

The assisted migration of western larch in British Columbia: A signal of institutional change in forestry in Canada?

Nicole L. Klenk¹ and Brendon M.H. Larson¹

¹Corresponding author, Assistant Professor, Departments of Physical and Environmental Sciences and Political Science, University of Toronto Scarborough, 1265 Military Trail, Toronto, Ontario, M1C1A4, Canada, Phone +1 416 208 5089

² Associate Professor, Department of Environment and Resource Studies, University of Waterloo, 200 University Avenue West, Waterloo, ON N2L 3G1, Canada

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Highlights

- The assisted migration of western larch represents major institutional change
- Genetic conservation discourse legitimizes western larch assisted migration policy
- Coupling genetic paradigm with new values on traditional economic interests
- Discordance between coordinative and communicative discourses on assisted migration policy
- Genetic paradigm poised to replace ecological paradigm in Canadian forestry

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1. Introduction

Dismal climate change projections have led some scientists to propose moving species to establish new populations in areas predicted to be suitable in the future given climate change projections (“assisted migration”, AM)—either as a last ditch species rescue strategy or as a matter of sustainable ecosystem management (Hoegh-Guldberg et al., 2008a,b; Vitt et al., 2009). In forestry, the assisted migration of species refers to moving populations of native species either within or outside their historical range, or translocating non-native species into areas they have never occurred (Pedlar et al., 2012).

In Canada, several provinces are changing tree seed use guidelines to enable the movement of populations of tree species within or just beyond their natural range for commercial forestry purposes (Pedlar et al., 2011). Moreover, the first explicit assisted migration policy was developed to enable the movement of western larch (*Larix occidentalis* Nutt.) from southern British Columbia to northern parts of the province. According to Rehfeld and Jacquish (2010), western larch is the most productive of the three *Larix* species native to North America. And while its distribution in BC—limited to the upper Columbia River Basin of southeastern BC—is relatively small compared to other trees, it remains commercially important as demonstrated by the breeding program put in place in BC since early 1980s (Jacquish et al., 1995). Thus, to sustainably manage western larch populations in the context of climate change, managers must adjust seed zone boundaries and seed transfer guidelines to ensure that planting stock remains physiologically suited to the planting sites (Rehfeld and Jacquish 2010). Accordingly, the Tree Improvement Branch’s new seed transfer policy for western larch AM created three new seed planning zones and makes provisions for agreement holders to plant up to 10% of western larch seedlings planted each year to be planted further north in these three new zones (Lee, 2010a,b).

In the last decade, the scientific community has engaged in a heated debate over the potential benefits and risks of AM, the scientific technicalities of which can be summarized as avoiding species extinctions or species maladaptation versus the risk of creating new invasive alien species or disrupting recipient communities (Hewitt et al., 2011). The scientific debate is strongly suggestive of competing values and ethics: “to protect endangered species or conserve native biota; to manage ecological system actively or leave nature wild and uncontrolled; and to preserve resources or managed them to promote their fitness under future conditions” (Camacho, 2010, p.171). This complex debate has been commented upon and comprehensively reviewed in the last several years (e.g., Schwartz, 2005; Aubin et al., 2011; Klenk and Larson, 2013).

Given the competing values and ethics structuring the debate on AM, our objective was to investigate the extent to which AM policy development represents institutional change

in relation to the established norms, ideas and practices of sustainable forest management in Canada.

This manuscript begins with a description of our theoretical lens: Vivien Schmidt's discursive institutionalism, from which we derive our analytical framework. Next we describe our qualitative discourse analysis methods. We then present and discuss our results.

2. Theory

2.1. Discursive Institutionalism

To better explain institutional change, many scholars have begun to focus on the role of the ideas, practices and discourses of actors across a wide spectrum of public policy domains, including forestry (Kleinschmit et al., 2009; Giessen, 2011). Indeed, there is a growing field of research that examines policy change in forestry using discourse analysis (Grainger and Malayang, 2006; Kleinschmit et al., 2009; Sadath and Krott., 2012; Storch and Winkel, 2013; deKoning et al., 2014). Discourses constitute institutions and they give meaning to and direct the implementation of institutionalized ideas and norms through policy. Once instituted, these ideas and norms can become structures to which policy actors may have to conform, and in some cases, they may become naturalized as the way these actors think, speak and do policy work (Schmidt, 2008, 2011). Ideas, practices and discourses, however, can be questioned, re-interpreted, contested and modified by policy actors, even if they seem ingrained or intuitive. According to Glynn and Howarth (2007), an individual living or working with(in) an institution never identifies completely with these ideational factors. Thus, policy actors may come to change institutions by changing the ideas that give them shape through policy (Schmidt, 2008). The way they do so is through discourse, which embodies a particular grammar, logic and rhetoric. These three communicative elements involve politics, to the extent that discursive choices set boundaries that divide what is considered appropriate and necessary (e.g., scientific evidence, values, norms, attitudes, policy options) from what is considered inappropriate and is disregarded (Feindt and Oels, 2005; Howarth, 2010).

To account for the power of ideas and discourse to change institutions, Vivien Schmidt (2008, 2011) has developed a theory of 'discursive institutionalism'. Discursive institutionalism examines both the meaning content and interactive/performative aspects of sharing ideas with others. To understand how policy work may lead to institutional change, Schmidt examines three levels of generality of public policy ideas: policies, programs and philosophies. In the context of forestry, the first level of ideas refers to specific policy tools and associated processes, plans and choices that allow for implementation and monitoring of technical and operational practices (e.g., standards for tree seed zones, transfers and stocking standards). The second level of institutional ideas refers to how policy problems are framed and defined. This level of ideas generally represents the synthesis of strategic goals and tends to be geared towards larger scale problems, which result in broader solutions than at the operational scale (Andersson and Eriksson, 2007). At the philosophical level, ideas are more abstract and refer to public sentiments and worldviews that bring together knowledge, values, and principles about how society should be organized. In forestry, the philosophical level of ideas represents

‘where one wants to go in the long term’; in contrast, the policy and program levels of ideas are the means to ‘get there from here’.

Furthermore, Schmidt (2008) distinguishes the cognitive and normative content of ideas, as well as their application in practice. Broadly speaking, the cognitive content of ideas refers to conceptual schemas such as scientific theories, while the normative content of ideas refers to values and norms of behavior. The cognitive and normative content of ideas can be communicated using several rhetorical devices, including narratives, myths, collective memories, and scenarios. As Schmidt explains (2008: 309):

Discourse may intersperse technical and scientific arguments with more generally accessible narratives that fit together the specialists’ arguments with accounts of events, emblematic cases, and even doomsday scenarios to compelling stories about the cause of current problems, what needs to be done to remedy them, and how they fit with the underlying values of the society.

Schmidt (2008) also makes a distinction between two different kinds of discourse, the coordinative discourse that is internal to the process of analyzing, developing, and implementing policy and the communicative discourse between policy makers and the public. In other words, the theory specifies both who is involved in a particular discourse and who is targeted by it. As explained by Schmidt (2008: 311), “Coordinative policy ideas may remain in closed debates out of public view, either because they might not be approved or because the issues are too technical to capture the sustained interest of the public”. Therefore, there can be discordance between the discourse internal to the process of policy development and the discourse used by decision-makers to present the policy to the general public.

Discursive institutionalism, as Schmidt (2008: 313) explains, provides an opportunity to examine the role of policy actors in making a compelling case for particular policy ideas, norms and values, and practices that may in turn restructure institutions:

Discourses succeed when speakers address their remarks to the right audiences (specialized or general publics) at the right times in the right ways. Their messages must be both convincing in cognitive terms (justifiable) and persuasive in normative terms (appropriate and/or legitimate). A successful discourse ‘gets it right’ in terms of a given ‘meaning context’ according to a given ‘logic of communication.’ This suggests not only that the ideas in the discourse must ‘make sense’ within a particular ideational setting but also that the discourse itself will be patterned in certain ways, following rules and expressing ideas that are socially constructed and historically transmitted.

Thus, discursive institutionalism is particularly germane to our objective of tracing the extent of institutional change through an examination of AM forest policy development in Canada.

2.2 Analytical Framework

Our analytical framework focuses on the discursive processes by which the idea of AM is constructed in a ‘coordinative’ policy sphere and deliberated in a ‘communicative’ political sphere. In our analysis, the coordinative discourse refers to policy developers’ and implementers’ ideas and norms, which is performed in their policy work.

Communicative discourse refers to how actors involved in policy work communicate policies to stakeholders, through various knowledge mobilization tools, which may

include formal consultative processes, educational initiatives, official announcements, training or research outputs. Following Schmidt (2008), we analyzed institutional change at three levels of ideas: policy, program and philosophy. In addition, we distinguished between the cognitive and normative content of ideas at each level and how the ideas are put into practice.

Moreover, tracing institutional change required assessing the presence and significance of change at each level of ideas. Although there is no hard and fast rule for conducting such an assessment, our analytical strategy was to differentiate ‘moderate’ from ‘major’ change. We consider ‘moderate’ change as consisting of new ideas being integrated within established ideas and practices. Namely, moderate change could be represented, at each of the three levels, respectively, by the tweaking of policy instruments; the layering of new issues and goals on existing policy programs; or, the reinterpreting of principles and values at the philosophical level of ideas. In contrast, we considered ‘major’ institutional change as consisting of a departure from established ideas—in terms of their cognitive and/or normative content and/or their associated practices. A major change at the policy level could consist of the development of alternative processes, plans and choices on the basis of consultation with new policy actors or stakeholders. At the program level we considered change to be major if a new policy frame oriented policy towards new issues requiring decision-making at different temporal and spatial scales than those it replaced. At the philosophical level of ideas, we considered change to be major if a new worldview seemed to be gaining ascendancy in guiding program and policy ideas (e.g., what should be the ‘natural’ ecological baselines that guide forest management practices).

We now turn to a description of the methods we used to understand how discursive processes in both the coordinative and communicative political spheres have influenced the development of AM policy.

3. Methods

3.1 Sample description

To trace institutional change in forest policy in Canada through a comparison of coordinative and communicative discourses on AM policy, we conducted interviews with 46 policy actors in government agencies or public organizations (e.g., research councils and universities) currently discussing the merits of or developing policy on AM. In this study we neither sought out nor analyzed the discourses of other actor groups that may have been or were consulted in AM policy development in Canada because we were not seeking to understand either the origins of the ideas, norms and values shaping AM policy development or potential disagreements between the views of stakeholders and actors involved in policy work. We focused our study on the perspectives of actors who did the work of AM policy analysis, development and implementation and who communicated AM policies to the public and stakeholders. Hence, our sample mainly consists of public servants.

Our purposive sampling approach began by selecting key government actors involved in the western larch AM policy development in BC. We were also aware that policy development on AM was happening across Canada with regards to changing tree seed standards (Pedlar et al., 2011) and thus snowball sampling was performed to identify policy actors engaged in conversations about and/or policy development on AM in other provinces in Canada, including Manitoba, Saskatchewan, Ontario and New Brunswick (Table 1). Our snowball sampling consisted of asking our BC interviewees to suggest other people, in particular their counterparts in other provincial Ministries, who may be involved in AM policy analysis, development and/or implementation. Thus, while our analysis concentrates on interviews with government actors in British Columbia, we also drew upon the interviews conducted with actors outside BC to determine the extent (or lack of) institutional change represented by AM policy development and implementation. Given our snowball sampling approach, we are fairly confident that our sample captures the general tone and outline of conversations on AM in government forest agencies in Canada.

Table 1. Sample description

Organization	Number of Interviewees
<i>British Columbia</i>	
Forests, Lands and Natural Resource Operations	11
BC Parks	1
Forest Genetics Council	1
Royal Museum	1
Ministry of Environment	2
University of British Columbia	1
<i>Ontario</i>	
Ministry of Natural Resources	13
Parks Ontario	1
<i>Saskatchewan</i>	
Forest Service	1
University of Saskatchewan	1
<i>Manitoba</i>	
Manitoba Conservation	1
<i>New Brunswick</i>	
Department of Natural Resources	2
<i>Federal Government</i>	
Canadian Forest Service	9
Parks Canada	1

3.2 Interview design

We interviewed each respondent about how he/she has been involved in conversations or policy development on AM within and outside his or her organization; to what extent has AM been controversial within his or her organization; how does the practice of AM compare to current practices in sustainable forest management and biodiversity

conservation; how has policy development on AM unfolded; in what ways is climate change being planned for in his or her organization; and, how is the idea of novel ecosystems (e.g., species assemblages that have no historical precedent) characterized and perceived? The interviews, conducted by phone by Nicole Klenk in November and December 2012, lasted from 30 to 90 minutes each. Interviews were recorded and transcribed. Due to the low number of interviewees in some government agencies and the need to protect the anonymity of respondents (as per our research ethics protocol), below we cite quotations by reference to the province of work of the interviewee, rather than his or her organizational affiliation, with the exception of interviewees working for the federal government.

3.3 Analysis

Our work is set within an interpretive research tradition in the social science and humanities that seeks to generate knowledge from immersion within a particular context (Gomm et al. 2000). We thus emphasize critical explanations that respect the self-interpretation of the policy actors interviewed, while not reducing explanations to their personal viewpoints (Glynos and Howarth, 2007). The interview transcripts were coded using our analytical framework; that is, in terms of whether the interviewee referred to ideas about AM within the policy analysis process (coordinative) or in the context of communication with the public and stakeholders (communicative), and whether the interviewee referred to policy ideas and practices at the level of policy, program or philosophy, including their cognitive and normative content. We use quotations from our interviewees extensively in the presentation of our results, below, to provide readers with the range of perspectives encountered and to allow the interviewees to ‘speak’ through our writing (Richardson, 1994).

Our analysis is mostly focused on the coordinative and communicative discourses associated with western larch AM policy development because it is the first and only AM policy targeting a specific tree species in Canada. Nevertheless, other provinces are changing seed transfer policies to enable the movement of trees further north or to higher altitudes than was previously the case, and the potential need for AM policy targeting specific trees is being discussed across Canada (Pedlar et al., 2011).

4. Results and Discussion

We divide this section into subsections on each of the three levels of policy ideas. In each section we present and discuss results that indicate the extent of institutional change with regards to the cognitive and normative content of ideas and/or their associated practices. The means by which we assessed the extent of institutional change (none, moderate change or major change) is explained in the analytical model section above. We summarize the results of our analysis on the extent of institutional change in Table 2, though it should be noted that whether or not, and the extent to which, institutional change is detected can best be understood through a comparison of the coordinative and communicative discourses of the actors who did AM policy work. Thus, in Table 2 we indicate when there is discordance between the coordinative and communicative

discourses by referring to the extent of institutional change *according* to a particular discourse. If there is no discordance between the discourses we simply state the extent of change detected.

Table 2. The extent of institutional change at three levels of AM policy ideas with reference to their cognitive and normative content and their associated practices.

	Policy	Program	Philosophy
Cognitive	New climate change directive from BC Climate Action Secretariat (Moderate change)	Competing scientific paradigms, ecology versus genetics (Major change according to the coordinative discourse)	The changing nature of ecological baselines (Major change)
Normative	Vulnerability and adaptability (Moderate change)	Future oriented rather than status quo (Major change according to the coordinative discourse)	Shift from a naturalistic ethics to a humanistic ethics (Major change)
Practices	New ‘climate-based’ stocking standards (Major change according to the coordinative discourse)	“Interim measure” and “conservative” approach (Moderate change according to the communicative discourse)	Design of future ecosystems Versus maintain ecosystems as they have been for the last 300 years (Major change)

4.1 Policy Level of Ideas

At the policy level, while we traced moderate change with regards to cognitive ideas, values and norms associated with a new climate change directive guiding forest management in BC, we detected major change at the level of practices involved in setting stocking standards. With reference to the former, there has not been a major change in policy ideas and norms, in part because although climate change adaptation represents a new direction for forest management in the province (Presscott and Weese, 2014), it is couched within traditional economic interests associated with forest productivity, as the following interviewee suggests:

In BC, foresters have to balance productivity and economics, and forest productivity with the values of society—and there are many different values people associate with forests.

When you talk to foresters, if it is about increasing productivity and helps survival, as long as it is done with good science, they would accept the idea of doing AM. (BC7)

Indeed, on June 3, 2010, Jim Snetsinger, the Chief Forester at the time, amended the Chief Forester's Standards for Seed Use. According to the official statement, the purpose of these amendments is “to expand the seed transfer limits of western larch to increase species diversity, and address the potential forest health and productivity impacts associated with a changing climate. Specifically, this amendment provides for the range

and population expansion of western larch beyond its contemporary range (historical and current climate envelope) in areas projected to be climatically suitable in the year 2030.” It is also a priority of the Tree Improvement Branch to advance climate-based seed transfer (Lee, 2010a). These amendments align with the BC Climate Action Secretariat's vision to "make adaptation apart of the BC Government's business, ensuring that climate change impacts are considered in planning and decision-making across government"—which represents a new climate change directive for BC (Lee, 2010a).

Hence, the new climate change policy imperative that exists in BC is coupled with economic drivers, in particular in terms of how to enhance forest productivity. In BC, forestry is a key driver of the economy and in 2011 it accounted for 53000 jobs and contributed \$8.5 billion to the provincial economy (about 5.4% of BC's gross domestic product, Prescott and Weese, 2014). This coupling is also reflected in the particular characterization of AM in forestry (Pedlar et al., 2012). Whereas AM was first proposed as a conservation measure for species at risk due to anticipated climate change impacts (Hewitt, et al., 2011), in forestry only species of economic importance are being considered for AM. All of our interviewees affirmed the economic rather than conservation motivations for conducting AM in forestry. While the official policy statement on western larch AM (communicative discourse) explicitly mentioned western larch AM's role in increasing forest biodiversity, “biodiversity” here refers to the protection of forest genetic resources, which we will return to below. The official policy goes on to state that western larch AM will address potential forest health issues expected to arise due to climate change and *mitigate the productivity impacts associated with a changing climate* (Lee, 2010a, emphasis added). Similarly to DeKoning and colleagues (2014) who studied the coupling of climate change and forest conservation across Europe, our analysis suggests that economic drivers were integrated within a new climate change discourse which allowed policy makers to “legitimize distinct interests already present before the climate change debate emerged” (DeKoning et al., 2014,129).

We next suggest that the normative content of the new climate change policy directive represents moderate institutional change. While the norms of vulnerability and adaptability are not new in forestry because forest management has to take into consideration the impacts of forest disturbances within relatively long planning horizons, these norms are now framed as part of a climate change adaptation policy discourse. As the following interviewee suggests, forest management in BC will have to adapt to climate change projections to mitigate negative impacts on forest productivity.

Temperatures are warming in BC, they are projected to warm on the coast at about the global average, in the southern interior at about twice the global average and parts of the north about three time the global average. If the global average increase to 1-2 degrees that means 2-6 degrees change in BC. An increase of 4 degrees for lodgepole pine means increased disease incidence, lower productivity, malformation, etc. We are not going to be able to grow trees in the same way we have in the past, we cannot ignore climate change because of what temperature increase will do to the form and productivity of the trees.
(BC10)

Such shifts in discourse aligning new social and ecological objectives with traditional economic drivers in forestry (e.g., sustainable development, biodiversity conservation,

and climate change) have been observed at other national (Winkel et al., 2011; Somorin et al., 2012) and international levels (Arts and Buizer, 2009).

With regards to the extent to which AM represents change in terms of practice, our analysis suggests that it depends on the discourse. The communicative discourse on western larch seed transfer guidelines seems to reflect only moderate change. That is, the flexibility already present in the seed transfer policy in BC seems to have facilitated the development of policy for AM of western larch. Indeed, the communicative discourses on AM in the province suggests that there is nothing new in this practice, it is simply an extension of what has always been done in forest management in the province. The following interviewee expresses the care taken to communicate with the public how AM represents a very moderate change to current practice.

From the number of talks I've done in communities of foresters and agriculturalists, AM has been well received. People are accepting the idea of movement of populations around the province. I speak less about moving species around the range, I always make sure to tell people I am speaking about moving populations around. It is more acceptable to talk about moving populations than moving species beyond their range, the latter would be more controversial. (BC7)

This quotation suggests that the practice of moving a population of species beyond its seed transfer guidelines represents the layering of a new idea on an established practice (Béland, 2007).

However, the coordinative discourse on the western larch stocking standards suggests otherwise. Indeed, to incentivize licensees to plant western larch in areas where they have not planted it before, it was necessary to 'count' western larch plantations within licensees' regeneration requirements by changing the stocking standards. All timber-harvesting operations on public lands in BC must comply with the *Forest and Range Practices Act*, which sets out requirements for silvicultural stocking standards. Stocking standards refer to licensees' requirements to plant species that are deemed ecologically suitable and that are expected to maintain or enhance an economically valuable supply of commercial timber consistent with timber supply models. However, changing stocking standards to enable AM requires a shift in perspective from assessing the ecological fitness of a species in the current zoning system to assessing its modeled future distribution given climate change projections in BC (Snetsinger, 2010a). As explained by one respondent:

While we defined seed zones for western larch beyond its species range, in order to get it approved in forest stewardship plans, they needed to address stocking standards, which is where the ecological suitability came in. We did not have climate-based scientific analysis on ecological suitability, so there policy folks working in the ecology side of things had to develop policy guidance based on context, not data driven. It is a bit of gap, the ecological suitability piece is not as advanced in terms of climate modeling. (BC1)

While the practice of western larch AM has been presented to the public as business as usual in the context of seed transfer guidelines, to provide an incentive for licenses to actually plant western larch outside its current ecological distribution, stocking standards had to be changed. Yet, the latter change represented a challenge to policy analysts due to the shift in perspective from the ecological fitness of western larch in biogeoclimatic zones to its projected climate change fitness in areas outside its current distribution

(Rehfeld and Jaquish, 2010). Hence, the coordinative discourse on changing the stocking standards suggests that the AM of western larch may represent major change in terms of established practices.

4.2 Program Level of Ideas

Two-thirds of British Columbia's surface area of 95 million hectares is forested (136 million acres) and 95% of this forestland is publicly owned and administered by the BC Ministry of Forests, Lands and Natural Resource Operations. In addition, the Chief Forester is responsible for determining allowable annual cut, leading research and development in tree improvement, regulating tree seed use, and ensuring that management practices evolve to reflect climate change (Snetsinger, 2010a). Western larch policy development was based on forest genetic resource management (Rehfeldt and Jaquish, 2013; Snetsinger, 2010a), particularly in the BC Tree Improvement Branch (Lee, 2010a). As one of the interviewees stressed, the coordinative discourse on western larch AM policy explicitly sought to couch AM within a genetics perspective:

I am more and more reminding people about this in developing climate policy, that is to think of a framework for managing adaptation at the genetic level. When we first developed the concept of genetic resource management, we went through a challenging dialogue process involving stakeholders and technical people. We moved from tree improvement to genetic resource management. (BC1)

Forest geneticists' characterization of forests, however, does not necessarily overlap perfectly with ecosystem-based forest management, the dominant approach in Canada and the Pacific Northwest since the mid-1990s (Winkel, 2014).

On a cognitive level, from a genetics perspective, different components of forests such as genes, individual trees, and evolutionary time are given a more prominent place than in an ecological perspective, which emphasizes community composition and species interactions. This new theoretical perspective constructs the identity of forests in a particular way, which in turn, determines to a great extent how forests are valued and what forest management practices are deemed appropriate. One of our respondents provided the following expression of this new perspective, which figured prominently in the western larch coordinative discourse:

The concept of ecosystem may not be suitable. Species behave independently, although there are interspecific interactions, above and below ground, so yes there are assemblages, but species respond to climate change separately depending on their genetics. So new assemblage will happen, but how to distinguish different shades of grey? In our business we are not worried about ecosystems but about individual species and their populations. (BC18)

As the above quotation suggests, a genetics perspective on forest management in the context of climate change differs from an ecosystem-based approach. For geneticists, to adapt forests to climate change requires focusing on: "species' intrinsic abilities to respond to climate change, life history characteristics, adaptive strategies, population genetic structure, and patterns of genetic variation" (Rehfeldt and Jaquish, 2010, 284). Hence, the presence of competing scientific framings of western larch AM represents a critical piece of evidence in our argument, because, as Panizza and Miorelli (2013: 305) have put it:

Discourse is not a neutral medium of signs and symbols that simply connects ideas and objects... Discursive practices enable actors to experience and think about the world in certain

ways. In doing so, discourses crystallize power struggles and set the parameters of what is *sayable* and indeed *thinkable* in a given social order.

Moreover, forest geneticists typically adopt a much longer time scale for understanding species assemblages and in particular, the adaptive capacity of species. Evolutionary genetics reaches back thousands of years to interpret the long history of species movements associated in part with past climate change. The following interviewee explains the time scales appropriate to a genetics perspective on forest management:

I say always go to the fossil record to know what is appropriate to do. At least to begin with but things might change so fast that even that might not be the best baseline, maybe we should look at a million years ago. In BC we are still responding in part to glaciation in some places, in some parts to the cooling in the last 6000 years, the time scales are very different. (BC5)

Clearly, a genetics characterization of forests looks back to the distant past for guidance in future ‘climate change fitness of species’. This represents a major conceptual shift, which significantly affects the temporal and spatial scales on which forest management planning occurs.

This shift can be characterized, furthermore, by the deployment of new normative goals for forest management: rather than trying to recreate current forest composition and functions, the values and norms guiding forest management from a genetics perspective seek to accelerate forest transition to the future, to a ‘climate resilient’ state. This normative shift has real material consequences, such as enabling the movement of western larch 1000 km north of its current distribution, sidestepping the issue of its ecological appropriateness in the recipient ecological community, because from a ‘climate fitness’ perspective, western larch may eventually migrate to northern BC (Snetsinger, 2010a; Rehfeld and Jacquish, 2010). Thus given the genetical frame structuring the AM policy coordinative discourse, we argue that there is a major shift in the cognitive and normative content of ideas at the program level.

However, when we analyzed the communicative discourse on western larch AM policy, we found that concerted efforts were taken by policy developers to downplay the significance of this program change in their communication to the public. To begin, educational and training outreach activities stressed the low risk associated with population range expansion, as the following interviewee explains:

We are very open and inclusive in talking about AM. I talk about the risk of action and inaction and more importantly the difference between the various forms of AM. We are very clear that we are not testing or interested in exotic translocations. (BC15)

Moreover, after the western larch AM policy was drafted, public consultations were held for three weeks and public concerns about the risks involved in AM were alleviated by the official qualification of the measure as a “conservative approach” because the deployment of western larch AM only allows 10% of plantations to be western larch in new seed zones. Additionally, by characterizing this new western larch seed transfer practice as “interim”, communicative discourse seems to imply a moderate change in practices that seek to address anticipated climate change to impacts to forest health, biodiversity and forest productivity (Lee, 2010a).

Similar to studies conducted in Germany, the Congo and the Pacific Northwest of the U.S.A (Winkel et al., 2011; Somorin et al., 2012; Winkel, 2014; DeKoning et al., 2014), we were able to trace discordant discourses that shed light on why some ideas and norms are successful and others fail in adapting forest policy to anticipated climate change impacts. Although the moderate change we detected with regards to ideas and norms at the policy level could simply be reduced to symbolic change (Sadath and Krott, 2012), we were able to trace major change in practices in terms of setting stocking standards and at the program level, with regards to a new genetics framing of forest policy requiring forest management planning at different time and spatial scales than those it replaced.

4.3 Philosophical Level of Ideas

At the level of philosophical ideas, we detected a major change in the cognitive and normative content of ideas that relate to societal values and how the human/nature relationship is conceived within coordinative discourses on AM across Canada. The significance of this shift in philosophy is closely tied to the ascendancy of forest genetics in framing climate change adaptation policy in forestry in BC, as well as more generally across Canada (Pedlar et al., 2011). Up to now, an ecological characterization of forests has been embodied in the dominant approach to forest management in Canada, which is to emulate the ‘ecological range of variation’ of forest ecosystems (Klenk et al., 2009). In BC, the ecological range of variation no longer seems to have a stronghold in guiding forest policy:

In the Future Forest Ecosystems Initiative we considered what resilience meant. We decided earlier on in 2006, in a very inclusive conversation, that we can’t prevent all disturbances caused by climate change, all we could do is to build resilient ecosystems. The touchstone was forest resilience. In the literature, the definition of resilience is the ability to absorb shock and return to original conditions. But that is not what we are looking for. Purists insisted on range of natural variation as being what we should have, conveniently ignoring climate change and the fact that trees might not adapt fast enough without our help. Only relying on range of natural variation as in 1900 would not allow us to adapt. So we use the term but we don’t mean trying to maintain the current range of natural variation. (BC10)

To contextualize this quotation, consider that the Future Forest Ecosystem Initiative (FFESC) was launched by the Chief Forester, Jim Snetsinger, in 2006 in response to increasing certainty that climate change is affecting BC forests. The FFESC oversaw a five-year program (2008-2012) of climate change adaptation research to support the Ministry’s adaptation of forest policies to the anticipated effects of climate change (Presscott and Weese, 2014). As the above quotation suggests, from the start of this 5 year research mobilization and science-policy dialogue, the range of ecological variation was no longer deemed useful or appropriate to guide forest management in BC.

From the perspective of evolutionary genetics, there are no forest ecosystem conditions that clearly stand out as an ecological baseline to which management can be scientifically anchored—as opposed to the range of ecological variation of forest conditions spanning the last three centuries used in natural disturbance forest management. As some of the interviewees suggested, assessing what is a healthy forest ecosystem or what is an

appropriate ecological baseline in the context of climate change is akin to assessing a moving target:

So the species that were here have changed since glaciation. Numerous times there have been expansions and movement of species. Today's range of tree species is an artifact of time and climate, so natural range is only a point in time. Mother Nature has helped keep the distribution of species in line with climate, and will continue to do so. (BC10)

Similarly to Winkel's (2014) results, anticipated climate change impacts appeared to be a game changer for determining what is an appropriate ecological baseline for forest management in BC.

With reference to change in the normative content of philosophical ideas, we turn now to the pro-active approach to climate change adaptation that is embodied in AM, which speaks to a different (humanistic) land ethic from the 'stand back and let nature take its course' (naturalistic) land ethic associated with emulating natural disturbances (Klenk, 2009; Aubin et al., 2011). As one interviewee in Ontario put it: "The forestry professional comes to issues of ecosystems in a humanistic way. AM is a natural extension of the belief that humans can control nature." (ON13) This confidence is echoed in the words of a BC interviewee: "In forestry we know what we are doing, we've got good data, and while we cannot model everything we also know that doing nothing is also a risk. It is our role to make these tough calls." (BC18) Such a pro-active, humanistic value system is cause for concern for some interviewees across the country. The following three quotes report some philosophical topics of conversations that were discussed as part of AM policy analysis (i.e., the coordinative discourse) in BC, Ontario and the Federal government.

I really think it is not the idea itself, but the thinking behind the idea, that scientists know all the answers, that we could actually predict where migration will happen with climate change. It is a bit of hubris on the science part. I've been interested for a long time on this issue, we always think we know the answer, but things are far more complex than we expect.(ON7)

The idea of AM could be dangerous in its application. I've heard it said: "In Canada we don't have enough plantations and we should be cutting forests in zones where they have not been cut to put into place plantations of species that will be adapted to a future climate." This idea is scary; it goes pretty far pretty quickly. I think we should ask ourselves, what is our objective? What are the alternatives to AM to adapt forests to climate change? (CFS1)

Philosophical discussions in the stocking standard committee are stalling. Biogeoclimatic zones will change with climate change, so they [policy actors involved in changing the stocking standard] are projecting how they are moving and each zone has species assemblages that have given shape to stocking standards. Moving species into zones where they were not adapted caused problems [in the past], so they [policy analysts] are cautious about these changes. (BC13)

While our results suggest that the underlying philosophy of AM was debated in coordinative discourses on AM in forestry across Canada, this philosophical debate was not communicated to the public, but rather remains within the research community (Aubin et al., 2011).

Whereas both policy and program ideas tend to be discussed and debated on a regular basis, philosophical ideas are rarely contested except in times of crisis (Schmidt, 2008). Indeed, according to the following interviewee, recent forest health crises seemed to mobilize BC politicians, stakeholders and scientists to come up with solutions to adapt BC forests to projected climate change impacts.

In 2002-3 we had a new Chief Forester and the very first thing he did is to convene a meeting in Prince George. There was 100 people: half were scientists and half were community groups and non-profits. The Minister, Deputy Minister, and the Chief Forester recognized climate change, increased fire disturbance, mountain pine beetle, significant fungal attacks, and cedar dieback disease—lots of problems in the forest were recognized. There was an awareness from foresters and the public, and everyone was pushing for finding solutions. We said we can do something, such as change seed transfer system based on climate rather than geography, diversify species in stocking standards, and we proposed AM. (BC15)

Similar to the case of UK flooding crises, where pre-crisis discourses appeared to set the stage for the unfolding climate change adaptation responses (Penning-Rowsell et al., 2006), pre-crisis coordinative discourses of forest geneticists were ‘signals’ of the direction policy ideas would take with regards to climate change adaptation in forestry in BC after the mountain pine beetle crisis. It is perhaps due to this crisis that our analysis suggests, contrary to Winkel’s (2014) recent analysis of the policy deadlock in the Pacific Northwest of the U.S.A., that *major* rather than *gradual* shifts in forest-related discourses were facilitated by social, political and economic events.

To sum up, our analysis suggests that policy analysts, forest geneticists and policy implementers in the BC Tree Improvement Branch characterized forests so as to *highlight and diffuse* an *evolutionary theory* of forest ecosystems that is tied to a new set of norms and values associated with a humanistic philosophy that are highly controversial in the conservation community—yet which, in turn, are signals of major institutional change in forest policy in BC. In line with Storch and Winkel’s (2013) results, scientific models of western larch future distributions were used to legitimize the new temporal and spatial scales within which western larch AM policy is enacted (Rehfeld and Jacquish, 2010; Lee, 2010b; Snetsinger, 2010b). If a genetics framing continues to gain ascendancy in forest policy across Canada, as other studies have observed (Klenk, 2008), a similar shift in the philosophical underpinnings of forest policy in Canada may be expected. Such a philosophical shift oriented towards ecosystem-design and pro-active forest management practices may legitimize, perhaps even encourage, the introduction of more productive non-native species to Canada in the long run.

6. Conclusions

Despite the (perception of) risks involved, BC has developed an assisted range expansion policy for western larch enabling its movement at least 1000 km north of its current range. Our paper investigated the extent to which AM policy development represents institutional change in relation to the established norms, ideas and practices of sustainable forest management in Canada. Through the lens of Vivien Schmidt’s theory of discursive institutionalism, our analysis suggests that the discourse internal to the western larch AM policy analysis reflects major institutional change through the coupling of a new scientific paradigm with new norms and values on long-standing economic interests.

Specifically, the growing importance of genetic conservation in forestry played a central role in the development of the western larch policy and with this new paradigm came different models of nature and different perceptions of the role of humans in nature that tend to support the AM of western larch, especially given recent disastrous forest insect outbreaks in BC. However, discourses aimed at actors outside the policy development process suggest that the western larch policy does not represent a major departure from the values, norms and practices already in place in forestry in BC. Our results suggest that the deployment of the first AM policy in Canada has successfully avoided the philosophical debates on AM in the conservation scientific community by changing the scientific discourse associated with best forest management practices (i.e., from an ecological point of view to a genetics point of view) and this discursive shift may signal what we might expect in future forest adaptation policy development in Canada. Indeed, we hypothesize that this shift in discourse will legitimize the introduction of more productive non-native species to Canada as a climate change adaptation strategy for the forest sector in the long run.

From a theoretical perspective, distinguishing between the coordinative and communicative discourses on AM policy allowed us to detect major changes forest policies, programs and philosophy guiding forest management in BC. Had we only examined the official communicative discourse on western larch AM policy we would not have detected any major institutional change with regards to the cognitive and normative content of ideas and their associated practices at different levels of policy ideas. But by examining the discordance between the coordinative and communicative discourses across the policy and program levels of ideas, we were able to trace major change in terms of setting stocking standards and with regards to a new genetics framing of forest policy requiring forest management planning at different temporal and spatial scales than those it replaced. But it was at the philosophical level of ideas that the discordance between the coordinative and the communicative discourses on AM policy was most revealing. What our analysis suggest is that the AM coordinative discourse is in the midst of a continued philosophical debate on the (appropriateness of) ideas, values and ethics embodied in AM. Perhaps it is time to take this debate to the public sphere, since it seems poised to shape the future forests of Canada.

7. References

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