Sullivan and Sullivan 2003, Fortier *et al.* 2005). However, such scientific studies have not allayed public concerns and the issue is often portrayed as a debate between experts with technical knowledge advocating a program of management activities and an emotive uninformed public opposing any form of chemical treatment. A closer understanding of risk perception can help us to move beyond this dichotomy.

Social judgements about FVM reflect not only the values and attitudes of society but also how individuals view the risk associated with various management actions. Risk may be described numerically, such as the probability that an undesirable situation could arise as a result of human actions or natural events, but it is increasingly understood to include social and cultural elements (Freudenburg and Pastor 1992, Hannigan 2006). Assessing risk requires considering both the probability of occurrence and the seriousness and extent of potential effects, which in turn reflect social judgements. Hannigan (2006: 117) noted that sociologists who study risk now insist that it is a socio-cultural construct, but also agree that technical risk analysis is still an integral part of how risk

is conceived. Slovic (1987) concluded that perceived inequity in the distribution of risks and benefits influenced judgements. More specifically in forestry, Cavanagh *et al.* (2000: 354) concluded that respondents' perceptions of risk are inversely related to their assessment of potential benefits: "People likely associate building roads as a service that confers greater freedom of mobility. Conversely, the perceived lack of benefit derived from pulp mill effluents and clearcut logging potentially elevates the general perception of risk associated with these two practices." Similarly, risk perception can be influenced by the availability of knowledge and by technical experience associated with the activity (Rousseau 2008).

Public and expert perceptions of risk

The early risk perception literature generalized the difference between *objective* experts who *only deal in facts* when evaluating hazards and *subjective* citizens who *only deal in values*. Hannigan (2006: 114) suggests that three types of arguments are used to make claims about risk and to frame the development of attitudes or opinions about a specific risk: legal, scientific, and moral. The first two are often voiced by experts and portrayed as *objective and factual* while the third is often voiced by lay persons and characterized as *emotional*. Lupton (1999: 2) notes that in research on risk, "lay persons' judgements on risk are typically portrayed as biased or ill-informed compared with experts' more accurate and scientific assessments". Slovic (1987) suggested that experts' assessment of risk represents a mix of science and judgement with psychological, social, cultural, and political factors. As such, neither the experts nor the public are purely objective or subjective (Weingart 1999).

However, more recent reports indicate that when expressing opinion on risk, both experts and public advocacy groups use scientific reasoning (Tesh 1999). The rationale for this is that in our culture science is the most prestigious form of knowledge, so to maintain credibility environmental citizens groups need to use scientific evidence (Nelkin 1975). Reports produced by different groups' for the public hearings conducted by the BAPE (1983b, 1997, 2006) about herbicides use in Quebec's public forest represent an obvious example of efforts made to locate and generate technical information that support the groups views, and to communicate that information to government. Hannigan (2006) noted a power differential in who sets the terms of the debate about risk, with public concerns and viewpoints often being subordinate to those of experts or those considered powerful in society. However, in reference to social construction of risk, Slovic (1987: 285) concluded that "there is wisdom as well as error in public attitudes and perceptions. Lay people sometimes lack certain information about hazards. However, their basic conceptualization of risk is much richer than that of experts and reflects legitimate concerns that are typically omitted from expert risk assessments."

As stated by Tesh (1999: 43), "we are not facing a conflict between citizens and experts but between two groups of experts." In reality, groups have different values. Thus, understanding the role of social values in risk perception and acceptance appears essential. As noted by Decision Research (1995: 3), "public support (for vegetation management) often reflects underlying environmental values and environmental risk perceptions". According to their results, the public's paradigm of FVM seems closer to that of biologists than foresters. Accordingly, resource managers with a forestry background may want to consider how their values and perceptions compare with those of the broader public, and how this could affect public acceptance of decisions about vegetation management.

Information and the management of risk perceptions

Scientific information is undoubtedly a key element in evaluating risks associated with various FVM treatments, but peoples' judgements are also likely to reflect other factors (Shindler *et al.* 2004). Recognizing how the public perceives and evaluates risk is important if resource managers are to communicate effectively with the public (Slovic 1987, Tesh 1999). To reach a socially acceptable decision, the public needs to be involved in defining the problem and the risks associated with possible solutions (Kakoyannis *et al.* 2001, Rousseau 2008). Understanding the need for an action can contribute to building support for it. In some situations, personal or local knowledge represents a source of insight and information that can help specialists to better understand and estimate risks (Wondolleck and Yaffee 2000).

Many researchers suggest that resource managers and citizens should establish a dialogue, moving away from the argument that people simply need to be convinced or educated about environmental risks (Slovic 1987, Freudenburg and Pastor 1992, Tesh 1999, Hannigan 2006). Kakoyannis *et al.* (2001) suggest that "the main role of science in natural resource management is to provide information about different alternatives that can assist managers in making decisions to achieve societal goals". This suggests that resource managers should provide a range of options, presenting information about the relative advantages and disadvantages, with the goal of finding a position that has wider acceptance (although it is unlikely that all opposing viewpoints can be accommodated). Such an approach contrasts with that of presenting information to support a single action with the goal of convincing opponents to change their beliefs and attitudes.

Public Concerns about Forest Vegetation Management

In eastern Canada, much of the public debate about techniques for FVM has been focused on the use of herbicides, leading to Québec's ban on herbicides for public forests and ongoing controversy in Ontario. The most detailed analyses are reported in two national surveys on Canadian public opinion on forestry (Environics 1989, Omnifacts 1991), an Ontario survey of public and professional perspectives on vegetation management (Decision Research 1995), and four public hearings in Quebec (BAPE 1983b, 1991, 1997, 2006). Among these studies, only the Ontario survey specifically addressed relative preferences among FVM techniques.

More recent research has concentrated on issues related to particular techniques (such as herbicide use or manual brushcutting), understanding and categorizing public values related to forestry, and use of consultation processes to inform or involve citizens in forest management planning. However, as values and attitudes are highly dependant on social context, preferences identified in a study from 1995, from Quebec, or from Australia are not reliable indicators of current public responses. Forest advisory committees, such as the local citi-

zens committees (LCC) in Ontario, are a potential source of information about current forest values and attitudes. Forest advisory committees also serve as a forum where a broad set of values are expressed and where stakeholders discuss a range of issues related to forest management and its implementation (Parkins *et al*. 2006a).

Rather than examining each practice in detail, we identify public concerns associated with FVM in general, which reflect the factors that influence public judgement of acceptability of different vegetation management practices. They are based in social values and, as such, provide a more reliable guide to assessing public responses in a variety of contexts (Kakoyannis *et al*. 2001, Stankey and Shindler 2006, Rousseau 2008). Hence, we use *concerns* as representing an *output* or as a manifestation of a perceived risk to something that people care about and that needs to be protected from some form of threat. Although much of this discussion draws on studies reflecting the controversy around herbicides, where available studies related to other techniques are used to illustrate how these concerns affect a variety of practices. Aboriginal peoples require specific recognition as they share some concerns with the broader population but also have particular rights and a distinct relationship with forest lands. As well, we briefly summarize the limited research describing public preferences among various vegetation management alternatives.

Concerns about human health

Among participants of Quebec's first BAPE hearings on herbicide use, threats to human health were identified as the primary concern (BAPE 1983b). Opponents to herbicides unanimously argued that they present a hazard to human health, echoing concerns voiced a year earlier about spraying of pesticides to control spruce budworm. Results from the 1989 national survey indicated that 40% of respondents believed that forest chemicals represent a major hazard to the health of people living in the treated area, with 38% indicating they represent a moderate hazard, 18% a minor hazard, and 2% no hazard (Environics 1989). Results of the Ontario survey were similar, with 40% of the general public perceiving herbicide use as a high risk to human health (Decision Research 1995). When respondents were asked if people should be prepared to accept some risks to health to strengthen the economy, 70% disagreed. In western Canada, Cavanagh *et al*. (2000) found that the public considered pesticide use the worst activity among a series of choices including clearcutting, effluent from pulp mills, fertilizer use, construction of logging roads, and selective logging. Reasons cited included its ecological effects, risk to human health, and the number of people and scope of area potentially affected.

A point raised in the BAPE report (1983b) that strongly characterized the perception of herbicide treatments was the "individual right to human health". One submission expressed this as: "The physical integrity of an individual or a population should be the most fundamental right in a society. Nothing or no one should infringe the right to health."[6] This right was identified as the major driver motivating people to protest aerial herbicide spraying in Quebec. Similar issues were identified as contributing to participants' concerns about herbicides in the 1997 BAPE report and in the 1995 Decision Research survey. Some participants in the 1997 BAPE considered manual brushing more acceptable since health risks were anticipated and accepted by workers. This view presumes that workers are informed, can choose to accept the risk or refuse the work, and receive a direct compensation for any perceived risk to their health. In the same way, the Ontario public was resistant to the idea of being exposed to health risks without knowledge or consent, even when the risk was small (Decision Research 1995). In that survey, 51% of respondents did not feel in control of risks to their own health. Slovic (1987) also identified people's aversion to being exposed to involuntary or dreaded risks.

Concerns about the possible effects of chemical treatments on human health appear common in relation to forest management, but may also be influenced by local factors. For example, Chang *et al*. (2008) suggested that familiarity with agricultural chemicals in Saskatchewan may have contributed to greater acceptance of chemical control of insects. A common response by resource managers has been to provide information materials and scientific evidence that chemical products used in forest management are safe for humans when used as directed. The effects of knowledge and education will be discussed further below, but providing information about chemical use in forests does not appear sufficient to overcome deep concerns about human health and individual rights to this. It is such concerns about human health that led to the recent ban of cosmetic pesticides in Quebec (MDDEPQ 2010) and Ontario (OMOE 2009).

Concerns about ecological effects

In 1983, concerns about the environmental and ecological impacts of chemical treatments were second only to human health concerns (BAPE 1983b). More than twenty years later, Nadeau *et al*. (2008) found that the protection of water, air and soil was overwhelmingly ranked as the most important forest value in New Brunswick, followed by a variety of animal and plant life, and by economic wealth and jobs in third place. Over this period, numerous studies and surveys (whether by researchers or by public pollsters) have shown the extent of public concern about the environmental effects of forest management decisions. These concerns are most often associated with water systems, wildlife, biodiversity, and forest integrity. In Ontario, the Walkerton drinking water contamination has lead to increased scrutiny of social, political and institutional factors, including the failure of regulations and control systems (Ali 2004). It is possible that this could create a flow-on effect in forestry as people's concerns about safe water increase and their confidence in official controls and assurances decreases.

Concerns about possible contamination of wetlands, aquatic environments, and ground water and subsequent effects on wildlife health were particularly prevalent in the 1983 and 2006 BAPEs. Opponents of herbicide use, especially hunters, were worried about both their direct effects on wildlife, as well as indirect effects given that vegetation management alters wildlife habitats (BAPE 1983b). Similarly, Environics (1989) found that 64% of Canadians considered chemicals to pose a major hazard to fish and wildlife living in,

[6]Submission entitled *Mémoire conjoint des intervenants et personnes inquiètes du Transcontinental* [Joint memo of stakeholders and concerned individuals of Transcontinental], p. 2, presented to BAPE 1983.

or near, the area being treated. Cavanagh *et al.* (2000) examined public perceptions of ecological risks to water environments from forest industry activities. They reported that the ecological effect factor explained 50% of the variance of data, with other factors including human benefits (18%), controllability (13%), and knowledge (8%).

The relevance of FVM and the importance of maintaining biodiversity also contribute to concerns about ecological effects. In 1983 and 1997, submissions to the BAPE questioned the need to control vegetation, expressing a preference for a diverse forest (BAPE 1983b, 1997). Participants in 1997 emphasized the importance of conserving the original character of the forest to maintain a diversity of resources and uses (BAPE 1997). By 2006, BAPE participants stressed the ecological role of *competing* vegetation (BAPE 2006). Similarly, in western Canada Cavanagh *et al.* (2000) found that pesticide use was perceived as leading to high species loss and violating the rights of non-human species. It appears likely that increasing familiarity with terminology is affecting how members of the public and interest groups describe their concerns and preferences. Specific concerns about water and wildlife in the 1980s may now be expressed in terms of biodiversity or the ecological integrity of forests.

Concerns about ecological effects can affect choice of vegetation management techniques. As noted, chemical treatments attract much criticism and manual application has been preferred to aerial methods. However, participants at the 2006 BAPE also noted that the construction or maintenance of roads for mechanical application could increase ecological effects in sedimentation of watercourses (BAPE 2006). Mechanical techniques were recognized as being less efficient than herbicides, so are presumed less harmful to biodiversity and wildlife (BAPE 1997, 2006). Public concerns about ecological effects are not simply a matter of which FVM technique is more acceptable, but also raise the issue of whether forest vegetation should be managed at all.

Concerns about non-timber uses of forests

Forests are used for a variety of activities and products beyond wood fibre for the timber industry. Notable among these are recreational and tourist activities, hunting and fishing, and collecting edible forest products.

Recreation value can be related to scenic values (see visual aesthetics below), but also depends on the recreational activity and the related effects of forest management practices. Taylor and Daniel (1984) indicated that campers were the most sensitive to prescribed fire effects, followed by picnickers, hikers, backpackers, and nature observers. For certain activities, such as hiking, walking, cycling (Gan *et al.* 2000), and deer hunting (Rousseau 2008), preference is for forest management treatments that offer open space. However, since clearcutting of large areas is often considered unacceptable, preferences for open space are probably better obtained through mosaic or small-block treatments. Furthermore, visual assessment for recreational preferences might differ significantly from those made for scenic beauty. Tahvanainen *et al.* (2001) found that while small openings had the most positive effect on assessment of scenic quality, the most important recreational value was the forest being in a *natural* state. Adjusting forest management techniques to account for a variety of non-timber values can be more beneficial than providing a single use. For example, Boxall and MacNab (2000) concluded that negative effects of management on recreation could be justified by providing a combination of other benefits, including hunting and passive uses such as wildlife viewing.

Hunters are particularly concerned about the possible effects of aerial spraying on wildlife (BAPE 1983b) and about the loss of natural regeneration and the associated effects on wildlife habitat and cover for hunters and anglers (BAPE 1997). Bottan *et al.* (2001) found that 64% of moose hunters in Thunder Bay, Ontario, stated they would not hunt moose in areas that had been treated with herbicides during the last two years. Hunters were worried about the potential effects on moose, water quality, the environment, and human health. Their most frequent concern, however, was that killing hardwood species would cause moose to leave the area. These concerns seemed to be shared by hunters in Quebec as operators from the hunting and fishing industry claimed that concerns about herbicide spraying led to a reduction in clientele (BAPE 2006). Burning slash during hunting season, which may be similar to prescribed burning for FVM, was rated as negatively affecting the hunting experience. Hunters expressed concerns that fire and smoke might frighten moose away and that fire could burn surrounding forests (Bottan *et al.* 2001).

In some regions of Quebec, blueberry harvesting constitutes an important commercial activity, making herbicide use a concern for some local and First Nation communities (BAPE 2006). Use of herbicides can prevent blueberry pickers from obtaining a bio-certification for their product, which can affect their market access or sales price. Similar concerns may affect other emerging businesses related to edible non-timber forest products such as mushrooms.

Concerns about visual aesthetics

Landscape aesthetics and scenic beauty have been recognized as a major factor influencing the social acceptability of forest practices (Shindler *et al.* 2002), especially logging. Brunson and Reiter (1996) mentioned that visual impact of a practice will be less negative if more trees are left or if logging debris is removed (although maintaining debris is also important for ecological functions). The scenic quality of a treatment (whether logging or otherwise) will largely depend on regeneration recovery, with the presence of tall, high-density regeneration improving the visual acceptability of a cut (Pâquet and Bélanger 1997, Yelle *et al.* 2008). Similarly, exposed soil disturbance and the presence of woody debris after logging operations are particularly badly perceived by the public (McCool *et al.* 1986, Ribe 2002, Yelle *et al.* 2008). However, in the long term, treatments that create homogenous even-aged stands are more visually sensitive (Pâquet and Bélanger 1997).

Results of research on landscape aesthetics in forestry show the importance of both time and geographic scales. Brunson and Reiter (1996) concluded that the use of fire to prepare a recently logged site for replanting had immediate negative visual effects, although if regeneration recovered quickly the long-term effect may be positive. Taylor and Daniel (1984) reported that light fire may improve scenic quality for five or more years. Visual effects also depend on the distance between the practice and the viewer: an observer will be more concerned about fine detail, such as stumps and slash, in the foreground, and with forms, textures, and lines in the mid-ground (McCool *et al.* 1986).

Nevertheless, scenic beauty does not equate to acceptable practices. Instead, acceptability also incorporates cognitive processes, reflecting what the observer knows about the scene. In particular, observers without strongly held views (either for or against a practice) are more likely to be influenced by aesthetics than are those who have already formed opinions about the environment (Ribe 2002, Ford *et al.* 2009a). Research indicates that more intensive management systems will be more acceptable if observers are able to see the full cycle of management activities (Ford *et al.* 2009a). The aesthetics of FVM is not simply a question of whether or not the site looks good or bad, but is rather a more complex matter of where and when observers may make judgements and what values and knowledge they hold.

Concerns about the availability of information

Access to sufficient and credible information about forest management treatments is also a recurrent theme, especially in relation to health. In 1983, opponents to herbicide use in Quebec were shocked by the proposed use of 2,4,5-T, a product banned in several countries (BAPE 1983b). Submissions to BAPEs consistently show that groups doubted that the recommended dosages of herbicides are harmless (BAPE 1983b, 1997, 2006). In 1997 and 2006, despite the introduction of new products approved for use as not toxic to humans, participants were still unsure and anxious about the use of herbicides in public and private forests. Both proponents and opponents were able to produce scientific evidence to support their positions, raising doubts about the real toxicity, and contributing to a perception of insufficient knowledge about the actual effects.

In this context, opponents of herbicides may claim that an activity should not be undertaken if it is not possible to confirm, without a doubt, that there is no danger. A submission to the 2006 BAPE stated "everything suggests that the debate is far from finished, that few conclusions are unanimous concerning the risks of glyphosate use on human and environmental health. For this reason we consider that in this case, and even generally, the precautionary principle should apply."[7] Other submissions to the same BAPE adopted the opposing view, emphasizing that research did not provide evidence of unacceptable dangers to human or environmental health. Participants in BAPEs opposed to herbicide use have raised concerns about possible reactions with other pollutants already present in the environment, accumulation of chemicals in food chains, lack of knowledge of ecosystem complexity, cumulative effects on future generations and on groups who obtain a significant part of their food supply from forest environments, such as First Nations and regular hunters and anglers. Opponents argue that the outcomes of previous chemical use should be subjected to greater study before further applications are authorized.

Concerns about the ability to control treatments

Even if the treatment itself is acceptable, how it is applied and the ability of resource managers to control it or to limit undesirable effects can raise concern. Results of the 1989 national survey show that 56% thought manual application was less harmful to the environment, 29% said that it allowed more control over the area of dispersal, and 23% considered it more effective (Environics 1989). This illustrates the distinction that is made by the public between the risk to the environment, the ability to control the application, and the effectiveness of the treatment in achieving the objectives. In the Ontario survey (Decision Research 1995), 83% of respondents perceived herbicide use as being risky because it is seen as difficult to control; for the same reason, ground-applied herbicides, biological agents, and prescribed fire were also rated as high-risk treatments. Perceived controllability was an issue for respondents, even for practices such as grazing and cover-cropping. In the 1983 BAPE report, opponents to herbicides expressed concern about potential drift during aerial spray operations (BAPE 1983b) and in 2006 environmental groups opposed herbicide application near current or future protected areas (BAPE 2006). Wagner *et al.* (1998a) attributed preference for ground-based application of herbicide over aerial spraying to greater control over where the product is applied. Interestingly, Cavanagh *et al.* (2000) found that respondents ranked pesticide use as being fairly controllable, although they considered its effects likely to be rapid and irreversible. However, they did not specify to which application methods the results referred.

Concerns about costs, effectiveness, and efficiency

The economic value of FVM (Homagain *et al.* 2011, this issue), and particularly issues of effectiveness and efficiency (Wiensczyk *et al.* 2011, this issue), are often used in the arguments of both proponents and opponents of various treatments (BAPE 1983b, 1997), and may be perceived as a determining factor. Despite an appearance of objectivity, such quantitative analyses reflect assumptions about what can and cannot be measured and how this is interpreted. Accordingly, it is important to clarify related terms and concepts. The 1989 national survey illustrates this: respondents in favour of aerial spraying justified their choices on the basis of them being more effective (51%), more economical (22%), and more efficient (15%) (Environics 1989). Usually, *effectiveness* refers to the capacity of a treatment to achieve the desired results, and so aerial spraying of herbicides would be effective if it resulted in increased survival and growth of desired crop trees.[8] A treatment is considered *cost-effective* if it results in increased value of desired product that exceeds the costs of the treatment, for example, in the case of aerial spraying it increased the value of wood produced by more than the cost of the spray application. *Economical* refers to the cost of implementing a treatment, and so aerial spraying may be more economical if a given area could be treated at less cost than would be the case for alternative treatments. *Efficiency* considers whether the results were obtained without wasting time, money, or resources.

Dampier *et al.* (2006) noted that few researchers have studied the cost-effectiveness of alternative FVM treatments in Canada. They concluded that aerial spraying of herbicides is more cost-effective than manual brushcutting, which in

[7]Submission by Nature Quebec presented to BAPE 2006 (translated).

[8]Definitions adapted from the Miriam-Webster online dictionary and thesaurus.

turn is more effective than a tractor-mounted brushcutting device. However, this analysis was limited to direct treatment costs. Due to the economic and ecological uncertainties of the future of the treated stands Dampier *et al.* (2006) did not undertake a cost–benefit analysis, which could have included future financial returns. The authors also noted that a full evaluation of the cost to society would need to include all forest values, including hardwoods and non-timber products, concluding that "treatments that provide the greatest cost effectiveness may not necessarily be the most socially acceptable" (Dampier *et al.* 2006).

Hence, public concerns about costs, effectiveness, and efficiency will typically be expressed in terms of what is included or excluded from an analysis, rather than about the numbers themselves. In the 1997 BAPE, opponents argued that costs associated with pollution, contamination, and health were ignored, as were effects on other commercial activities such as hunting, fishing, recreation, and fruit picking (BAPE 1997). Unfortunately for resource managers, quantitative data for many of these costs and effects are not available but an economic evaluation that ignores these issues will do little to alleviate public concerns.

Concerns about local socio-economic benefits and effects

For some regions dependant on forestry resources, vegetation treatments and other management and harvesting activities may be seen as providing employment, economic development, and similar benefits. In particular, it is assumed that manual brushing of vegetation creates more jobs for local communities than does aerial application of herbicides (BAPE 1997). However, as it is mentioned by Fortier and Messier (2006), "it is not clear that manual brushing needs a larger labour force than hand-applied chemicals". The Ontario survey linked high Aboriginal interest in job creation with their support for managing forests for employment (Decision Research 1995). Little research has been conducted on the socio-economic benefits associated with silviculture or vegetation management as compared to the benefits to be derived from the establishment or improvement of sawmills, pulp mills, and other timber transformation facilities. Charnley (2006) reviewed international experience with industrial forest plantations and concluded that jobs were good for those who could get them, but that the number of such jobs was generally below local community expectations.

Other socio-economic benefits associated with vegetation management could include the establishment of specialized businesses or contractors (such as aerial sprayers or mechanical treatments), training opportunities and indirect employment and business activity. Disadvantages could include impacts on non-timber forest-related businesses (such as recreo-tourism) and on subsistence uses, or even health costs associated with unsafe treatments. It is often argued that intensive management (incorporating FVM) of forests in one region will help to reduce pressures of forest cutting in another region (e.g., Fortier and Messier 2006), and this could entail socio-economic impacts, both advantageous and problematic. Although Charnley's (2006) review concentrated on intensive plantations rather than on management within a predominantly natural forest, her conclusion that such management often failed to provide adequate benefits to local communities may well be equally applicable. In the absence of benefits, local populations may be more concerned about the risks associated with management (Cavanagh *et al.* 2000). Charnley (2006) related such fears directly to support for management actions.

Concerns of Aboriginal peoples

Aboriginal peoples[9] in Canada share some concerns with the non-Aboriginal population but also present other unique issues. In the Decision Research (1995) survey, members of First Nations showed the highest support for forestry practices that favoured environmental protection and the highest opposition to the use of herbicides. However, more than any other group they were supportive of managing the forest for employment goals. Similar conclusions were drawn by BAPE (2006) in relation to concerns raised by the Atikamekw nation. Aboriginal concerns can be grouped in three broad categories: recognition of rights, effects on practices and uses of forest lands, and the relationship between humans and the forest environment.

Aboriginal peoples in Canada hold particular rights in relation to forested lands, whether these are specified under traditional title, negotiated treaties, the Canadian constitution, or legal decisions (Smith 1998, Wyatt 2008). Cases in the Supreme Court of Canada, including Delgamuukw (1997), Taku River Tlingit (2004), and Haida (2004), have clarified the duty of governments and industry to consult and accommodate Aboriginal peoples' concerns before development occurs. Several provinces also have specific legal or policy requirements for Aboriginal consultation (e.g., OMNR 2004), but the specific nature of their rights means that Aboriginal peoples are not "just another stakeholder" in a consultation process (Stevenson and Webb 2003).

Given the high proportion of food stuffs that are often obtained through hunting, fishing, and collecting, concerns about human health and ecological effects of vegetation management are of particular importance for Aboriginal peoples (BAPE 2006). Unsurprisingly, perceived risks are greater when it is feared that chemical residues could accumulate in the food chain. Furthermore, vegetation that resource managers are seeking to control may be seen as useful habitat or food for wildlife. Hunting, fishing, gathering, and other activities on forest lands are not only a food source for First Nation communities, but they also have critical cultural and symbolic values (Nelson *et al.* 2008). If Aboriginal peoples spend more time on forested lands than non-Aboriginals, then FVM techniques are more likely to affect their activities, culture, and lifestyle. For some, employment opportunities associated with FVM may provide benefits. Although anecdotal and case study information supports local successes, Parkins *et al.* (2006b) found little evidence of systematic economic benefits associated with policies for promoting Aboriginal employment in the forest sector.

A common Aboriginal view is that nature and the environment should be treated with respect and that it is inappropriate for humans to attempt to control or manage forests (Stevenson and Webb 2003: 86). Hence, any form of FVM

[9]Canada's constitution recognizes three groups of Aboriginal peoples: First Nations, Inuit, and Métis.

that disrupts or modifies natural processes could be considered unacceptable, regardless of the potential benefits identified by resource managers. Conversely, management techniques used to re-establish natural conditions or to assist natural processes could be acceptable.

Finally, it is important to recognize that no universal Aboriginal perspective or values for forest vegetation exist. Instead, the onus is on resource managers to consult with local Aboriginal peoples, in full respect of their rights, and to find ways to accommodate their concerns.

Preferred vegetation management alternatives

The use of herbicides has fuelled many public concerns and controversies in FVM across North America over the past three decades (Fortier *et al.* 2005, Thiffault and Roy 2011). However, few surveys have specifically investigated public preferences among a range of vegetation management treatments. The Decision Research (1995) survey indicated that most Ontario respondents were in favour of controlling unwanted vegetation but that this support varied depending on method. Among a list of 22 forest management practices, the most acceptable vegetation management technique was manual brushing. Grazing, mechanical site preparation and fire were also supported by at least half the respondents. Most respondents considered all forms of herbicide use unacceptable, even when used to control a foreign invasive weed that was jeopardizing wetlands. Aerial spraying of herbicide garnered only 17.6% support. Tractor-mounted and backpack spraying were more acceptable than aerial application, but were supported by less than 45% of respondents. Microorganisms and viruses were also considered unacceptable but, interestingly, the use of natural plant toxins was acceptable to nearly 75% of respondents.

Slightly less detailed information is available from the Canada-wide Environics (1989) survey. A clear majority of Canadians (76%) did not support the use of chemicals in managing forests. Despite this, 66% of respondents were in favour of manual herbicide application by pump at ground level compared to only 20% in favour of aerial application (Environics 1989). Another national survey conducted in 1996, showed that the use of herbicides to control unwanted vegetation was perceived negatively, while responses to sheep grazing and manual methods were more favourable (Robinson *et al.* 1997). Other studies to compare public views of forest treatments for vegetation or insects have indicated clear preferences for biological over chemical control techniques (MacDonald *et al.* 1998, Wagner 1998a, Chang *et al.* 2008). In a study of public values and attitudes towards forest management, Nadeau *et al.* (2008) found that New Brunswick residents perceived the use of herbicides as more detrimental than beneficial. In another study comparing public attitudes towards controlling insect infestations, Chang *et al.* (2008) found that residents of New Brunswick were more concerned about chemical treatments than those in Saskatchewan. The authors suggested that this could be due to a long history of concerns and media coverage about forest spraying in New Brunswick or to greater familiarity and comfort with the use of agricultural chemicals in Saskatchewan.

It is also likely that individual preferences are relative rather than absolute (Ford *et al.* 2009a), and that the responses given in a survey could be affected by the range of techniques considered. For example, if aerial application of herbicides were removed from the list of potential treatments, then tractor-mounted or backpack spraying acceptability might decrease. Conversely, if genetically modified organisms were considered as a management option, aerial spraying might be relatively more acceptable. Social acceptability is sometimes considered a threshold that needs to be surpassed, but Brunson (1996: 13) asks: "If foresters strive for social acceptability, are they shooting for a suitable target or sinking to an endurable threshold?" For FVM this is reflected in two different questions: "what treatments are you willing to put up with" (a threshold) or "what treatments do you prefer" (a desired outcome). This is an important distinction; the first view suggests that public concerns are a barrier to be overcome while the second implies that public preferences have a legitimate place in forest management decision-making.

Vegetation Management within Broader Forest Management Decision-making

Choices about FVM are made within the broader context of management of forest lands and public acceptance of treatments will be affected not only by the concerns outlined above, but also by perceptions of how forests are managed. Three themes are addressed here: information about management, trust in resource managers, and public participation in forest decision-making.

Education and information

An often-made assumption is that low public acceptance of controversial treatments, such as herbicide use, is due to a lack of knowledge and that education would result in a better informed public that will support the proposed treatments. Studies of the relationship between knowledge about and acceptability of forest practices produce variable results. Taylor and Daniel (1984) found no significant difference for visual and recreational acceptability of prescribed fire between respondents that were informed and not informed. However, they also found that information increased public tolerance and understanding of fire; a finding supported by Kakoyannis *et al.* (2001). Ford *et al.* (2009b) found that information about the consequences of forest management activities changed the relative acceptability of alternative harvesting treatments. Knowledge can also influence environmental activism, and as concluded by McFarlane and Hunt (2006: 283) "managers may be surprised that individuals with more factual knowledge of forests engage more often in environmental activism".

The consensus for most researchers is that knowledge alone is a poor predictor of acceptability. Individuals respond differently to information that is provided (Ribe 1999) and do not necessarily draw the same conclusions. Resource managers may hope that additional information will build acceptability but it can also be used to mobilize opposition to a proposal (Stankey and Shindler 2006). Knowledge is only one factor that influences individual judgement and "it is unlikely that people's judgements will change based solely on technical information" (Shindler *et al.* 2004: 151). The idea that the public is misinformed and that resource managers should provide information to gain support for FVM is generally denounced in the literature. Instead, resource managers should seek to understand public concerns, to provide information about issues and options, and to develop solutions that take account of public concerns and interests.

Trust in resource managers and management processes

Public trust in resource managers can affect public willingness to accept professional judgements about FVM. Shindler *et al.* (2002: 16) concluded that: "Many citizens do not trust natural resource agencies and therefore do not support their decisions or the way those decisions are made." Results of the 1995 Ontario survey indicate that 74% of public respondents placed responsibility for protecting the forest environment in the hands of government agencies, but only 9% agreed they were doing an excellent job (Decision Research 1995). In addition, 35% of the variance in public support for herbicides was explained by trust in those who manage decisions about their use. Höppner *et al.* (2007) noted that trust is not the same as confidence—trust is used in relation to people, groups, and institutions whereas confidence concerns outcomes or processes. Accordingly, resource managers need to build both public trust in themselves and confidence in the processes of forest planning and management.

Examining the effect of trust on natural resource management (specifically the relation between the U.S. Corps of Engineers and local communities in Illinois), Leahy and Anderson (2008) distinguished five aspects of trust: trust in the federal government, social trust reflecting a willingness to trust others, technical competency, shared values and interests, and procedural justice in decision-making. Although the first two points are beyond the control of staff within an agency, the remaining three represent areas where resource managers and planners build can public trust and confidence. Höppner *et al.* (2007) noted that the provision of information had no effect on trust. They also noted that the trust of participants in workshops decreased during the process; an effect that they attributed to a shift from enthusiastic expectations to a more realistic assessment of probable outcomes. Hence, trust-building efforts do not have guaranteed outcomes for resource managers.

Public participation in forest management-related decision-making

As demonstrated throughout this paper, the spectrum of values, concerns, perceptions, and experiences associated with the management of Canada's forests is diverse. Public involvement in decision-making is becoming increasingly important, and is reflected in forest management criteria, provincial regulations and policies, and market-oriented certification systems (see Hamersley Chambers and Beckley 2003 for a review). According to Beckley *et al.* (2006), forest management is moving from an expert-driven, regulatory, science-based model to one that is more inclusive and socially responsive. This change is particularly important for FVM, where different views have often been stereotyped as a debate between professionals and the public. Public participation can help to ensure that resource managers are informed about the relative importance of local concerns, inform key local stakeholders about the benefits and disadvantages of proposed actions, and provide the public with an opportunity to learn about and be involved in forest decision-making. Charnley (2006) linked the absence of mechanisms for community participation to both fewer opportunities for local benefits from plantation forests and to increased opposition. Involvement can help the public to see the big picture of forest management and to understand issues around operational decisions.

Beckley *et al.* (2006) provided a comprehensive review of various public participation techniques while highlighting their strength and weaknesses. A key message is that no single tool can deliver efficient public participation and that resource managers should consider a suite of tools that will help them understand the issues from multiple points of view. The Ontario vegetation management survey (Decision Research 1995) provided a wealth of information that enabled resource managers to consider the preferences of the broad population at that time, and to validate certain assumptions made about the views of different groups within the public. However, as noted above, such information is time- and context-specific and is rapidly dated. Advisory committees provide a complementary role, enabling deeper exchange and direct discussions about specific practices. However, reliance upon local public participation processes in areas with high economic dependence upon the forest sector may lead resource managers to conclude that there is higher acceptability than exists in the wider population (McFarlane and Hunt 2006). Although public hearings are an essential part of Quebec's BAPE process, committee members use other ways to engage with people and inform their evaluations (BAPE 1983a,b, 1991). New initiatives for ecosystem-based management in Quebec aim to involve partners such as other government agencies, the forest industry, First Nations, recreational associations, and ecological groups (Thiffault *et al.* 2007). Höppner *et al.* (2007) stressed the usefulness of a long-term participation strategy, including a variety of places and processes for participation, as a means of fostering engagement and building trust.

Concerns Related to the Forest Vegetation Management Workforce

All FVM techniques require some degree of human work, but the extent of this varies greatly. Labour costs and productivity issues are discussed in Homagain *et al.* (2011, this issue) and Dampier *et al.* (2006) as part of the analysis of comparative effectiveness of different FVM techniques (see also Fortier and Messier 2006, LeBel and Dubeau 2007, Toupin *et al.* 2007). The FVM workforce forms a defined group within the broader population, with particular concerns and knowledge. Workforce issues are frequently raised by both proponents and opponents of particular FVM techniques. Here, we review questions of worker health, safety, remuneration and workforce availability.

Mechanical treatments are the most common alternative FVM choice across Canada (Thompson and Pitt 2003), and are often perceived as less dangerous to human health than herbicides. However, this view may be erroneous; concerns about herbicides are routinely refuted by governments and researchers, while new research is examining problems associated with the health and safety of silvicultural workers. These issues include ergonomic questions of work and equipment, the risk of injury, and dangers associated with exhaust fumes (Fortier and Messier 2006). Toupin *et al.* (2007) monitored workers' heart rates, finding that these were well beyond maximum acceptable levels. Seasonal work, remoteness, and physical demands have all been identified as problems associated with silvicultural work (CIDMOAF 2001, LeBel and Dubeau 2007, Toupin *et al.* 2007).

Remuneration for brushcutters typically adopts a production-based pay system, with rates reflecting vegetation density, but ignoring other site factors. Toupin *et al.* (2007) reported three main negative aspects of any production-

based pay system: reduction of quality, increase in incidence and severity of accidents, and variable site characteristics leading to variable payments, uncertainty, and stress for workers. The introduction of pay systems that included an hourly rate, rather than being solely production-based, has been recommended (BAPE 2006, Toupin *et al.* 2007).

Employment creation is sometimes cited as an advantage of manual techniques over herbicides, but shortages of silvicultural workers have become an issue in many regions of Quebec. This has been attributed to factors such as heavy workload, poor working conditions, low remuneration, the instability of employment and low job status (CIDMOAF 2001, Toupin *et al.* 2007, Villeneuve 2009). Service Canada (2009) notes that the numbers of silviculture and forestry workers in Quebec increased in the second half of the 1990s, before falling with overall trends in the forestry sector. They add that many workers leave the sector each year, citing factors such as difficult working conditions, seasonal work, physically demanding tasks, and remoteness. Interestingly, although the Quebec region of Service Canada has collected this information, it does not appear that similar assessments have been made in other provinces or nationally. Egan and Taggart (2004) identified similar issues as affecting employment in forest harvesting in New England, suggesting that concerns about ensuring the availability of forest workers is not limited to Quebec.

Recommendations about recruiting and retaining silviculture workers include (CIDMOAF 2001, Egan and Taggart 2004, Toupin *et al.* 2007):

- Develop variable remuneration systems that are not solely productivity-based.
- Provide comprehensive training for productivity, worker safety and environmental protection.
- Improve financing of silvicultural work to increase employment duration and stability.
- Recognize skills associated with effective silviculture and its contribution to future forest conditions.

Faced with recruitment difficulties, Quebec forestry companies and contractors are recruiting immigrant labour for silvicultural work. Using employment data, Service Canada (2009) concluded that the proportion of immigrants engaged in such work[10] rose from 1% to 6% between 2001 and 2006. Table 1 provides employment data provided by Domtar in the Abitibi-Témiscamingue region of Quebec showing the origins of workers in terms of the local region, other regions in Quebec or outside Canada (no workers came from other parts of Canada). This data suggests that the workforce available within the region numbers only 35 to 55, and that the remaining positions (up to 300 positions depending on the year) must be filled with workers from outside the region or from overseas. To date, research on the extent and issues of immigrant workers in forest management has not been done, but anecdotal reports mention both the benefits of multiculturalism along with the problems of conflicts with local communities, illegal immigrants, and tax evasion (Villeneuve 2009).

Workforce considerations do not automatically support any particular FVM treatment. Instead, the effects of different treatments upon the workforce, and the communities of which they are part, should also be recognized by resource managers as potential social concerns that could arise from choices about FVM. All of these factors may influence the social acceptability of treatments, as well as their comparative effectiveness.

Limitations of Available Knowledge

The forest sociology approach adopted here has several limitations, especially when compared with the methods used in other papers, which evaluate alternative FVM techniques using a range of indicators. Firstly, very little research has been done to specifically compare public views of various techniques, or to model how social issues inform decisions about vegetation management. In particular, the state of knowledge about the human dimensions of FVM and the social acceptability of related forest practices does not allow us to make generalizations. Accordingly, we have based this review on available research that examines public values, attitudes, and perceptions associated with forest management,

[10]Code 8422 - Silviculture and forestry workers in the National Occupational Classification.

Table 1. Origins of silvicultural workers at Domtar Inc. in Abitibi-Témiscamingue[a]

		Number by region			Percent by region		
Year[b]	Total number[c]	Abitibi	Other Quebec	Outside Canada[d]	Abitibi	Other Quebec	Outside Canada[d]
2003	260	165[e]		95	63[e]		37
2004	300	35	120	145	12	40	48
2005	300	55	40	170	19	14	57
2006	350	50	170	130	14	48	38
2008	90	35	30	25	40	35	25
2009	70	35	15	15	52	24	24

[a]Data provided by K. Szuba at Domtar, Nairn Centre, Ontario and M. Sigouin at Domtar, Val d'Or, Quebec
[b]Data not available for 2007
[c]Number of workers has been rounded to 10 for totals and to 5 for origin.
[d]Workers originated in Africa, Russia, Albania and Romania.
[e]No distinction was made between "Abitibi" and "Other Quebec" in 2003.

both concerning FVM choices (such as herbicide use) and broader questions. This has led us to structure our review around a number of key concepts to provide readers with a sense of the complexity that underlines assessment of social acceptability of forest management.

A second limitation derives from the research methods used in each study, and particularly the choice between qualitative or quantitative approaches. While the quantitative approach, such as a survey, allows us to document the "what" and "how much", the qualitative approach provides deeper understanding about the "how" and "why" (Miles and Huberman 2003). A hybrid approach, which would rely on a mixed-method approach, would be quite relevant to assess social acceptability. A survey, when designed around a good sampling frame, allows for generalization to a broader population, while qualitative research is usually based on a deliberate sample that leads to conclusions that cannot be generalized. However, as Marshall and Rossman (1999) noted "although no qualitative studies are generalizable in the statistical sense, their findings may be transferable". Allen *et al.* (2009) provide a good technical guide to help navigate through methodological choices involved in assessing public values and attitudes.

Finally, judgements about the social acceptability of FVM practices are highly dependant on specific contexts (e.g., spatial, temporal, social, political). While the information provided in one study may provide hints as to what people in other contexts would consider acceptable, such studies should not be used to make firm predictions. Instead, forest vegetation managers would be well advised to seek additional information within their own context to inform their decisions.

Conclusions

For some resource managers and policy-makers, choices about alternative FVM techniques may be a purely technical matter, requiring an evaluation of which techniques will provide the most effective results at least cost in a given environment. It is possible to consider social issues in a similar way—as costs in public acceptance or controversy that should be estimated and included in an evaluation matrix, indicating which technique will create the fewest social problems in a given environment. However, we have deliberately chosen not to compare different techniques in terms of their social acceptability or effects on social values or interests.

The model presented here is based on recognizing human values and concerns in order to integrate these into management processes. Research shows that public values associated with forests and acceptability of management actions depend on many factors, including context. We have identified and described a series of common concerns about FVM—concerns that can be seen as manifestations of perceived risks to things that people value and that need protection from perceived threats. As such, the concerns identified here provide a means of linking research about forest values and attitudes to perceptions of risk. These concerns, organized around the five factors identified by Stankey and Shindler (2006) and illustrated in Fig. 1, can help resource managers consider the social acceptability of FVM options.

Forest resource managers are almost certainly familiar with the concerns identified but, as our sources indicate, much of the available information is dated or relates to particular contexts. Public opinion surveys, such as those in Ontario (Decision Research 1995) or New Brunswick (Nadeau *et al.* 2008), can help resource managers to identify social values and concerns, to address these in forest management planning, and to choose among management options. When carefully prepared, such instruments can also provide specific information about local concerns or about newly emerging issues. Other public participation tools can provide complementary information. For example, local advisory committees can be used to gather detailed information and explanations that are not possible through surveys, while also providing information to key stakeholders, and enabling members of the public to participate in decision-making. However, no single tool can meet all objectives for public participation (Beckley *et al.* 2006).

In undertaking this review we noted that while the term "social acceptability" is being increasingly used in Canadian forestry, it is understood and applied inconsistently. Aggregating individual judgements about whether or not a certain event is acceptable is complex and highly variable, and depends on a variety of factors (Shindler *et al.* 2002). These factors could also lead to social refutation when the event is judged as unacceptable, and it is possible (indeed likely) that various segments of a population could make opposing judgements. The concerns and issues presented here will not always lead to a judgement against an activity; they could also lead to support for a FVM choice if significant numbers of people felt that this choice was an appropriate response to their concerns.

Knowledge and access to information is an important factor in both decision-making and social acceptability of such decisions. Both proponents and opponents of controversial actions typically produce scientific information to support their positions, but providing additional information is rarely sufficient to change peoples' values or attitudes. Attempting to categorize specific groups as right or wrong or as misinformed is unlikely to resolve problems that arise from differences in perspectives. While resource managers have specialized expertise in forest management, they need to recognize that the general public does not necessarily share their values and perceptions. Using this expertise as a starting point for building trust and discussing concerns may provide better results than trying to convince a sceptical public not to oppose a decision that has already been made. Involving key stakeholders in the full cycle of management planning and actions may also contribute to a greater understanding of the reasons for choices.

Some resource managers may have hoped that we would have identified those FVM techniques with the highest public acceptance, or provided a model to predict public reactions to forestry options in particular situations. Unfortunately this is not possible with the existing state of knowledge, a situation not unique to the Canadian context (e.g., McCarthy *et al.* 2011). Instead, we have sought to assist resource managers to identify potential social concerns that could arise from choices about FVM. Once managers have identified probable concerns, they can seek more detailed or up-to-date information about these and consider ways to address them, whether through changed practices, consultation, information, or some other strategy. Given this need for information, government agencies should consider additional resources for monitoring social values and concerns, similar to regular invento-

ries of forest vegetation. We expect that public debate about FVM in Canada will continue. It is our hope that this review helps resource managers to understand the origins of this debate and to better integrate social concerns into their FVM decisions.

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