Exploring public perceptions of forest adaptation strategies in Western Canada: Implications for policy-makers

Reem Hajjar *, Robert A. Kozak

Faculty of Forestry, University of British Columbia, 2900-2424 Main Mall, Vancouver, BC V6T 1Z4, Canada

A B S T R A C T

Various reforestation strategies that could potentially help forests adapt to a changing climate are currently being debated. We sought to gauge the public's acceptance levels of different reforestation strategies, and explore which factors seem to be associated with people's willingness to accept different forms of human and technological intervention in forest management. To do so, a public survey was administered in British Columbia and Alberta, Canada to assess acceptance of different forest adaptation strategies that could be employed to adapt to a changing climate, and explore variables identified from the literature as potentially affecting public decisions on biotechnology and assisted migration. A logistic regression was used to determine the degree to which variables identified in the literature are associated with levels of acceptance of different forest management strategies. What emerged was an explanatory model that can be used as a starting point to further engage the public in a discussion over appropriate and acceptable technologies and policies to help forests adapt to a changing climate.

© 2015 Elsevier B.V. All rights reserved.

1. Introduction

Forests have become increasingly vulnerable to mortality due to the direct and indirect effects of climate change (Fettig et al., 2013). In Western Canada, recent increases in the frequency and severity of natural disturbances in forests, such as wildfires, pest outbreaks, and droughts, have been attributed to a changing climate (Aubin et al., 2011; Parkins and Mackendrick, 2007, and citations within). Reforestation practices that source seeds locally as a principal means of local adaptation no longer ensure forest health and productivity, as local climates are expected to change over the coming decades (Wang et al., 2012) and individual trees and populations may be maladapted when exposed to conditions outside of their climate niche (Fettig et al., 2013). For these reasons, scientists have been considering different strategies to inform policy on helping forests adapt to changing climates, such as assisted migration – moving a population or a species outside its historic range to habitats that would become more suitable than present habitats in the future climate (Hewitt et al., 2011; Ste-Marie et al., 2011).

However, such interventions are not without controversy, and scientists continue to debate the efficacy of adaptation strategies like assisted migration (Hewitt et al., 2011). Much of this discourse revolves around the ecological risks and benefits of such interventions (Aubin et al., 2011), but public opinions regarding these sorts of adaptation strategies are also an issue. Given the substantial uncertainty associated with assisted migration, and the complex scientific, social, policy, and economic implications of the topic, Aubin et al. (2011) argue that the debate on assisted migration is based on more than just an objective risk assessment that weighs the ecological risks and benefits; the debate should also include a discussion of beliefs, values, visions of the future, and subjective perceptions of risk and desirable outcomes (Minteer and Collins, 2010; Aubin et al., 2011). While studies on public perceptions of biotechnology (Durant and Legge, 2005; Bonny, 2003; Costa-Font et al., 2008; Fischhoff and Fischhoff, 2001) and climate change (Kellstedt et al., 2008; Slimak and Dietz, 2006; Maibach et al., 2009) abound, such studies situated within the forest sector are comparatively rare.

In this paper, we sought to gauge the public's acceptance levels of different reforestation strategies, including assisted migration, natural regeneration, seed selection for future climates, and use of genetically engineered seeds. We further sought to explore which factors, such as risk perception, knowledge, values, and attitudes, are associated with people's willingness to accept different forms of human and technological interventions in forest adaptation strategies, with a view to informing the policy-making process for forest adaptation. To do so, we tested the association between acceptance of different forest adaptation strategies and variables identified by various studies on attitudes surrounding biotechnology, as well as thought pieces on climate change and assisted migration technologies. These variables formed the basis of a questionnaire administered to the general public in British Columbia and Alberta which also assessed the public's acceptance of various

* Corresponding author at: International Forestry Resources and Institutions, School of Natural Resources and Environment, University of Michigan, 440 Church St., Ann Arbor, MI 48109, USA.
E-mail address: reem.hajjar@gmail.com (R. Hajjar).

forest management strategies that could be used to adapt forests in Western Canada to projected future climate conditions.

2. Background

In order to contextualize this study, background information on current climate change adaptation strategies in the forestry sector of Western Canada is provided, followed by a review of the variables explored in this research as being associated with acceptance of forest adaptation strategies.

2.1. Climate change and forest adaptation in Western Canada

Current action on adaptation to climate change in Western Canada's forests could best be described as nascent and evolving. While policy surrounding assisted migration has yet to be enacted, the provincial governments of both Alberta and British Columbia seemed poised and willing to adopt this strategy as a means of adapting to climate change. For instance, tree improvement and adaptation programs in Alberta acknowledge that climate change will bring about challenges for the forest sector and Alberta Environment and Parks recommends that trees be planted to better suit future conditions that are expected to be warmer and drier. To that end, they have funded a number of research projects and pilot programs related to tree breeding and assisted migration strategies (Alberta Environment and Parks, 2015). In British Columbia, the Ministry of Forests, Lands and Natural Resource Operations has released a number of relevant reports, including a Climate Change Strategy, 2013–2018 (British Columbia Ministry of Forests, Lands and Natural Resource Operations, 2013a), a Climate Action Roadmap (British Columbia Ministry of Forests, Lands and Natural Resource Operations, 2013b), and a Forest Stewardship Action Plan for Climate Change Adaptation, 2012–2017 (British Columbia Ministry of Forests, Lands and Natural Resource Operations, 2012). The latter document outlines three goals for adapting forests to future climate conditions: fostering resilient forests; maintaining future options and benefits; and building adaptive capacity. Under each, a series of practicable actions are proffered, for example, to prepare a charter and implementation plan for climate-based seed transfer program (British Columbia Ministry of Forests, Lands and Natural Resource Operations, 2012). Like the Alberta government, the British Columbia Ministry of Forests, Lands and Natural Resource Operations has also been very active in supporting research and pilot studies pertaining to the adoption of assisted migration as a viable climate adaptation strategy.

2.2. Variables affecting public acceptance of new forest adaptation technologies

A number of factors can affect public acceptance of new technologies. For GMO technology, Costa-Font et al. (2008) found that personal attitudes are formed by complex decision-making processes based on values, knowledge, trust, and risk perception, among other factors. These and other factors, such as desired outcomes, past hardships, and beliefs, have been found to affect public opinions of other such technologies (e.g. Aubin et al., 2011; Marx et al., 2007). We chose to test the importance of these variables in this present study on public acceptance of forest adaptation technologies. While it is not our intent to provide a comprehensive literature review on this ongoing debate (there are many works related to this, e.g. Adger et al., 2008; Aubin et al., 2011; Minteer and Collins, 2010; Slimak and Dietz, 2006), in order to explain our choices of variables in this study, we offer the following brief review of the above-mentioned factors and how they might affect a person's decision to accept or reject forest adaptation strategies. All the variables discussed were selected for exploration given their prominence in the literature on public acceptance of new technologies in the field of biotechnology in agriculture and the limited available literature related to climate change and forestry. While a systematic review of the literature was not conducted, these variables repeatedly emerged

in both empirical studies and synthetic reviews, which were found using various combinations and variations of search terms such as *public acceptance/perceptions*, *biotechnology*, *climate change*, *GMO acceptance*, *assisted migration*, and *adaptation*.

2.2.1. Environmental values and beliefs

Values, in the context of forest management, can be defined as, "… culturally and emotionally informed beliefs about desirable and appropriate standards for judging appropriate actions and goals," influenced by the information received through social ties and other means (Harshaw and Tindall, 2005, p.435). Where the environmental ethics debate is concerned, the value-based concepts of anthropocentrism, ecocentrism, and anthropocentric conservationism are very much at the fore. These values and beliefs can shape attitudes towards forest adaptation strategies.

Anthropocentrists, those who see the primary purpose of nature as a resource for human use, might argue that the risks of climate change can be mitigated using human knowledge and technological fixes (Hulme 2009, as cited in Aubin et al. (2011)) and, thus, might be more willing to accept higher degrees of human intervention to help forests adapt. Conversely, ecocentrists, those who emphasize the intrinsic value of nature in a pure and pristine state that should be protected independent of human use and benefits (Osanken in Aubin et al. (2011)), might argue that human and technological interventions for forest adaptation are diverting attention from the need for humans to reduce their impact on nature (Aubin et al., 2011). On the other hand, ecocentrists might also be interested in using such technologies to prevent species extinction, or to preserve vital ecosystem processes that are at risk due to climate change (Aubin et al., 2011). This so-called anthropocentric conservationist view capitulates to the fact that species are in trouble because of human-induced climate change, and that the more pragmatic alternative is to manage populations and species to help them survive changing conditions (Minteer and Collins, 2010, p.1801). Similarly, Donlan et al. (2005) point to an ethical responsibility to save species that we have put at risk through our own actions. Thus, individuals with more ecocentric values may hesitate when considering where to place the threshold of human manipulation of nature; when exactly is a 'technofix' acceptable?

Steg and Sievers (2000) approach the issue of values using the lens of cultural theory and its effects on risk perception and preference for risk management strategies. In discussing mitigation strategies, they categorize the following: individualists believe that technology will fix the problem so that there is no need to change human behavior for mitigation; hierarchists will put trust in the government or experts to tell them when the limits to environmental damage are reached and when to control resource use; egalitarians have a strong sense of responsibility for the environmental problem and prefer changing human behaviors and reducing needs rather than controlling resources; and fatalists feel that there is no point in learning about and managing nature since nothing is controllable and all is left up to chance (Steg and Sievers, 2000). In the context of forest management, individualists and hierarchists may be more willing to accept adaptation strategies due to their belief in the 'technofix' and their trust in expert decisions, while egalitarians may be more hesitant as they would be more inclined to change human behavior rather than changing nature. The choices of fatalists would be unpredictable.

2.2.2. Desired outcomes

Acceptance of adaptation strategies may depend on desired outcomes (Aubin et al., 2011) – what society prioritizes in forest management. Desired outcomes can be a manifestation of values and beliefs, and can include non-environmental values such as social, cultural, and economic values. For example, if the desired outcome is to maintain or enhance the productive capacity of forests and, thus, sustain a sector of great importance in many locations, perhaps one would be more accepting of strategies that promise to do just that. If biodiversity