Are human values and community participation key to climate adaptation? The case of community forest organisations in British Columbia

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Abstract
This study develops a multidisciplinary framework composed of a range of determinants of adaptive capacity to climate change found in economic, sociological, political, geographical and psychological literature. The framework is then used to carry out a survey of community managed forest organisations to measure their adaptive capacity and establish the characteristics that enable their adaptation. The research finds that adaptive organisations spend a substantial amount of time on community consultation and involvement, and prioritize environmental considerations over other aspects of their organisation. The effort invested in creating and maintaining links with the wider community by adaptive organisations may give them a legitimacy which enables adaptive changes to be made with community support. Reflecting calls for values based approaches to climate change, the article discusses the role that different values play in adaptation, and the 'transcendent' values that adaptive organisations tend to hold. The article concludes by suggesting that a deeper understanding of community adaptation to climate change could be derived from an exploration of the role of human values in adaptation across the disciplines.

Introduction

This research aims to broadly consolidate a range of theorised determinants of adaptive capacity from the disciplines of economics, sociology, political science, geography and psychology into a framework, then to use this framework as the basis of a survey which describes and assesses adaptive capacity in community led natural resource management. It addresses two important gaps in the literature that have been observed: firstly it explores indications that adaptive capacity does not necessarily result in adaptation (Repetto 2009; Ford and King 2015); secondly it aims to establish which attributes of adaptive capacity (a concept which has been developed from multiple disciplinary perspectives) are present in organisations that are adapting and explores their relative importance with the aim of refining the concept. We aim to use this broad multidisciplinary approach to describe the characteristics of adaptive organisations in a way that can be of use to disciplines across the social sciences as well as being relevant to natural resource managers with a background in the natural sciences. We look specifically at community based organisations that are managing natural resources; firstly because community governance and involvement are seen as significant tools to increase adaptive capacity to climate change (Finan and Nelson 2009; Eakin et al. 2011), and secondly because understandings of social and community relationships and values in adaptation remain under-researched (Adger and Brown 2010; Keenan 2015).

1 Background to the study

The research was carried out in British Columbia (BC), a largely forested province on the west coast of Canada with Community Forest Organisations (CFOs). Most CFOs are based in rural areas in BC, where much of the economy is dependent on resource extraction: forestry is an important industry both at the local and provincial level (Horne 2009; Schrier 2012). 95% of BC's forested land is owned by the provincial government that awards most tenures to companies and other organisations that carry out forestry planning and operations. The question of adaptation is relevant to these organisations as the health of much of BC's forests is likely to decline as the climate warms over the coming decades (Daniels et al. 2011; Sturrock et al. 2011). Climate model projections suggest significant warming of the province by 2050 (Stocker et al. 2013). By 2050 BC will have warmed on

average 1.7°C compared with the period between 1951 and 1990, which is slightly higher than the global average expected warming. Predictions show winters will continue to warm faster than summers, which will reduce contrast between seasons, though summers are still projected to warm. BC is a varied region and the Northern half of the province is projected to see a greater change, with winters warmer by 3–5°C (Rodenhuis et al. 2009). Increased droughts are likely in the interior of BC, with windstorms and forest fire becoming more frequent, along with increases in tree stress, pathogens and insect attack (Williamson et al. 2009).

Community forest organisations in BC are varied organisations with some common characteristics which usually hold a Community Forest Agreement (CFA) with the provincial government. The organisations are constituted as shareholding or membership organisations such as corporations, cooperatives, societies or partnerships, with shares held by various combinations of Municipalities, First Nations (indigenous peoples), small NGOs, and individuals. The majority of CFOs are small bodies governed by a voluntary committee of 6 or 7 local people and managing anywhere between 418 and 120,000 hectares of forest. Therefore 'community based' in our example is defined as a structure which represents local residents who vote for a voluntary board who then administer the organisation on their behalf in consultation with any other local stakeholders (Teitelbaum et al. 2006).

Researching, planning and implementing strategies which may enable improved forest resilience in a changing climate is increasingly important for CFOs in BC. Although prescriptions for any ecosystem adaptation are at best uncertain, there are some key management decisions that organisations can implement, for example thinning and pruning trees to reduce risks of fire and damage from drought; and improving forest health monitoring and response to forest disturbances (salvage logging and treatments). Realistic climate informed modelling of future timber yields may help avoid financial instability, assist decisions on infrastructure investments and in diversifying income streams. In the long term adjusting planting strategies to have a diversity of species, trialling seed from a variety of provenances, and keeping a mix of age classes may spread risk. The objective of our study was firstly to establish which CFOs in BC were adapting and secondly to identify what aspects of adaptive capacity were present in these organisations versus non-adaptive

organisations, with the aim of better understanding what theorised components of adaptive capacity may enable adaptation.

1.1 Adaptation

Adaptation can be defined as changes made in "response to actual or expected climatic stimuli and their effects or impacts" (Smit and Pilifosova 2001, p. 881). In our study adaptation was defined in this way. We included adaptation activities such as researching expected impacts and potentially beneficial changes that could be made by the CFO in their particular (ecological and climatic) circumstance; planning adjustments into their work programs with the aim of reducing the vulnerability of the organisation and the forest it manages; and making "changes in processes, practices, or structures to moderate or offset potential damages" (Smit and Pilifosova 2001, p. 881).

1.2 Adaptive capacity

Adaptive capacity is the "ability or potential of a system to respond successfully to climate variability and change"(Adger et al. 2007a, p. 727) . An entity with high adaptive capacity is expected to adapt to future climate variation, and adaptive capacity has developed as a concept largely with the aim of predicting future adaptation; below we explore the components of adaptive capacity and adaptive capacity assessment. Adaptive capacity has been developed and refined as a concept in particular in vulnerability and resilience literatures; there are a number of reviews of the concept which cover this in detail and discuss the overlapping approaches that have developed (Gallopin 2006; Smit and Wandel 2006). Engle (2011) provides an overview of the assessment of adaptive capacity, and the difficulties of operationalizing the concept. Adaptive capacity is seen as being influenced by a range of determinants such as economic, natural, social and human capital as well as values, perceptions and cognition. The measurement of adaptive capacity is a contested area, there are a wide variety of approaches across studies which vary in the choice of determinants that are included, and how these determinants are measured and quantified. There have been concerns raised about the selection and measurements of determinants of adaptive capacity on the national scale (Eakin and Luers 2006; Noble et al. 2014) and increasingly adaptive capacity is seen to be highly influenced by local context specific factors

(Adger et al. 2011), with this in mind we have designed our framework in accordance with the ecological and social context that CFOs are situated in .

There is a discrete literature which is dedicated to the development and evaluation of metrics in order to measure the effective components of adaptive capacity (Yohe and Tol 2002; Cutter et al. 2003; Adger et al. 2004; Brooks et al. 2005; Engle and Lemos 2010; Ford and King 2015). The process of establishing what factors enable greater adaptive capacity is on-going. Studies aiming to identify the determinants have been carried out at different scales; the national (Brooks et al. 2005; Eakin et al. 2011), the community (Daniels et al. 2011), and the individual (Bolnick et al. 2003). It is clear that determinants have different influences at different scales (Smit and Pilifosova 2001), and consequently there will be differences in what makes a nation respond to climate change and what makes an individual respond to climate change, though the two scales will interact (Brondizio et al. 2009). Disentangling the determinants of adaptive capacity is difficult as authors use different terms to refer to the same or significantly overlapping concepts, and may be writing from different perspectives or traditions (Engle 2011). Measuring adaptive capacity and developing systematic indices to do so is challenging, since the influence of changes in adaptive capacity are not direct or clear and there are many competing variables that may work together, eclipse or mask the effects of one another, or substitute one another (Smit and Pilifosova 2001; Smit and Wandel 2006; Gupta et al. 2010; Engle 2011). Below we explore the concepts we have chosen to include; these were chosen after trials were carried out with three Registered Professional Foresters (RPFs) in BC who are familiar with CFOs as well as the ecology and social circumstances they are situated in.

Both terms ‘natural capital’ and ‘natural resources’ are used throughout the adaptive capacity literature; natural capital is closely linked to the concept of ‘ecosystem services’ which provide storm and flood protection, erosion control, clean water, plant and animal habitat, trees and other harvestable plants, as well as recreation and cultural services (Costanza et al. 1997; Wackernagel et al. 1999). The availability of natural resources such as fuel, minerals, trees and edible foodstuffs can have a significant impact on the adaptive capacity of a community (Adger et al. 2007a), and access to a wealth of natural resources could give CFOs different options to consider if a particular avenue became untenable due to the impacts of climate change.

In broad terms economic wealth increases social adaptive capacity, however, in combination with other factors, the strength of economic determinants is contested. It was thought that adaptive capacity was correlated with GDP per capita (Yohe and Tol 2002), though subsequent studies suggested that this overlooks the role of local knowledge in enabling people to adapt to changing and variable environments over generations in places as marginal as the Sahel and the Arctic (Adger 2006). An over-reliance on financial capital has meant that adaptive capacity has been lost in cases where local knowledge is underused in favour of economic 'fixes' and the relative importance of access to economic resources varies with context (Jennings 2009). With these caveats, economic determinants play a valuable part in adaptive capacity; this is apparent in our British Columbian context, where economic diversity could play a large role in increasing adaptive capacity by spreading risk (Joseph 2010).

Physical capital is physical objects that makes a person more productive than he or she otherwise would be, a bicycle or a screwdriver is physical capital (Putnam 2001) and so are buildings and equipment (Goode 1959). Physical capital can also be infrastructure like the provision of electricity, roads or transport systems which mitigate isolation (Smit and Pilifosova 2001; Smit and Wandel 2006). It is not necessarily the case that ‘more is better’ in terms of access to physical capital, as an excess of something can become a liability. For example to cut down a tree one chainsaw will suffice, 10 chainsaws would not make the job any easier, and would require investment of additional resources (in that they would need to be stored and maintained). In terms of adaptive capacity, lack of access to physical capital is seen as a potential limit to adaptation.

Human capital is the state of education and knowledge, skills and experience (as well as health, punctuality and various other qualities) of people that contribute to a shared project (Goode 1959; Becker 1994), it is widely accepted as being an important determinant of adaptive capacity (Yohe and Tol 2002; Adger et al. 2007a; Williamson et al. 2012). There needs to be some analytical or experiential understanding of a problem within an organisation or community before it can be solved, as well as information available to communities to enable them to look at different options. This information can be scientific or it can be traditional or local: derived from oral traditions, historical knowledge or anecdotes developed through generations of people with the experience of living in a

particular place (Duffield et al. 1998; Adger 2006). Human capital is also thought to create organizations which are more innovative and more likely to adapt (Adger 2006; Allen and Holling 2010; Joseph 2010).

The concept of social capital is multifaceted in part because it has developed from different proponents such as Bourdieu (1988), Coleman (1988) and Putnam (2001). Putnam defines social capital as “the social norms and networks that enhance people's ability to collaborate on common endeavours” (Putnam 2001, p. 135). Sociology has developed social network theory, which examines the type and amount of relationships (or ‘ties’) people and groups have with each other, and the impact of these ties on 'influence and information, mobility opportunity, and community organization' (Granovetter 1973, p. 1360). However social capital is defined, it remains a complex quantity to measure, and there are a large range of approaches taken by researchers. There is a need for a consistent approach to enable the comparison of adaptive capacity (Pelling and High 2005), and work has been done by the World Bank and OECD as well as many governments to develop this (Franke 2005). Social capital plays an important role in communities’ ability to adapt to risks related to climate change and it has long been recognised that empirical studies on social capital enable greater understanding of collective management of environmental resources (Adger et al. 2007a). In community forest management evidence indicates that when the majority of community members participate in a management program it is more successful (Pagdee et al. 2006), and that social capital is a necessary ‘glue’ for adaptive capacity to climate change; enabling communities to organise despite lack of access to other resources such as money and access to equipment, and maximising the benefits of these resources if they are present.

The inclusion of values has been called for in climate change research but rarely carried out (O'Brien 2009; O'Brien and Wolf 2010; Adger et al. 2013), so it was judged as an important factor to include in the framework. The rationale for applying a “values-based approach to climate change” (O'Brien and Wolf 2010, p. 232) is compelling, with recent research demonstrating that “distinct values systems drive different types of inquiries of the changing climate, its consequences and responses to them”(O'Brien and Wolf 2010, p. 235). Defining values is an ongoing area of work, (for examples see Rohan (2000); however, there is a broad consensus that values express a belief about a desired end, which guides

individual action (de Vries and Petersen 2009). Values are not only applicable to individuals and can be associated with groups, institutions, organizations and cultures. Values have been variously conceptualized as intrinsic and extrinsic (concerned with social contribution and personal growth versus concerned with status and appearance), or materialist and post-materialist (O'Brien and Wolf 2010). The idea of values as a competitive list is also well established, and in this case multiple (and sometimes conflicting) values are held but constantly reprioritised according to the situation the holder is in (Schwartz 2006). This constant reprioritizing indicates that values themselves often do not translate directly into action, and are better seen as a foundation from which attitudes or behaviours stem, as they are influenced by experience, habits, and the norms of wider society. In the last ten years there have been developments that suggest that although a community may have sufficient adaptive capacity in the form of social, cultural, human, physical and economic capital; it may not begin a process of adaptation. This has led to research concluding that communities are restricted in their adaptation to climate change by social limits including their values and attitudes (Naess et al. 2005; Adger et al. 2009; O'Brien 2009), which influence their perception of the necessity of adaptation (Hamilton and Keim 2009; Borick and Rabe 2010).

Previously adaptive capacity assessment has usually been carried out by examining the impacts of previous events, viewing them as stress tests and evaluating the response to those events; examples include Naess et al. (2005), Brooks et al. (2005) and Hill (2013). Although a useful approach, it is imperfect in two main ways: Firstly climate change is likely to create impacts of a far greater scale and severity than has been previously documented (Breshears et al. 2011; Engle 2011; Stocker et al. 2013); and secondly many climate impacts involve gradual change in the short term (Engle 2011; Hinkel 2011). Some research has dealt with this by using proxies, observed in the present with the assumption that they hold some predictive value for adaptation in the future. For example, Posey (2009) explored the relationship between socio-economic variables and participation in flood protection schemes at the municipal level in the United States using municipal engagement in floodplain management programs as a proxy for adaptation. Beier (2011) used similar reasoning in his work examining the factors influencing adaptive capacity in forest management in Alaska. In this case he “considers evidence of *adaptation to change* as a

positive proxy of adaptive capacity" (Beier 2011, p. 3 emphasis added). We have used a similar approach in asking respondents to what extent their organisation is carrying out research, planning or implementing adaptive responses to the threat of climate change impacts and using positive answers as evidence that they are adapting. In this way we use present evidence of adaptation as a proxy, with the assumption that present behaviour may indicate how and if CFOs will adapt in the future.

2 Method

As set out above, we included natural, human, economic, physical and social capital, values, attitudes and observations as our independent variables in our framework assessment of adaptive capacity in community forest organisations. The approach is one of audit rather than parsimony as it incorporates a wide range of research across disciplines to give a broad overview. The research was carried out in partnership with the BC Community Forest Association and surveyed all their active member organisations (those who had an approved forest management plan and tenure agreement); the data was obtained over 3 months using a telephone survey, and produced a complete census dataset of all 38 organisations. The independent variables were collected as a mixture of interval data (eg. age of the organisation) and ordinal data (5 point Likert scales) measuring each of the factors. A similar method is used by Nilsson et al. (2004) in assessing the influence of values on the acceptability of climate change policies in different organisations in Sweden. The dependent variable (adaptive capacity) was also collected on 5 point Likert scales (see Table 2) ; measuring to what extent each organisation was carrying out research, planning, and adaptation actions, this is similar to the approach of Beier (2011) who uses evidence of current adaptation to predict future adaptive capacity.

Table 1 gives an overview of each of the determinants of adaptive capacity, the operators derived from them, and their relation to existing literature in a variety of disciplines, while Table 2 shows how we measured adaptation. We chose to measure the organisations' values in a number of ways to try to capture how they prioritised multiple concerns when faced with decisions. We have used a framework based on Schwartz' framework of individual values (Schwartz 1992; Schwartz 2006), and adapted it for use with CFOs in (a similar way to Sagiv and Schwartz (2007)). The organisations are run by small committees

(on average 6 or 7 people) and at this scale the values of the individuals and the organisation are thought to be largely congruent (Schneider 1987). There are a variety of examples in the organisational psychology literature where this approach is taken (Finegan 2000; Abbott et al. 2005).

To measure values, the survey first sought data on the organisations' normative beliefs, then measured the balance that the organisation had between identifying with 'public serving' and 'organisation serving' motives (see Table 1). These motives are conceptualised as 'self-transcendence' by Schwartz (2006); but in organisations are perhaps better understood as 'outward looking' versus 'inward looking' (Nilsson et al. 2004; Terwel et al. 2009). Thirdly, in addition to normative and transcendence values, organisations can also value climate change as an opportunity (Burch 2010; Field et al. 2014), and these opportunity values can be measured along an opportunity-organisation dimension or scale (Rohan 2000; Schwartz 2006) which can help predict organisational responses to novelty or change. An 'opportunity focussed' organisation would identify with innovation and progressive exploration rather than conformity and security.

Table 1 Community Adaptation Assessment Framework

Determinant	Relation to literature	Definition of the determinant		How the determinant was operationalised
Natural Capital	Brooks et al. (2005); Adger et al. (2007b)	Natural resources such as metals, fuels, minerals, rocks, trees and other harvestable plants, recreation and cultural services, flood protection, erosion control, clean water & habitat; closely related to 'ecosystem services' (Costanza et al. 1997; Wackernagel et al. 1999).		CFOs were asked about diversity of trees species and other revenue sources from their forest; how they rated the importance of their ecosystem services; importance of their cultural & recreation services.
Human Capital	McCarthy et al. (2001); Burton et al. (2002); Brooks et al. (2005); Parry et al. (2007); Jennings (2009); Engle and Lemos (2010); Gupta et al. (2010); Field et al. (2014)	Human capital is the state of education and knowledge, skills and experience (as well as health, punctuality and various other qualities) of people that contribute to a shared project (Goode 1959; Becker 1994).		CFOs were asked about their access to skilled people ; access to people with knowledge and information; access to experienced people; and access to training and education.
Economic Capital	McCarthy et al. (2001); Burton et al. (2002); Yohe and Tol (2002); Brooks et al. (2005); Parry et al. (2007); Engle and Lemos (2010); Gupta et al. (2010); Field et al. (2014)	Access to economic assets, capital and financial resources (IPCC 2001) "For every percent economic growth, vulnerability falls by a percent" (Yohe and Tol 2002).		CFOs were asked about their availability of financial surplus; availability of staff time for planning; access to external financial capital; and diversity of income.
Physical Capital	McCarthy et al. (2001); Burton et al. (2002); Parry et al. (2007); Engle and Lemos (2010)	Physical capital is infrastructure and equipment that makes a person more productive than he or she otherwise would be (Goode 1959; Putnam 2001).		CFOs were asked about their satisfaction with access to forestry equipment; any impediment caused by lack of forestry equipment; how favourable the geographical location of their forest is; and access to equipment for future plans.
Social Capital	Adger and Vincent (2005); Folke et al. (2005); Pelling and High (2005); Parry et al. (2007); Adger et al. (2009); Engle and Lemos (2010); Gupta et al. (2010)	"the social norms and networks that enhance people's ability to collaborate on common endeavours" (Putnam 2003 p. 135).		CFOs were asked about the representativeness of the board; supportiveness of the community; level of trust in the wider community; and organisational time spent on community involvement & consultation.
Values	Nilsson et al. (2004); Schwartz (2006); Parry et al. (2007); O'Brien (2009); O'Brien and Wolf (2010); Field et al. (2014)	A foundation from which attitudes or behaviours stem; they are influenced by experience, habits, and the norms of wider society, they guide individual action (Rohan 2000; de Vries and Petersen 2009) Conceptualised as competing scales assessing normative, transcendent, and opportunity values, developed from Nilsson et al. (2004) and based on Schwartz (2006).	Normative	CFOs were asked to make trade-offs between the importance of environmental stewardship; faithful community representation; making an economic return; and First Nations' traditional cultural values.
			Transcendence	CFOs were asked to make trade-offs between prioritising the community over their organisation; the environment over their organisation; and community opinion over expertise; they were also asked about their perception of community goodness.
			Opportunity	CFOs were asked if they saw themselves as conventional, if they identified with innovation; whether they saw themselves as risk adverse; and whether they identified with progressive exploration.
Attitude to climate change	Schultz and Zelezny (1999)	Attitudes are theorised to stem from values, and to influence behaviour (Schultz and Zelezny 1999).		CFOs were asked if they were concerned about global climate change; direct impacts on their CFO; their understanding of likely climate change impacts and their understanding of risk reduction.
Observations/ Expectations of climate change	Hamilton and Keim (2009); Borick and Rabe (2010)	The role of direct experience are thought to play a role in climate change observation and belief (Borick and Rabe 2010).		CFOs were asked about their level of observation /expectation of extreme events, pathogens, warmer winters and species changes.

Table 2 The measurement of adaptive capacity with associated statements

Extent of research carried out	1. As an organisation we have begun to research adaptations we may be able to make to minimize some of the likely impacts of climate change on our CFO.
Extent of planning carried out	2. As an organisation we have begun to put plans into place for what we may be able to do to minimize some of the likely impacts of climate change on our CFO.
Extent of adaptations already integrated into work	3. As an organisation we have already begin to make adaptations to our work to minimize some of the likely impacts of climate change on our CFO.
Overall organisational response to climate change	4. As an organisation we have yet to do anything to minimise the impacts of climate change.

Organisations were asked to respond on a Likert scale to the questions in the right hand column of the table (1. = strongly disagree; 2. = disagree; 3. = neither agree nor disagree; 4. = agree; 5. = strongly agree). Those who had carried out research, planning or implementation were classified as adaptive. Those who had not were classified as non-adaptive. Two organisations were excluded from either group as they were neutral in their answers.

3 Results

The data measuring adaptive capacity was coded to allow the population be split into two groups (adaptors and non-adaptors) according to their research, planning and adaptation activities; cross tabulations were then carried out (see Table 3 for details). In this analysis eighteen organisations had begun to adapt, eighteen had not carried out any adaptive actions, and two were ambiguous (perhaps reflecting lack of consensus within their organisation).

Fisher's exact test showed few significant differences between adaptors and non-adaptors: adaptive organisations spend more time on community involvement and consultation, prioritise the environment over their organisation (when asked to make trade-offs), understand the impacts of climate change, possibilities of risk reduction and observe more impacts of climate change than non-adaptive organisations. Overall the social capital questions and questions about values that participants were asked raised the most interesting contrasts between adaptive and non-adaptive organisations. Access to natural, economic or human capital was similar for both adaptive and non-adaptive organisations. Despite CFOs having access to considerable natural capital, this did not translate into a diversity of revenue sources; in general all CFOs had very low diversity of income sources and low economic capital; most made all their income through harvesting trees which are exported via international log markets. Human capital was high for both adaptors and non-adaptors, indicating a high level of access to education and skills among CFOs in general.

Looking at Table 3 we can see in the right hand column that 100% of adapting organisations saw their ecosystem services as important, spent considerable time on involvement and consultation, chose both the environment and their community as a top priorities in decision making, prioritised the health of the environment over the health of their organisation, identified with innovation and with progressive exploration. By contrast the only attribute that was shared by all the non-adaptive organisations was that their boards were seen as representative of wider community demographics.

Table 3 Cross tabulations comparing adaptive and non-adaptive groups

Concept	Variables present	Fisher's (2 sided)	Not adapting %	Adapting %	Neutral answers *[1]
Natural Capital	Diversity of trees species	1	71	76.5	7
	Diversity of revenue sources from tenure	.68	20	31	7
	Importance of ecosystem services	.49	88	100	6
	Importance of cultural & recreation services	Universally important			5
Human Capital	Access to skilled people	1	78	83	2
	Access to people with knowledge and information	Universally accessible			3
	Access to experienced people	Universally accessible			7
	Access to training and education	1	86	86	10
Economic Capital	Availability of financial surplus	1	58	62.5	10
	Availability of staff time for planning	1	69	69	12
	Access to external financial capital	.69	42	57	12
	Diversity of income	1	19	23.5	5
Physical Capital	Satisfaction with access to forestry equipment	.22	67	87.5	7
	Impediment caused by lack of forestry equipment	1	54	45.5	14
	Favourable geographical location of the forest	1	50	44	6
	Access to equipment for future plans	1	71	75	9
Social Capital	Representativeness of board	.10	100	76.5	5
	Supportiveness of community	Universally supportive			11
	Level of trust in the wider community	1	89	86	15
	Time spent on involvement & consultation	.042*	64	100	12
Normative values	Comparative importance of environmental stewardship	.46	92	100	12
	Comparative importance of representing the community	.485	87.5	100	8
	Comparative importance of making an economic return	.62	87.5	75	10
	Comparative importance of First Nations traditional cultural value	1	80	83	11
Transcendence values	Prioritization of community over organization	1	50	50	7
	Prioritization of environment over organization	.048*	71	100	13
	Prioritization of community opinion over expertise	1	15	8	13
	Perception of community goodness	Universal			3
Opportunity values	Identification with conventional forestry business	.59	12.5	6	4
	Identification with innovation	.44	92	100	11
	Risk adversity	.64	58	78	17
	Identification with progressive exploration	1	93	100	10
Attitude to climate change	Level of concern about global climate change	.27	73	94	11
	Concern about climate change impacts on organization	.23	54	80	10
	Understanding of likely climate change impacts	.002*	17	80	11
	Understanding of risk reduction	.000*	7	77	6
Observations/ Expectations of climate change	Level of observation /expectation of extreme events	.07	58	92	13
	Level of observation /expectation of pathogens	.33	79	93	9
	Level of observation /expectation of warmer winters	.23	37.5	100	5
	Level of observation /expectation of species change	.02*	25	73	11

* = $p < .05$

*[1] Organisations which answered the question neutrally on the Likert scale were removed from the percentage calculations for both adaptive and non-adaptive groups.

4 Discussion

There are a number of notable features that characterise adaptive CFOs, firstly adaptors all spend a large amount of time on community consultation and involvement, and prioritise the environment over their organisation. Both of these characteristics are resonant of Schwartz's portrayal of transcendence values, where the owner (in this case the organisation) holds values that are transcendent of themselves or their organisation. In this case rather than being motivated by self enhancement, the organisations are motivated by broader value goals: a commitment to accountability within their wider community, and commitment to environmental stewardship which reaches beyond their forest, in this context these values seem to provide some impetus for climate change adaptation.

Since the 1990s psychological research has carried out looking at values, attitude and behaviour specifically in relation to environmental concern and pro-environmental behaviour. This focus has built on the initial socio-cultural work of Rokeach (1968); Schwartz (1992); and Inglehart and Welzel (2005) who sought to measure social values and explore their antecedents. Dietz et al. (2005) provide an in-depth review of work concerned with environmental values; examples of this type of work include the development of the New Ecological Paradigm (NEP) (Dunlap and Van Liere 1978; Dunlap et al. 2000), the work of Stern et al. (1995); Stern et al. (1998) and Stern (2000) that incorporates theoretical understandings of value into a 'value-belief-norm' theory of environmentalism. There has been some success in finding a relationship between self-transcendence values (valuing other people and nature and seeing them as entities which it is important to care for) and pro-environmental behaviour (Schultz and Zelezny 1999; Schultz et al. 2005). Our research seems to support this area of enquiry.

However, little is known about how values change and there is very little theoretical reflection on the association between environmental behaviour and self-transcendent values to help us understand what this association may mean or how it could be used as a way of increasing adaptive capacity. It is important to note that despite the amount of work that has gone into understanding the relationship between values and environmental behaviour and the large growth in the research area in the past 25 years, the relationship between measured values and environmental behaviour is loose. What this body of work has demonstrated most clearly, perhaps unintentionally, and our research reflects, is that values are associated with other concepts and mediated by other social processes. In other research into values subtle changes in the methods of measurement or the operationalising of different types of value result in significant findings in one study and insignificant findings in another (Hitlin and Piliavin 2004). Our research indicates that values are important, but values cannot be isolated from the influences of other determinants of adaptive capacity.

Paradoxically adaptive organisations may be committed to consultation and involvement, but often the boards of these organisations are less representative of the local population (see Table 3); one of the few measures in which adaptive organisations scored lower than non-adaptors was in the demographic representativeness of their board. However in these cases these unrepresentative boards were usually composed of people who had particular forestry expertise, rather than local lay people. It is thought that in many situations self-organised groups are better able to sustainably manage resources than either private bodies or centralised governments (Ostrom et al. 1999). It is this idea of community led natural resource management that BC's community forest policy originated from. Ostrom emphasised that there is no universally applicable form of governance that will enable sustainable management (which adaptation would be part of). She found that each case must be understood individually so that the most appropriate types of participation can be maintained or developed according to context. This research suggests that a form of expert led community supported governance may enable adaptation for many CFOs. Indeed, this type of relationship between expert knowledge and locally accountable governance could play a role in increasing adaptive capacity in many other situations. Board expertise combined with active involvement of the local population may give organisations confidence to act; as trusted experts in the community perhaps they are empowered and confident enough to innovate.

In our study general education level were high and unrelated to adaptation, however, adaptive organisations had significantly greater understanding of climate change impacts and risk reduction options. This could be a function of adaptive capacity, which preceded their research into adaptation or it could be a function of adaptation: that their understanding increased as they began to look into their adaptation options. Certainly it could be useful to carry out more research into this relationship to try to improve understanding of the role targeted climate change education could play in adaptation. In addition observation of impacts was greater in adaptive organisations. Again, this could be because organisations are predisposed to assign causality to climate change as a result of their greater awareness, or it could be that they are motivated by the impacts they see to adapt. The former explanation is supported by previous studies (Hamilton and Keim 2009; Borick and Rabe 2010).

A surprising find is how little of an impediment lack of economic capital is to engaging in adaptation. While 37.5% of the adaptive organisations have no financial surplus at the end of the year (compared to 44% of the non-adaptive ones) they are able to innovate despite the lack of financial liquidity that classical innovation theory tells us is essential when adopting new practices (Rogers 2003). We have to assume that these organisations devote time and resources to research, planning and implementation of adaptive actions without a research and development budget, but with value driven motivation. This reflects the

IPCC's observations that economic resources are not a "neither a necessary nor a sufficient indicator of the capacity to adapt to climate change" (Parry et al. 2007, p. 728).

5 Conclusion

The research developed a framework from the adaptive capacity literature and used it to design a survey that aimed to operationalise commonly posited determinants of adaptive capacity across disciplines. The metric gave a clear snapshot overview of the organisations and enabled us to describe and quantify the theoretical determinants of adaptive capacity that they have access to. We can surmise that organisations are seemingly not necessarily impeded by lack of human or economic capital, but by social capital and values.

Motivated by their values, perhaps the effort those adaptive organisations expend in fostering community participation leads to increased trust and a feeling of legitimacy that provides a mandate and favourable conditions to innovate, change their practices and adapt. This may not be a surprise to those familiar with the progress of the field of adaptive capacity over the years; doubts have been expressed about the role of economic resources in climate change adaptation (Adger et al. 2009), and values may play a larger role than access to resources (O'Brien 2009). This research contributes some empirical evidence in support of these doubts. These findings would be augmented by research into the values and governance arrangements of other community based resource management organisations to enable a focussed exploration of the influence of values and community governance in enabling adaptive capacity.

In this research 'transcendence' values which connect the holder (individual or organisation) to something greater than themselves are associated with adaptive capacity. There is some indication that values change over time through processes like social learning and leadership (Folke et al. 2005); perhaps using these channels to foster 'adaptation ready values' could lead to greater adaptive capacity. The adaptive organisations that participated in this study are community and environmentally minded, seeing themselves as forest stewards who will pass their legacy onto future generations; perhaps it is the values they hold which give them the motivation to transcend the 'business as usual' conventional industrial forestry that they seem so keen to distance themselves from. These organisations could be documented as 'adaptation innovators' in anticipation that their examples may diffuse across organisations in a social learning based variation of Rogers' theory. As a minimum, these findings should encourage us to ask further questions in all disciplines about the role that human values and community involvement may play in in future adaptation to climate change.

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