Community forest organisations and adaptation to climate change in British Columbia

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Abstract

The effects of climate change in many regions are expected to be significant, and likely to have a detrimental effect on the health of forests and the communities that often depend on those forests. At the same time climate change presents a challenge as it requires changes in both forest management, and the institutions and policies developed that govern forest management. In this paper, we report on a study assessing how Community Forests Organizations (CFOs) in British Columbia (BC) which were developed to manage forests according to the needs and desires of local communities and First Nations, are approaching climate change and whether or not they are responding to, or preparing for, its impacts. There are practical steps that CFOs can take to improve their ability to cope with future conditions such as planting a wider variety of species, practicing different silvicultural techniques and increasing monitoring and observation of the forest. This paper gives an overview of what current capabilities exist in CFOs and suggests potential areas for targeted development.

Introduction

The predicted impacts of climate change are becoming a reality for forest managers in BC. There are steps that those managers could take which may reduce the negative impacts of climate change in the future, however those steps need to be taken soon if they are to offer any protection. Community Forest Organisations (CFOs) usually have area based tenures which give people an opportunity to manage some of their neighbouring forest and distribute the benefits locally. If CFOs begin to implement adaptations to climate change soon, they may avoid some impacts in their forests and organisations and continue to provide existing benefits to communities. This article describes a study that investigated CFO's thoughts and actions about climate change in BC and gives us some insights into what resources may enable the organisations' adaptation to changing circumstances.

The impacts of climate change on forests in British Columbia

Canada's forests are already impacted by climate change, with increases in the large scale disturbance patterns of drought, insect attack, disease and fire (Williamson et al. 2009; Daniels et al. 2011). These increases in disturbance are likely to persist, putting pressure on local communities by affecting timber quality and production, watersheds and water availability, and increasing risk to health from smoke and fire. The impact of the mountain pine beetle epidemic has been partially caused by climate change, (Carroll et al. 2006, Cudmore et al. 2010, Woods et al. 2010), and gives us an indication of some of the impacts which forest dependent communities will need to contend with in the future. Specifically forests in British Columbia can expect to see increased biotic damage and disease, as well as an increased frequency and intensity of droughts in the southern interior, species migration, and loss of habitat in high-elevation forests. How forest managers anticipate and respond to these changes will affect the future of forestry in BC and have significant impact on rural forest dependent communities (Williamson et al. 2009). Whether forest managers adapt or not, the only certainty is that the future landscape of British Columbia will differ significantly from its current state (Hamann and

Wang 2006).

Community forests and adaptation to climate change

CFOs are of particular interest in terms of assessing how communities can best address the impacts of climate change because of their direct relationship with the forest. As the climate in BC is changing and community forests are, or will be, strongly affected by these changes, how they plan for and respond to change could have a significant influence upon whether they avoid or reduce the negative impacts of climate change on their organisations and communities (Ogden & Innes 2009). Top-down, rigid and centralized processes have been shown to be limited in their ability to deal with the impacts of local environmental change, and there are suggestions that local participatory governance structures such as community forests may be more effective in building resilience in face of stressors such as climate change (Ostrom et al. 1999, Brondizio et al. 2009, Eakin et al. 2011). Run by voluntary boards for the benefit of the whole community, CFOs could play a lead role in helping forest dependent communities in BC adapt to climate change by improving the adoption of adaptation strategies (Ogden & Innes 2009, Chapin et al. 2010). However, research also shows that communities and organizations vary widely in their ability to adapt to changing conditions, and that community forests are far from a panacea (Bradshaw 2003; Reed & McIlveen 2006; Bullock & Hanna 2007, Bullock et al. 2009).

Adaptations

Given the difficulties in producing accurate predictions of future climate and its impact upon forests in BC, it is hard to create robust prescription for adaptation. However, there are some potential adaptations that could be made; while some are in areas of research and technology, at the policy level, or require landscape scale co-ordination, others are adaptations that could be made by community forest managers. For example in the area of operations, managers may need to be prepared to increase the amount of salvage logging they are carrying out in the future and expect a reduced winter harvest due to difficulties in accessing trees in non-freezing conditions (Williamson et al. 2010).

There is now enough evidence of the probability of increasing fire risk to develop increasingly 'fire-smart' landscapes and communities (Williamson et al. 2010). Managers should expect to see an increasingly variable timber supply and begin to include changing climate variables in their growth and yield models and long term timber supply analysis. They could also be adopting risk assessment and adaptive management principles into their planning and day to day management decisions and including climate change considerations when planning, constructing, or replacing infrastructure (Williamson et al. 2010).

In terms of research, managers could expand their ecological monitoring and pathogen surveillance (Papadopol 2000), and at the stand level, managers can employ a variety of techniques depending on their particular location and expected impacts. For example, CFOs could use thinning to reduce moisture stress in trees and increase the growth of residual trees. They could also shorten rotations and reduce regeneration delays which can maintain or re-establish the CO_2 sequestration capacity of the land as well as reducing erosion where it is a problem (Papadopol 2000). In addition, organisations could develop and maintain a mosaic of species and age classes to try to spread the risk associated with dependency on only one or two commercial species (Cudmore et al. 2010), or experiment with planting alternative genotypes or new species in anticipation of future climate (Papadopol 2000, Aitken et al. 2008).

Challenges Facing Community Forests

Community forests in BC are charged with a myriad of responsibilities, amongst them creating employment, the development of value added products and non-timber forest products; conflict mitigation and resolution over ecosystem services, environmental stewardship, and valuable environmental resources; the sharing of First Nations traditional territories and areas under negotiation as part of treaty negotiations; as well as increasing community empowerment, implementing ecosystem based forestry, and the restoration of community links with the environment (Bullock et al. 2009; Berkes 2010). This wide range of expectations has been criticised as unrealistic and

undeliverable (Bradshaw 2003), indeed, community forests are expected to provide for many different and competing needs, including those of government, industry, community and First Nations stakeholders (Bullock et al. 2009). Community forests also actively attempt the incorporation of different worldviews and different types of knowledge into their management of forest ecosystems, something which to a great extent is not expected from their competitors in the forest industry. Adaptation to climate change is yet another demand upon the resources of these small organisations which represent only a very small part of BC's forest industry as a whole.

Method

The project studied members of the British Columbia Community Forest Association (BCCFA) and was conducted in collaboration with the BCCFA using a survey approach to detail organizations' awareness of and response to climate change, as well as any adaptation techniques they have embarked upon. The survey sample included all organisations that were members of the BCCFA and had an active tenure agreement with the BC Ministry of Forests. Sixteen members of the BCCFA do not have a tenure agreement and are in the early stages of forming a community forest organisation, meaning they are not yet actively managing a forest. Eight holders of Community Forest Agreement holders in BC are not members of the BCCFA and were not approached in this research (see Figure 1). The findings of the study are not generalizable beyond the membership of the BCCFA and it is worth noting that further research may be beneficial in this area. The sample frame was obtained through the BCCFA, with contact telephone numbers accessed through a record of their membership database (as it stood in November 2011). This gave a population of 38 organisations, all of which were included in the sample.

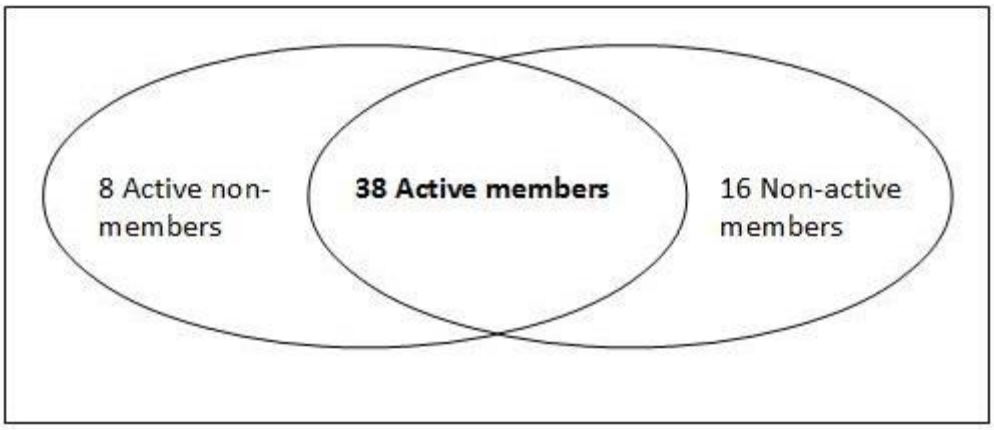

Figure 1 CFOs in BC: 62 organisations; 46 have active operations and 54 are members of the BCCFA, 38 are members with active operations..

Results

At the outset, there was little existing research to suggest whether or not CFOs in BC would be familiar with the concept of adaptation. All 38 of the organisations included in the sample responded to the survey, giving us a 100% response rate, and our results established that the concept of adaptation was both salient and relevant to many of the organisations. Indeed, just under half (45%) were already researching adaptation (Stage 1 Adaptors). Just under a third (32%) were already integrating adaptation techniques into their work (Stage 2 Adaptors). Of the remaining organisations some were not adapting (Non adaptors), and a small minority were unsure. Figure 2 illustrates the adaptation progress of all of the organisations in the sample.

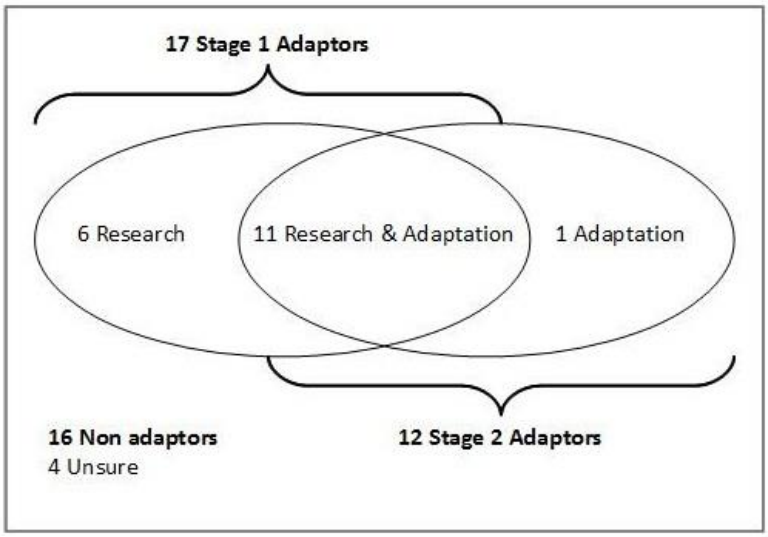

Figure 2 Adaptation progress among the 38 CFOs

In terms of the impacts of climate change that CFOs were experiencing or anticipating, we found that forest pathogens were the most commonly experienced or expected (82% of CFOs overall), extreme events were also frequently observed or expected, and species changes and warmer winters less so (Table 1 shows these results in more detail).

Table 1 Non-Adaptors, Stage 1 Adaptors and Stage 2 Adaptors: observation and expectation of climate change

Non-Adaptors (16 CFOs)	**Stage 1 Adaptors (17 CFOs)**	**Stage 2 Adaptors (12 CFOs)**
11 (69%) have observed or expect to observe an increase in extreme events.	13 (76.5%) have observed or expect to observe an increase in extreme events	10 (83%) have observed or expect to observe extreme events
12 (74%) have observed or expect to observe an increase in pathogens in the forest.	16 (94%) have observed or expect to observe an increase in pathogens in the forest.	11 (92%) have observed or expect to observe an increase in pathogens in the forest.
3 (18%) have observed or	11 (65%) have observed or	8 (67%) have observed or

expect to observe warmer winters	expect to observe warmer winters	expect to observe warmer winters
9 (56%) have *not* observed and do not expect to observe warmer winters	3 (18%) have *not* observed and do not expect to observe warmer winters	2 (17%) have *not* observed and do not expect to observe warmer winters
6 (40%) have observed or expect to observe species change	12 (71%) have observed or expect to observe species change	8 (67%) have observed or expect to observe species change

Attitude towards climate change was substantially different among Non-Adaptors and Adaptors, with the Adaptors more concerned about global climate change, and more likely to have observed or expected to observe the impacts of climate change (based on Table 2).

Table 2 Non-Adaptors, Stage 1 Adaptors and Stage 2 Adaptors: attitude to climate change

Non-Adaptors (16 CFOs)	**Stage 1 Adaptors (17 CFOs)**	**Stage 2 Adaptors (12 CFOs)**
7 (44%) are concerned about global climate change	14 (82%) are concerned about global climate change	11 (92%) concerned about global climate change
3 (19%) not concerned about global climate change	1 (6%) not concerned about global climate change	1 (8%) not concerned about global climate change
7 (44%) are concerned about the impacts of climate change on their CFO.	12 (73%) are concerned about the impacts of climate change on their CFO.	8 (67%) are concerned about the impacts of climate change on their CFO

2 (12.5%) have an understanding of likely climate change impacts	12 (71%) have an understanding of likely climate change impacts	9 (75%) have an understanding of likely climate change impacts
10 (62.5%) have *no* understanding of likely climate change impacts	2 (12%) have *no* understanding of likely climate change impacts	2 (17%) has *no* understanding of likely climate change impacts
1 (6%) has an understanding of risk reduction	12 (71%) have an understanding of risk reduction	10 (83%) have an understanding of risk reduction
13 (81%) have no understanding of risk reduction	4 (23.5%) have no understanding of risk reduction	2 (17%) have no understanding of risk reduction

Some of the attitudes about climate change amongst respondents are illustrated by the comments below:

> "*The older group (on our board) haven't bought into climate change; it's not a high concern, although we don't plant cedar anymore because it dries out."* (CFO 34: Non-Adaptor)

> "*Climate change is too uncertain; it's based on opinions, not knowledge."* (CFO 30: Non-Adaptor)

> "*Climate change all boils down to what side you're on. We haven't talked about climate change*." (CFO 26: Non-Adaptor)

> "*Climate change is something way off on the horizon and worrying about it is premature. It is not driving decision-making*." (CFO 23: Stage 2 Adaptor)

> "*In general people don't connect Mountain Pine Beetle with climate change, the board are not thinking about it, though the area based tenure is a huge incentive*

to plant for the future." (CFO 5: Stage 1 Adaptor)

40% of CFOs had an understanding of the likely impacts of climate change on their forest and 37% had an understanding of risk reduction. While this is encouraging, it indicates a significant gap in the understanding of the majority of organisations and a lack of appreciation of the probable impacts and potential adaptations that could be made to minimise vulnerability to climate change. Targeting this knowledge requirement may enable CFOs to better adapt, in fact there were suggestions directly from respondents about the role that education and training may be able to play in increasing the adaptability of CFOs (see below). Clear recommendations for actions that could spread the risk or minimise the impacts of climate change are essential, with 63% of organisations not knowing what to do.

"*A high education among the population here means that people are aware of climate change."* (CFO 1: Stage 1 Adaptor)

"*We have a heightened knowledge and interest in climate change because of a conference here put on by a graduate student from Simon Fraser University*." (CFO 12: Stage 1 Adaptor)

"*A lack of cold snaps has increased the spread of the Mountain Pine Beetle - 70% of our pine is dead. We're thinking about climate change, but we have a lack of understanding about what to do about it*." (CFO 8: Non-Adaptor)

Limitations to adaptation

It was common for CFOs to defer to government expertise, especially if lacking the time or money to invest in their own research, but it was also common for CFOs to complain about standards that government had imposed:

"*With our stocking standards we default to the government standards, we expect them to inform us on climate change, as they have been researching it. The major impacts are planting the wrong stuff - but really it's up to the Province, they are modelling it. We only have an AAC of 20,000M^3. We can't afford scientists - start-up costs are expensive*." (CFO 31: Non-Adaptor)

"*The Ministry of Forests needs to loosen up the preferred species*."
(CFO 17: Non-Adaptor)

"*We're limited by silvicultural rules, we can't be as experimental as we'd like."*
(CFO 19: Non-Adaptor)

"*There's no way to adapt, provincial stocking standards mean it's not possible to change."*
(CFO 34: Non-Adaptor)

"*We're constrained by prescribed species*." (CFO 35: Stage 1 Adaptor)

"Based on how the area has been hit now [by Mountain Pine Beetle], it is hard to plan for the future, BC Timber Sales [a government department which sets cost and price benchmarks for timber harvested from public land in British Columbia] have hampered progress, and law changes have not helped, overall the laws are not helpful." (CFO 38: Non-Adaptor)

Discussion and Conclusions

Previous to beginning this study it was unclear whether any organisations would be adapting to climate change, given the complexity and challenges there are in making changes. Having established that a significant minority of CFOs are adapting, it is worthwhile improving understanding of how their experience can inform further adaptation, not only among CFOs but in the broader system of forest management.

In terms of policy development, balancing demands for support and guidance from government with autonomy for communities to make their own decisions is an essential and very difficult task. Previous research suggests that community organisations involved in natural resources management have often been hampered by fractious relationships with government; it seems that successful community management is more likely to occur when local decision-making processes are free from government intervention and include a wide range and large number of participants (Bullock and Hanna 2007). There is still a salient role for government and institutional involvement in adaptation though, and there was distinct approval from CFOs about projects like the Pacific Institute for Climate Solutions and the Government of Canada's Regional Adaptive Collaborative, which suggests that there are already government and research initiatives which are on the right track and can be built upon or extended to support CFOs and improve local capacity for climate change adaptation.

Research carried out with Swedish foresters suggests that information about the practical tasks of risk reduction and adaptation may be more important than information on the possible impacts of climate change (Blennow and Pearson 2008). Although needs may be different in BC and further research into what forest managers and communities want could be beneficial to confirm that any future programs are addressing the needs of CFOs. In the survey more adaptive CFOs reported positive training experiences, with staff and board members attending workshops and seminars on climate change provided by government bodies, universities or other research initiatives as well as working alongside external organisations to improve their ability to adapt, this research indicates that continuing and widening these initiatives could increase the adaptive capacity of CFOs.

As well as access to education and training, the size of the tenures was an issue, some respondents pointed out that community forests are so small that their decisions have comparatively little impact on the landscape, so whether or not they begin to try to

adapt to climate change has little real implication for forests as a whole. Some suggested larger community forests as a solution to this, or the development of partnerships between CFOs and government and industry to collaborate on adaptation; some CFOs already had experience of creating partnerships with industry for research.

> "*We have been involved in a study with [a large logging company] looking into under planting with Douglas fir, researching erosion control and increasing evapotranspiration on an old Mountain Pine Beetle site."* (CFO 36)

> "When talking about scale of impacts the community forest is 'small potatoes', they only control 5% of the surrounding area." (CFO 24)

Finally, the willingness of some CFOs to explore and undertake adaptive actions shows the innovation that will be necessary in making more broad scale changes to our forest management system. Not only should their experiences be evaluated and communicated more broadly, for the wider knowledge they can generate, but it will also be interesting to explore how this innovation may be transmitted across organizations as well. Rogers' (1983) theory of the diffusion of innovation uses a diffusion curve (which resembles a normal curve) to explain how innovations (in this case adaptation to climate change) are adopted within a population. He suggested that this is done first by a small (2.5%) group of the population termed the Innovators, secondly by a larger proportion (13.5%) termed the Early Adopters, and progressively an Early Majority (34%), a Late Majority (34%) and eventually Laggards (16%). Rogers' extensive research in this area suggested descriptions for each group: for example Innovators are defined as being willing to take risks, having good access to finances, being very social and having access to scientific sources, and well as interaction with other innovators (Rogers 1962). This conceptualisation of the adoption of innovation could help better understand not only how different ideas and practices can be shared but how organizations more generally can start addressing climate change.

Conclusion

Being mindful of the variety of values, governance arrangements and level of understanding seen in these organisations, community forest organisations are certainly well placed to promote local climate change adaptation. Community forests in BC are some of the most advanced community governed forest management arrangements in the world and have built up a level of expertise which make them well placed to deliver on local climate change adaptation. Building on CFOs' initial adaptation efforts in order to develop success local preparation for climate change requires the evolution of a supportive policy environment. Community forests would need to have the right balance of autonomy and support from government and other institutions, as well as targeted training, funding and equipment to match the size and breadth of the task.

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