



REPORT

Climate Adaptation Professional Development Interests

2019

Adaptation Learning Network is licensed under CC BY 4.0



**Adaptation
Learning Network**

INSPIRING
CLIMATE ACTION

ROYAL ROADS
UNIVERSITY

adaptationlearningnetwork.com

TABLE OF CONTENTS

TABLE OF CONTENTS	1
OVERVIEW	2
INTRODUCTION	3
METHODS	6
SURVEY RESPONDENTS	7
CONTINUING PROFESSIONAL DEVELOPMENT	11
CLIMATE CHANGE ADAPTATION	15
PRIORITY CLIMATE CHANGE ADAPTATION ISSUES	18
CLIMATE CHANGE ADAPTATION CHALLENGES	22
EXCELLENT CPD COURSES	25
IMPLICATIONS	27
Appendix - Table of Contents	28
Appendix A. Scoping Study	29
Appendix B. Kresge Foundation Survey	33
Appendix C. Survey Questions	34
Appendix D. Other Organizations	45
Appendix E. Priority Issues Coding Results and Scheme	47
Appendix F. Facing Challenges Coding Scheme and Results	64
Appendix G. Excellent CPD Courses	91

OVERVIEW

This report includes selected results from the *Adaptation Learning Network: Inspiring Climate Action* survey of 703 members from seven BC professional organizations, conducted in Spring 2019. The survey endeavored to identify the needs of BC professionals for ongoing climate change adaptation education, as the basis for developing a suite of Continuing Professional Development (CPD) courseware for this community of professionals.

The report provides a snapshot of how BC professionals who participated in the survey perceive their own level of knowledge of climate change and their awareness of existing climate change adaptation tools and frameworks. It summarizes the range of climate change- related challenges and issues that they encounter or expect to encounter in their work. It also identifies how some BC professionals discover and select their CPD, and begins to construct a picture of both their diverse needs for climate change adaptation CPD, and how these diverse needs might be met.

INTRODUCTION

The Adaptation Learning Network Project

There is a growing awareness that professionals in our communities require skills to support planning for and responding to the current and future challenges of climate change. The *Adaptation Learning Network: Inspiring Climate Action Project* is intended to increase the province's capacity to adapt to climate change by enhancing the knowledge and skills of professionals, through climate change adaptation continuing professional development (CPD).

The *Adaptation Learning Network* project recognizes the sustained care Indigenous peoples have afforded the environment on which we all rely. The Project team is exploring reciprocal opportunities for involvement of Indigenous peoples and perspectives in this initiative, recognizing that they have adapted to changes in climate since time immemorial.

The *Adaptation Learning Network* project initiated in January 2019 and ends March 2022. From January through June 2019, phase 1 of the project gathered information from partnering professional organizations and post-secondary institutions, climate experts, and Indigenous knowledge-holders.

The project's phase 1 goals were to: *build relationships of mutual trust and benefit, support meaningful input to ensure the value of project outputs (courses, frameworks, professional learning community) and ensure a process of evidence-informed and collaboratively identified priorities and needs.*

Overall project objectives include:

1. Develop and deliver high quality CPD training, with topics focused on climate adaptation;
2. Develop a Climate Adaptation Competency Framework; and
3. Implement a climate adaptation Professional Learning Community to share and leverage the expertise and motivations of professionals in order to build adaptation resilience and capacity in BC.

This report contributes to project objective (1), by surveying the memberships of partnering BC professional organizations.

The Survey

The *Adaptation Learning Network* survey of BC professionals builds on two substantial climate change studies targeting professionals. In 2018, the BC Climate Action Secretariat (CAS) commissioned the ***Continuing Professional Development for Climate Change Adaptation in BC Scoping Study***, undertaken by the Pacific Institute for Climate Solutions (PICS) and Simon Fraser University (SFU)'s Adaptation to Climate Change Team (ACT).

This scoping study involved a gap analysis of existing and desired CPD offerings, interviews with practicing professionals throughout the province, and a workshop with representatives of professional associations and continuing education experts. It signaled strong support in BC for developing multidisciplinary climate change adaptation CPD offerings, which interpret complex theoretical knowledge into practical knowhow and profession-specific materials.

Recommendations for CPD included delivery methods that support easy access and multi-disciplinary participatory activities; a design approach that integrates continuing studies adult learning theory with content domain expertise; and course topics that include both general foundations on climate change adaptation as well as profession-specific offerings. See Appendix A for a more comprehensive summary.

The second study, by The Kresge Association, similarly examined American professionals in 2017. ***Professional Societies and Climate Change: An analysis of how urban-focused professional societies are integrating climate change into their member engagement activities*** reviewed publicly available material for 41 American professional societies to understand whether and how they were discussing climate change with their members, and then interviewed a subset of them. There was a wide variation in the level of sophistication and breadth of resources used to engage and educate society members. However, some clear themes emerged with recommendations to mainstream climate change into operations and engagement strategies of professional societies. These are outlined in Appendix B.

The *Adaptation Learning Network* survey was designed to better understand:

- How BC professionals perceive their own level of knowledge of climate change;
- How BC professionals perceive their awareness of existing climate change adaptation tools and frameworks;
- The range of climate change-related challenges and issues BC professionals encounter or expect to encounter in their work;
- The extent to which BC professionals are already considering climate change in their work;
- How BC Professionals discover and select their CPD; and

- Their interests and needs that could be addressed with climate change adaptation CPD in the future.

The results will be used to inform next steps in the *Adaptation Learning Network: Inspiring Climate Action* Project. These include working with partnering professional organizations and their members, post-secondary institutions and climate experts to develop high-quality climate change adaptation CPD that meets the needs and interests of BC professionals.

The survey included both quantitative (questions 1 to 26) and qualitative (questions 27 to 30) questioning. The qualitative questions have been analyzed in their own right, and individual responses have been inserted throughout the report to add context and illumination to the quantitative results. The following are some pertinent responses to set the scene:

- *There are many independent efforts occurring related to climate change and adaptation (e.g. municipalities, local government, provincial government). Some efficiencies could be made by combining and coordinating efforts to some degree, realizing that each entity is facing their own specific challenges.*
- *BC Agriculture climate adaptation research network (ACARN - bcacarn.com) and the Climate Action Network (CAI - bcagclimateaction.ca) are making a significant contribution to climate change adaptation networks and knowhow.*
- *BC could be learning from other regions of the world that have experience with climate impacts and adaptation. Creating linkages with 'sister' regions to transfer experiential knowledge is the first step. In addition, CPD could include updates on monitoring techniques and equipment-related knowledge to ensure use of appropriate indicators and methods in anticipating climate impacts.*
- *How can we connect with others working in the same area? How to advance much more quickly than we are currently? How to create a sense of urgency among decision makers and the public? Multiple communication tactics would help.*
- *As well as practitioners and policy makers, councils and community leaders need to be educated about adaptation as they review and pass judgement on new policy, development proposals, etc.*
- *There is a need to integrate the environmental, economic and social issues, impacts and aspects - that's where the solutions are to be found.*
- *Adaptation is an iterative process which requires sustained collaboration and action.*
- *It is essential to understand how the dots are connected - from how we cause climate change, to how it impacts us, to how we can and must urgently mitigate and adapt to it and how the future in a low carbon, resilient and equitable world will be so much better than what we have now.*

METHODS

The *Adaptation Learning Network* survey was crafted by the *Inspiring Climate Action* Project organizing team, research assistants (Jack Satzewich - Simon Fraser University ACT, and Holly Clermont), and was enhanced through feedback from BC's Climate Action Secretariat. The survey was administered through the mailing lists of seven participating professional organizations, primarily through newsletters or notices.

Professional Organization	Membership
Association of British Columbia Forest Professionals (ABCFP)	5,300+
Applied Science Technologists and Technicians of British Columbia (ASTTBC)	10,215
British Columbia Institute of Agrologists (BCIA)	1,300+
British Columbia Society of Landscape Architects (BCSLA)	600-700
College of Applied Biologists (CAB)	2,300
Engineers and Geoscientists of British Columbia (EGBC)*	34,000
Planning Institute of British Columbia (PIBC)	1,500+

*EGBC is the business name of the Association of Professional Engineers and Geoscientists of BC (APEGBC). APEGBC has 34,000 members.

Data were collected in SurveyMonkey® in a password-protected Royal Roads University account. The survey was open for 26 days (March 14th to April 8th, 2019). Results were examined with SurveyMonkey's analysis tool and Microsoft Excel. The complete set of survey questions is provided in the report's Appendix C.

Note: In this report, the terms *professional 'organization'* and *professional 'association'* are used interchangeably. Also, survey respondents did not answer every question; statements such as "percent of respondents" generally refer to the respondents to the question, not the entire survey.

SURVEY RESPONDENTS

Who responded (Questions 1 and 2)

There were 703 responses to the survey. Response rates ranged from less than 1% to nearly 15% (Table 1). Nearly 60% of all responses were from two organizations: ASTTBC and BCIA (Figure 1). (See Appendix D for ‘Other organizations’.) EGBC recently completed their own survey with similar intent, and so the survey was not amplified to that community. Most respondents were relatively new to their organizations, with 27% reporting they were members for less than 5 years, and 22% for 5-10 years. Many respondents belonged to two or more organizations (Table 2).

Table 1. Membership response rates

Organization	Response rate (% of membership)
ABCFP	41 / 5,300 = 0.8
ASTTBC	2.6
BCIA	14.7
BCSLA	51 / 650 = 7.8
CAB	6.1
EGBC	0.09
PIBC	2.1

Figure 1. Composition of survey respondents

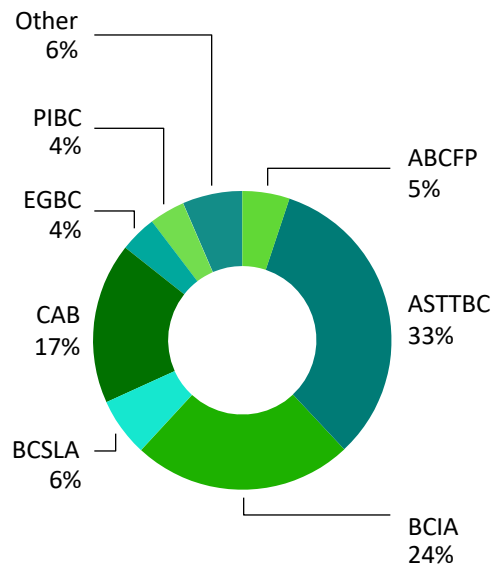


Table 2. Membership in participating and other organizations

	ABCFP	ASTTBC	BCIA	BCSLA	CAB	EGBC	PIBC	Other
ABCFP	41	2	9		6	3		2
ASTTBC	2	264	2	2	3	10	1	29
BCIA	9	2	191	1	11	5	2	9
BCSLA		2	1	51	1			1
CAB	6	3	11	1	140		1	9
EGBC	3	10	5			32	1	
PIBC		1	2		1	1	31	
Other	2	29	9	1	9			52

Specific responses of noted included:

- *As a component of CPD, this is a professional reliance issue. With the College of Applied Biology, how will climate change adaptation integration, which by its nature is dynamic and open to varying interpretation, be applied with respect to Codes of Ethics/Practice. This is a slippery slope where Professionals are potentially being required to conform to political based policy/positions as opposed to "formulate and present opinions, conclusions and recommendations from an impartial and factual science base" (CAB Code of Ethics). Who gets to decide what is acceptable CPD and what is not?*

Employers (Question 3)

Most respondents were employed by private sector companies (41%) and as independent consultants (26%) (Figure 2). More than half worked for federal (5%), provincial (23%), or local governments (23%).

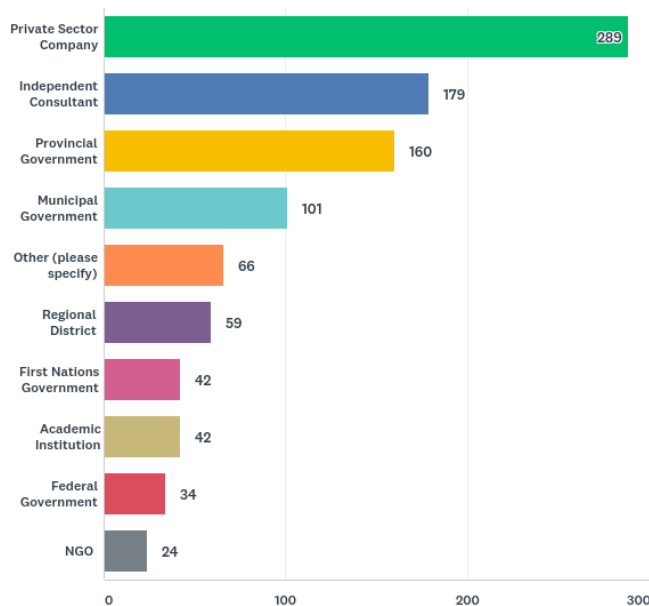


Figure 2. "I currently work for...."

Respondents could choose as many types of organizations as they wished.

'Other' responses included retired, student, Crown corporations, and public sector organizations such as school districts and health authorities.

Jobs (Questions 4 and 5)

More than 42% of respondents cited project management as one of their top three job responsibilities (Figure 3).

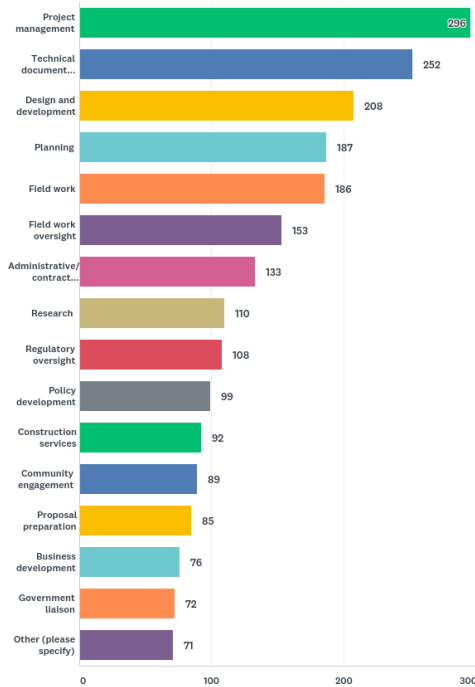


Figure 3. Primary job responsibilities

Respondents were asked to choose up to three responsibilities.

'Other' responses included "...strategy technical coordinator", wildlife assessment, review of work of other qualified professionals, material testing, lab analysis, scientific advice, occupational health and safety, reviewing documents and writing comments, student, securing customers, impact management/ mitigation, adjudication of water license applications, and people management.

Locations (Question 8)

Respondents worked in all regions of the province but were concentrated in the most populous areas (i.e., Metro Vancouver, Fraser Valley, and the Capital Region) (Figure 4).

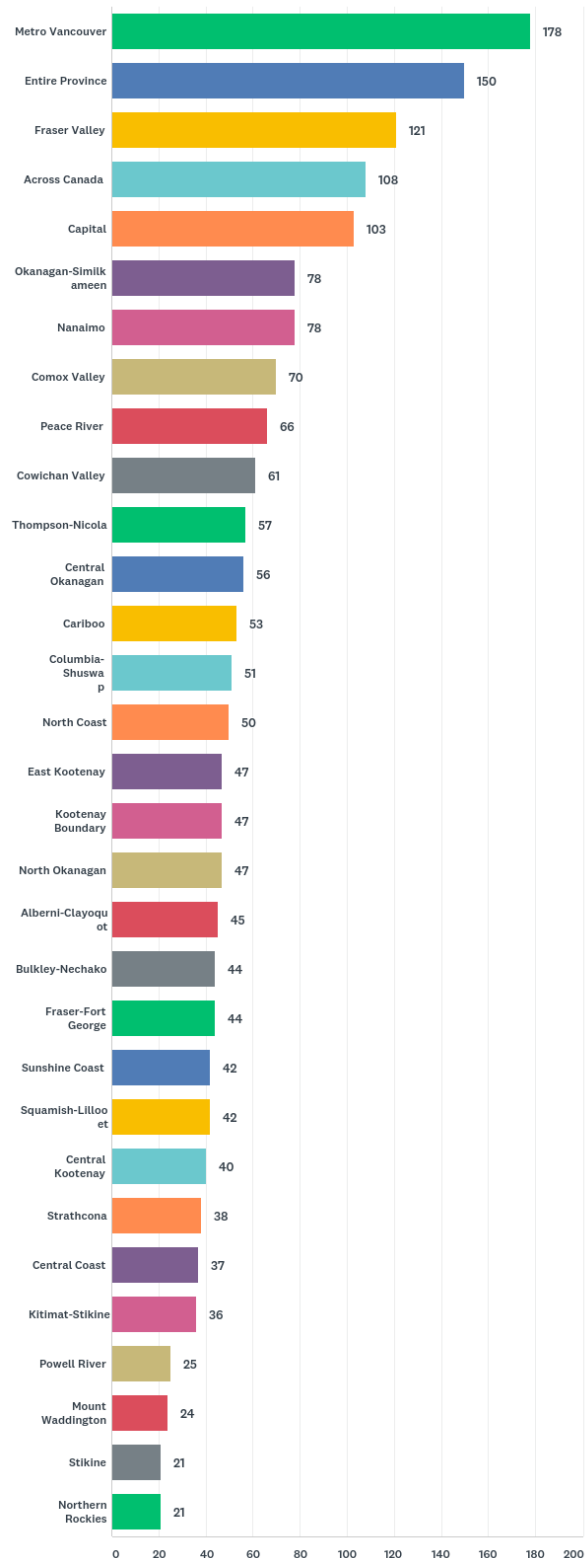


Figure 4. Geographic places of work

Respondents were asked where their work “primarily focused”. They could select as many regional districts as they wished, as well as ‘entire province’, ‘across Canada’.

There are some minor ‘errors’ in this chart. There are 27 regional districts in BC. Northern Rockies Regional District, formerly Fort Nelson-Liard Regional District, is now Northern Rockies Regional Municipality.

Stikine is in the Regional District of Kitimat-Stikine. Powell River Regional District has been renamed qathet Regional District. Missing is the Islands Trust, a federation of local governments serving islands in the Salish Sea.

Specific responses included:

- *I have missed a couple of opportunities because I wasn't willing to travel, I feel like using webinars or other virtual platforms that can prevent all the travel makes sense to prevent generating a carbon footprint*
- *make it easy and accessible. many members live in remote areas and travel can be difficult.*
- *How to work with First Nations groups to bring the visions and goals to life*

CONTINUING PROFESSIONAL DEVELOPMENT

Learning about CPD (Question 9)

Respondents were most likely to discover CPD opportunities from their organizations (82%) (Figure 5). Notably, some of the other offerings (e.g., conference-related brochures) may also arise from associations.

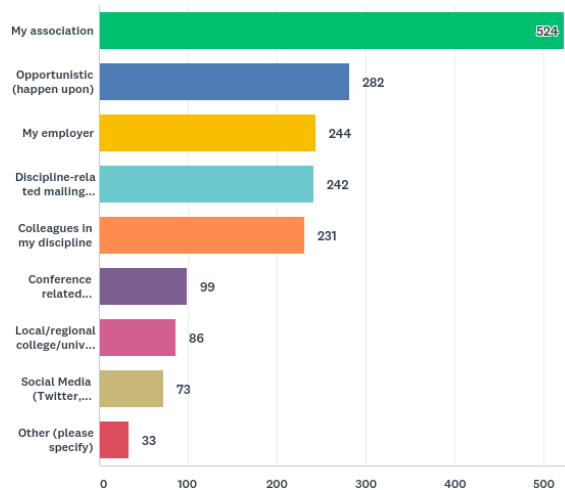


Figure 5. Learning about CPD

Five percent of total responses were 'Other'. These included other professional associations, similar organizations in other jurisdictions, non-profit organizations, self-taught education, Massive Open Online Courses (MOOCs - edx.org), publishers, periodicals, scientific organizations, webinars, word-of-mouth from others outside of the discipline, project work, labs, clients, suppliers/contractors, government, and web searches. Some respondents included specific organizations, such as Fraser Basin Council, Columbia Mountains Institute of Applied Ecology, and BC Housing.

Deciding on CPD (Question 11)

Where respondents *learned* about CPD may have had some impact on how they came to *decide* on CPD. However, many appeared to weigh several factors, such as travel (Figure 6). Fourteen percent of total responses were 'other'. These respondents tended to be highly deliberate in their selections. Some weighed ease of attending, including cost, travel, scheduling, child care, and courseware design (e.g., self-directed). Some considered recommendations by employers or managers, reputation of institution, relevancy to work or career goals, competencies and opportunities for advancement, organizational needs, themes or trends, skill-building with technical equipment, knowledge of codes and regulations, networking, and community engagement. Discussions with colleagues often played a role.

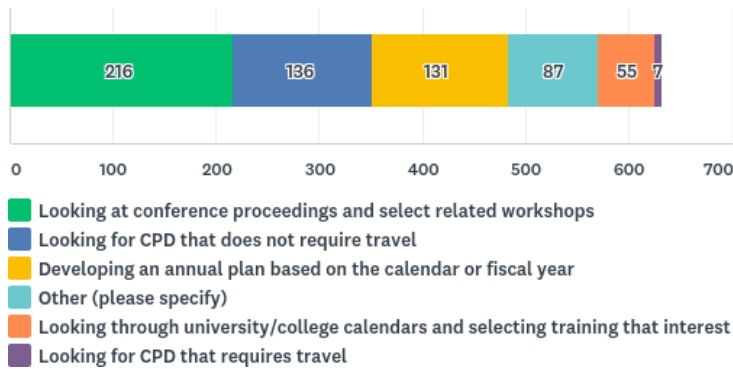


Figure 6. Deciding on CPD

Learning approaches (Question 12)

Respondents had a range of learning approaches or styles, including independent and self-paced (65%), interdisciplinary (43%), credential-based (37%) and intensive or focused time to learn deeply (34%) (Figure 7).

‘Other’ responses (6% of total responses) included hands-on, onsite or field training; face-to-face; applied (“i.e., grounded in projects, whether real or hypothetical”); learning by doing; on the job; “college courses”; local, regional; “staying connected with my community”; expert-led; mentoring; “learning by assisting/teaching/working with senior customer engineers and research centres developing new processes”; “active learning”; “passive - reading, listening”; and “idiosyncratic”.

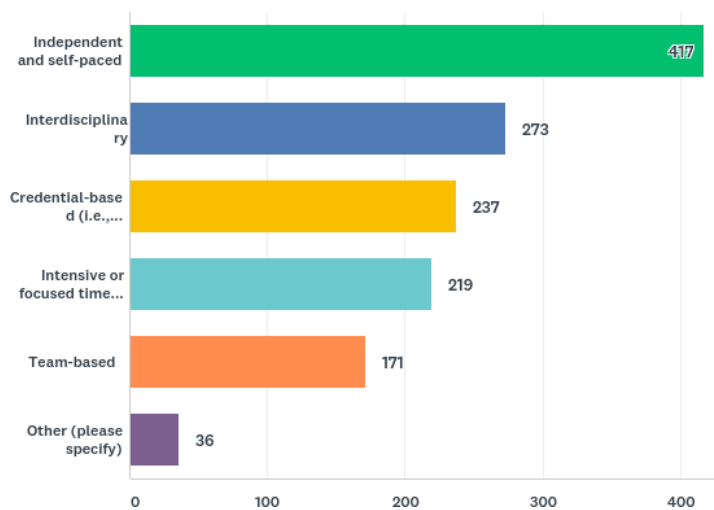


Figure 7. Learning approaches

Specific responses of note included:

- *Keeping CPD topics practical and targeting to specific industries/application would be more beneficial than generalized topics. If the scope is too wide it is likely not to be useful.*
- *Make it online, provide certification opportunities*

- *As someone who has worked in CC adaptation in an earlier job, I find most related CPD spends far too much time on basic information rather than the specifics of the situation and what that specific person can teach to others.*
- *Climate Change knowledge is changing rapidly. CPD should be short, intense, and frequent as it risks quickly becoming out of date. Monthly, quarterly or semi-annual updates on specific topics would be good, for example - like on-going forums.*
- *Will there be a certificate, or a way to recognize the CPD into my area of practice?*
- *Prefer something that is online and a maximum length of one day at a time*

Cost (Questions 10, 13 and 14)

More than 28% of respondents (or their employers) spent between \$300 and \$800 on their CPD each year, and 21% spent more than \$800. Yet, cost was a factor for many.

When respondents were asked what their top three choices for learning would be if cost was *not* an issue, they prioritized:

- in-person workshops (e.g., full day) (51% of all responses),
- in-person workshops associated with a professional conference (e.g., half day) (38%),
- multi-day intensive in-person courses (30%), and
- in-person workshops (e.g., half day) (29%).

When cost *was* an issue, they chose:

- self-directed online courses (41%),
- brief online courses (e.g., 1 hour) (36%),
- short live webinar with opportunity to ask questions and hear others' questions (e.g., 1 hour) (32%), and
- online short courses (e.g., 1 day) (30%).

Specific responses of note included:

- *Need combination of carrots and sticks. Early adopters will always adopt, laggards will always lag, need standardized mandate at the professional practice and/or provincial level to ensure adoption*

CLIMATE CHANGE ADAPTATION

Knowledge of climate change (Question 19)

Most respondents perceived their own understanding to be good (40%) or moderate (32%) (Figure 8).

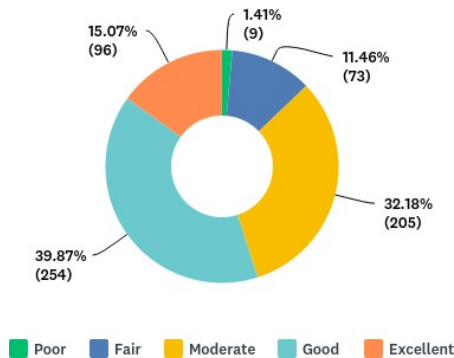


Figure 8. Perceived understanding of climate change.

Specific responses of note included:

- There is... *“limited understanding among other professionals of immediacy of climate-related risks”*; [it’s an] *“inherent challenge of garnering attention for issues that are low probability and high consequence.”*
- *I feel like I still need the basics. To have some sort of program to take us through basics to comprehensive, detailed oriented action based learning would be the best possible situation*
- *Of course, it is not just about “adaptation” to the effects of climate change in fact, it is equally important to concentrate on resilience*
- *I think any CPD offered should try and be rich in actual applicable tools for professionals. A good number of us are familiar with the principles but lack the technical knowledge to put them to practice.*
- *Natural resource professionals need to learn to work with the complexity of social-ecological systems: to support systems thinking, and interdisciplinary and integrative problem solving, and be more effective communicators, leaders, and collaborators.*
- *Climate change awareness basic education should include physics, chemistry, biology, history and sociology topics as they relate to CC. Cause and effect of industrial processes, food chain analysis, pollution prevention and rapid deployment of alternate energy generation must be included in the package*

Twenty-three people (3.3% of all respondents) were probable climate skeptics, based on their comments in open-ended questions. Eighty-seven percent of these skeptics rated their understanding of climate change as good or excellent (Figure 9).

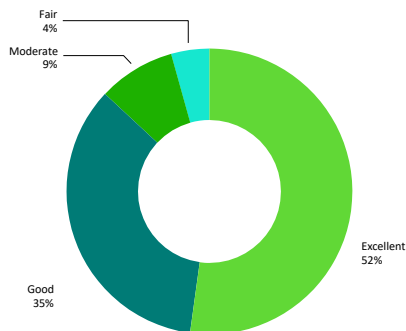


Figure 9. Skeptics' perceived understanding of climate change

Specific responses of note included:

- *CPD must be evidence and science based. All view points should be considered.*
- *Don't waste professional development time on this, better spent on building methods and materials training, etc.. and NEVER make it mandatory*

Awareness of tools and frameworks (Question 23)

A third of all respondents agreed with the statement, "I am aware of climate change adaptation-specific tools and frameworks relevant to my field," but only 8.5% strongly agreed. Nearly a third were neutral, and more than 26% disagreed or strongly disagreed, suggesting there is a need and opportunity to improve this measure.

Specific responses of note included:

- *"BEC [Biogeoclimatic Ecosystem Classification] and site series are effectively changing but not in simple linear ways. Finding ways to plan for drought, early spring, late fall, warm winters is key."*
- *Ideally, completed trials or adaptive mgmt techniques that are critiqued and discussed. Examples either in mgmt applications or in academic work.*
- *Weather modeling for rainfalls and soil reactions to the increased rainfall, quick snow melt, and a method of ranking the terrain for slips and mass movements.*
- *Adaptation tools for large scale public infrastructure that cannot be moved are needed for major projects. Adaptation tools for transportation planning are also necessary*

Previous climate change CPD (Question 20)

Most respondents had not taken climate change adaptation CPD (61%, n=387).

Currently considers climate change adaptation at work (Question 22)

A majority of respondents claimed to consider climate change adaptation into their work (54.5%) (Figure 10).

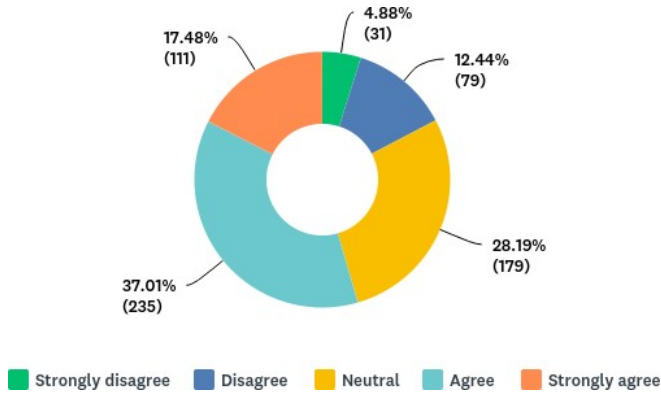


Figure 10. Currently integrate a consideration of climate change adaptation in my work.

Specific responses of note included:

- *“My work flow has specific requirements to ensure sample quality. I already take efforts to reduce climate change wherever possible.”*

Motivated to consider climate change at work (Question 16)

A majority of respondents were motivated to understand and consider the impacts of climate change in their work (88%)(Figure 11).

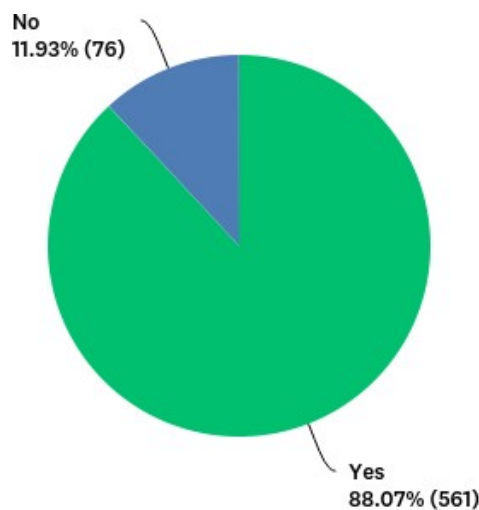


Figure 11. “I am motivated to understand and consider the impacts of climate change.”

Expects to consider climate change adaptation at work (Question 21)

Most respondents believed their work “requires, or will require, an understanding and integration of climate change adaptation” (38% agreed, and 39% strongly agreed, for a total of 77%) (Figure 12).

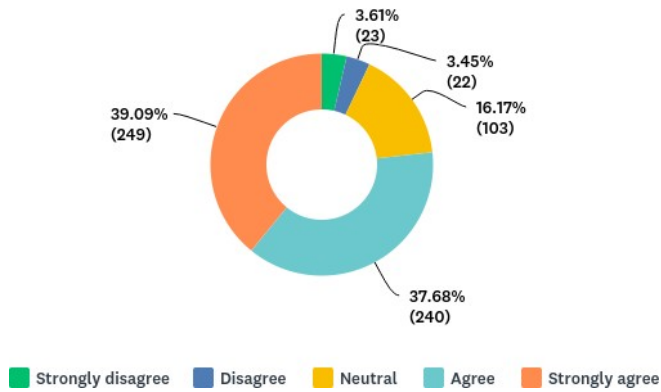


Figure 12. Work requires or will require a consideration of climate change adaptation in my work.

Specific responses of note included:

- [There is a need for the]... *“integration of a number of key elements... working landscape planning that incorporates biodiversity, impact of climate change, impact of urbanization or population growth, impact of landscape health, economic health, just to name a few.”*

Motivated to take climate change adaptation CPD (Question 17)

Still a large majority of respondents were motivated to take climate change adaptation CPD (82%) (Figure 13). At least 80% of respondents would take climate change adaptation CPD within the timeline of the *Adaptation Learning Network* project (Figure 14).

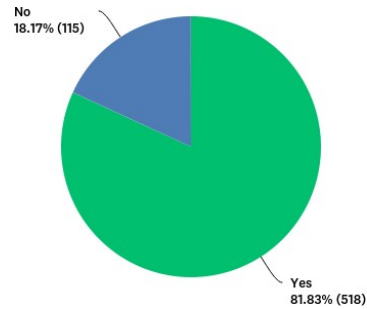


Figure 13. "I am motivated to take climate change adaptation CPD."

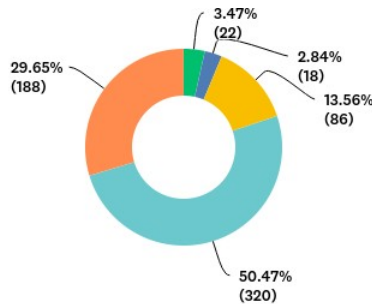


Figure 14. "I would take climate change adaptation CPD in the next 1-3 years if it were available."

Legend for Figure 14: Strongly disagree (Green), Disagree (Blue), Neutral (Yellow), Agree (Light Blue), Strongly agree (Orange)

CPD interests (Question 15)

What did BC professionals wish to learn? Of greatest interest were applied, advanced principles, concepts, and processes specific to one's profession (60%), followed by technical knowledge and practices (47%) (Figure 15). A significant proportion of respondents were interested in learning about the application of basic principles (42%), and interdisciplinary scenarios and experiences focused on sharing knowledge and practices (40%). Nearly a third wanted to learn to use specific adaptation tools.

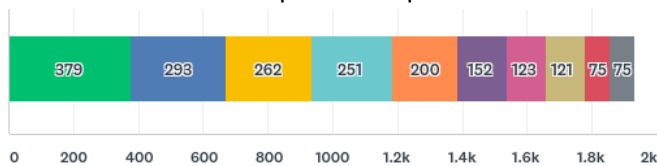


Figure 15. Climate change adaptation CPD of greatest interest.

Legend for Figure 15:

- Application of advanced principles, concepts, processes specific to my profession
- Technical and sector specific knowledge and practices
- Application of basic principles, concepts, processes specific to my profession
- Cross disciplinary scenarios/experiences focused on sharing knowledge, practice:
- Training in the use of specific adaptation tools
- Multi-sector regional/local case studies
- Basic concepts, principles and processes of climate change and adaptation
- Sector specific regional/local case studies
- Sector-specific provincial case studies
- Multi-sector provincial case studies

Respondents were asked to identify the climate change adaptation CPD of greatest interest to them, by selecting their top 3 choices among 10 options.

- I'd be interested in... *"Knowing what tools exist, if regulations exist and how to make effective decisions using these tools"*
- I'd be interested in knowing the... *"level of certainty currently available when making decision 20-50 years out"*.

Discipline/sector-specific or Interdisciplinary/cross-sector (Question 24)

With whom did they wish to learn? More than 62% of respondents recognized the benefits of discipline and sector-specific CPD, as they agreed (50%) or strongly agreed (12%) that "the most effective climate change adaptation CPD would bring professionals together within my discipline/sector". In a separate question, a greater proportion of respondents (74%) thought the most effective climate change adaptation CPD would bring professionals together from multiple disciplines/sectors (49% agreed, 25% strongly agreed).

Specific responses of note included:

- *"Basically, integration/collaboration of all disciplines involve with the Project Design in considering climate change."*
- *If there could be courses offered that were discipline/industry specific that would be great.*
- *Making it relevant to one's own profession or discipline is helpful to actually engaging in it as CPD.*
- *All sectors, government and industry, and the general public need to know what can be done... make this as interdisciplinary as possible please :)*

Rationale for taking CPD (Question 18)

What would motivate BC professionals to take climate change adaptation CPD? Most respondents wished to take CPD for professional training (72%), and/or to develop or participate in an interdisciplinary or discipline-specific climate change adaptation learning community (62% and 54% respectively, reiterating the sector and cross-sector findings above) (Figure 16).



Figure 16. Reasons for taking climate change adaptation CPD.

Respondents were asked to select their top 3 choices. Selections that are cut off in the chart should read, "learning community focused on climate change adaptation issues and practices".

PRIORITY CLIMATE CHANGE ADAPTATION ISSUES

Survey question #28, “What issues related to climate change adaptation do you see as a priority for your profession and/or for your discipline?” drew 450 responses. The total number of categorized issue responses was 618; many respondents offered responses in multiple issue categories.

In our analysis, Seventy-four (74) issue categories were identified, some noted only once, with one category being noted across all professions with a high of 101 mentions (“water management-planning”); as this was not a statistical survey, categories with only few counts may still be important as a courseware topic.

Approximately 12 percent of the respondents were members of more than one profession, and this led to a broader spectrum of responses including multiple issue categories.

Almost 20 percent of the categorized issue responses were some of same kind of “challenge areas” identified in the responses to Question #27 – e.g., costs; data gaps; funding; frameworks; knowledge gaps; integration into practice; policies, regulations, practices; standards, guidelines, tools; etc. These challenge areas are noted in yellow in Table 1.

While there is clearly some relationship between the kind of issues and the profession (e.g., foresters noted “forest management-planning” related issues more than other professions), this correlation appeared to be minimal.

Excluding the responses that were more akin to ‘challenge’ areas (as noted above), the following issue topics were mentioned most prevalently (15 and above mentions).

- a. **water management-planning – 101**
- b. **ecosystem management-planning – 35**
- c. **wildfire management-planning – 35**
- d. **building/construction design – 25**
- e. **forest management-planning – 18**
- f. **sea level management-planning – 17**
- g. **agriculture management-planning – 16 (note – crop, grassland and soil management-planning would add 9 more)**

More detailed subject matter information for each of these issue areas, and hence potential courseware topics and content, can be gleaned from the detailed responses within the raw response information presented in the Appendix E.

Table 1 below provides a summary of the issue categories by profession sorted by the prevalence of their mentions. Categories with total mentions of 10 and above are shaded blue.

Again, those responses that were more akin to ‘challenge’ areas are highlighted in yellow.

Those responses categories with total mentions fewer than 10 are presented in the following pages.

Table 1 - Summary of Issues Categories (sorted by prevalence of mentions)

CATEGORY	AGR	BIO	E&G	FOR	LA	PLN	TECH	OTHR	Total*:
WATER MANAGEMENT-PLANNING	28	19	7	2	15	3	24	3	101
ECOSYSTEM MANAGEMENT-PLANNING	10	19	1		5				35
WILDFIRE MANAGEMENT-PLANNING	18	5	2	4	3	2	1		35
KNOWLEDGE GAPS	8	11		2	1	2	6	2	32
INTEGRATION INTO PRACTICE	3	12	2		4	3	5	1	30
BUILDING/CONSTRUCTION DESIGN		1			4		14	6	25
FOREST MANAGEMENT-PLANNING	4	4		10					18
SEA LEVEL MANAGEMENT-PLANNING			1		8		7	1	17
AGRICULTURE MANAGEMENT-PLANNING	12	1		1	1	1			16
ECOSYSTEM/HABITAT MANAGEMENT-PLANNING	2	10		2					14
INFRASTRUCTURE MANAGEMENT-PLANNING	1	2	3			2	4	2	14
POLICIES REGULATIONS	2	3	1	1	1		4	1	13
ENERGY MANAGEMENT-PLANNING			1			1	6	4	12
PUBIC ENGAGEMENT EDUCATION	4	1	2			1	3	1	12
LAND MANAGEMENT-PLANNING	4	5	1			1			11
EMISSIONS MANAGEMENT-PLANNING	4	1				1	3	1	10
EXTREME WEATHER PLANNING-RESPONSE	1				2		6	1	10

CATEGORY	AGR	BIO	E&G	FOR	LA	PLN	TECH	OTHR	Total*:
VEGETATION MANAGEMENT-PLANNING	1	1			6				8
KNOWLEDGE GAPS GENERAL	3		1			1	2		7
LANDSCAPE DESIGN					7				7
WASTE MANAGEMENT-PLANNING	1						6		7
CROP MANAGEMENT-PLANNING	5	1							6
INTEGRATION ACROSS SECTORS	1	1			1	2	1		6
COASTAL ZONE MANAGEMENT-PLANNING		1			1	1	2		5
FISHERIES MANAGEMENT-PLANNING	1	4							5
OCEAN MANAGEMENT-PLANNING	3	2							5
TRANSPORTATION MANAGEMENT-PLANNING		1				1	3		5
COMMUNITY PLANNING	1	2			1				4
FOOD MANAGEMENT-PLANNING	3				1				4
FOREST HEALTH	2	2							4
FUNDING	2						1	1	4
HEALTH PHYSICAL/MENTAL CARE	1	1			1			1	4
KNOWLEDGE INFORMATION SHARING NETWORK	1	2				1			4
RECLAMATION MANAGEMENT-PLANNING	2	1				1			4
STANDARDS GUIDELINES TOOLS	3						1		4
AIR QUALITY MANAGEMENT-PLANNING		1		1	1				3
DATA GAPS	1			1			1		3
EMERGENCY RESPONSE MANAGEMENT-PLANNING	2						1		3
GRASSLAND MANAGEMENT-PLANNING	3								3
LEADERSHIP						2	1		3
NATURAL DISASTER MANAGEMENT-PLANNING	1				1		1		3
PEST MANAGEMENT-PLANNING	3								3
(WILD)FIRE MANAGEMENT-PLANNING					1		1	1	3
AQUATIC ECOSYSTEM MANAGEMENT-PLANNING		1			1				2
COST	1						1		2
CUMULATIVE EFFECTS MANAGEMENT-PLANNING		1		1					2
ECONOMIC PLANNING						1		1	2

CATEGORY	AGR	BIO	E&G	FOR	LA	PLN	TECH	OTHR	Total*:
HAZARD MANAGEMENT-PLANNING						2			2
INDIGENOUS PEOPLES IMPACTS	2								2
INSECT AND DISEASE MANAGEMENT-PLANNING				1	1				2
MITIGATION	2								2
SOIL MANAGEMENT-PLANNING	1				1				2
TERRAIN/NATURAL DISASTER MANAGEMENT-PLANNING			2						2
WIND MANAGEMENT-PLANNING	2								2
ALTERNATIVE ENERGY DEVELOPMENT	1								1
ALTERNATIVE FEED DEVELOPMENT	1								1
DEVELOPMENT OF TECHNOLOGIES	1								1
DISEASE MANAGEMENT-PLANNING	1								1
ENVIRONMENTAL ASSESSMENT	1								1
FACILITIES MANAGEMENT-PLANNING	1								1
HEALTHCARE	1								1
HUMAN CENTRED DESIGN					1				1
INDIGENOUS ECOSYSTEM/HABITAT MANAGEMENT-PLANNING	1								1
INDIGENOUS VALUES AND RECONCILIATION		1							1
INDUSTRY CLEAN ENERGY ADOPTION	1								1
INDUSTRY DEVELOPMENT PLANNING	1								1
INFORMATION FRAMEWORKS	1								1
MONITORING		1							1
NURSERY MANAGEMENT-PLANNING					1				1
PLANNING LONG-TERM						1			1
PROFESSIONAL FRUSTRATION						1			1
RECREATION MANAGEMENT-PLANNING					1				1
SOCIAL BEHAVIOUR CHANGE COMMUNICATION						1			1
URBAN PLANNING AND DESIGN						1			1
Total relevant responses*:	160	118	24	26	71	33	105	27	564
Total responses:	176	128	27	28	75	35	120	28	617

CLIMATE CHANGE ADAPTATION CHALLENGES

There were 462 responses to question 27, “What specific **challenges** do you face in integrating a consideration of climate change risks and adaptation in your work?”

Total number of categorized challenge responses is 499, with some respondents offering responses in more than one category.

In examining the responses, there appeared to be no meaningful trends related to any particular professional group, therefore all 462 responses were analyzed together.

The 499 categorized responses were first divided into what we termed ‘practice-specific knowledge challenges’ and ‘more generic challenges’.

The practice-specific challenges related to the categorization of ‘issues’ discussed in the previous section of this report, whereas the more generic challenges were of a different nature and order. The practice-specific challenges were as follows:

PRACTISE-SPECIFIC KNOWLEDGE CHALLENGES

- *Agriculture/Crop Management*
- *Agriculture/Grazing Management*
- *Agriculture/Livestock Management*
- *Air Quality Management*
- *Water Management*
- *Ecosystem Management*
- *Ecosystem Habitat/Wildlife Management*
- *Fisheries Management*
- *Aquatic Ecosystem Management*
- *Ocean/Marine Ecosystem Management*
- *Vegetation Management*
- *Forest Management*
- *Landscape Level Planning*
- *Wildfire Management*
- *Land Development*
- *Built Environment*

- *Ecosystem Reclamation Restoration Management*
- *Chemical Analysis Interpretation*
- *Emergency Response Management*
- *Community/Social Services*
- *Electric Vehicle Management*

MORE GENERIC CHALLENGES

The more generic challenge categories and subcategories were also of two somewhat different natures. Some focused on what might be termed ‘content’ challenges (ie a framework for more generic, cross-practice course content), while some were more focused on what might be termed ‘barrier’ challenges (ie challenges to be addressed or overcome if we are to move forward). One challenge, cultural change, appeared to be a more universal challenge. These challenges were formed into the following hierarchical typologies:

CONTENT CHALLENGES

DATA CHALLENGES

- *Data Access*
- *Data Completeness (Fitness-For-Purpose)*
- *Data Costs*
- *Data Integration*
- *Data - Meta*

KNOWLEDGE CHALLENGES

- *Currency*
- *Modelling*
- *Cause-Effect Understanding*
- *Knowledge Gap – Clients (see also Client Receptivity to CCA)*
- *Knowledge Gap - Others*
- *Research*

FRAMEWORKS, PROCESSES AND TOOLS (BEST PRACTICES) AND INTEGRATION RELATED CHALLENGES

- *Directory*
- *Framework, Process, Approach*
- *Integration, Multi-Disciplinary*
- *Knowledge Translation*
- *Decision Making, Tools*

POLICY-REGULATION, STANDARDS-GUIDELINES RELATED CHALLENGES

- *Standards*
- *Policy-Regulation*

CULTURAL CHANGE / SKEPTICISM RELATED CHALLENGES

BARRIER CHALLENGES

COSTS, RESOURCES, TIME, SCOPE, AND NETWORK RELATED CHALLENGES

- *Costs - Generally*
- *Costs to Client*
- *Costs – Capital*
- *Cost Perceptions*
- *Costs - Business Case*
- *Resources - Funding*
- *Time - Scope*
- *Network – Community Of Practice*

CULTURAL CHANGE / SKEPTICISM RELATED CHALLENGES

CLIENT RECEPTION TO THE CLIMATE CHANGE ADAPTATION CHALLENGE

LEADERSHIP RELATED CHALLENGES

CLIMATE CHANGE SKEPTICISM

Appendix F lists the categorized, detailed responses using the above classifications.

EXCELLENT CPD COURSES

In response to question 29, “Have you participated in a CPD course that you thought was excellent? What specifically made that course effective?”, 313 respondents shared positive opinions of courses that were online, local, regional, national, and international. They provided information on a wide range of topics ranging from seed transfer to Antarctica.

The general consensus was that for courses to be effective they must have all or most of the following characteristics:

- Be practically oriented, such as including case studies or be delivered on site or in a location where there can be practical hands on learning.
- Have a skilled facilitator and include high levels of interaction
- Be strongly science based
- Be interdisciplinary
- Provide useful tools and resources to take away and share with colleagues
- Be intensive in terms of time and content – generally short courses are preferred, one or two day max
- Reasonably priced.

Question 30 added to this understanding. - *Is there any other information that you think would be important to know about climate change adaptation CPD?*

This ‘any other information’ question gave respondents an opportunity to make any key, final points that they thought important. Of the over 700 respondents, 178 provided comments. The main themes noted in these final comments are noted below. A selection was made of those thought to be most reflective of the general themes. These 47 comments are noted in the appendix and many have been inserted earlier in this report as quotes.

The following are some broad themes:

Learning approach

Numerous responses reinforced previous comments on how the CPD learning should be delivered, such as:

- Make it practical – include case studies
- Target to specific industries/application.
- Online delivery - webinars or other virtual platform
- Certification incentives – a combination of carrots and sticks
- Courses should be short, intense, and frequent such as with monthly, quarterly or semi-annual updates - a maximum length of one day at a time
- Be offered in various packages from basic to comprehensive

Interdisciplinary approaches (or not)

There were two views – one that courses should be inter-disciplinary, one that they needed to be discipline or professional organization focused.

It's broader than 'adaptation'

Many respondents stressed that it is more than climate change ‘adaptation’ – prevention, mitigation, increasing community resilience were also noted as needing to be part of CPD courses.

The science is important

Many respondents wanted more basic science and evidence included in all courses.

Linkage to First Nations

Several respondents noted the importance of working with First Nation groups to bring their visions and goals to life.

Partners

A wide range of partners in this venture was noted. They included specific organizations, but also the need to involve and to connect with others working in the same area:

- municipalities, local government, provincial government
- community leaders
- other regions of the world - 'sister' regions

The bigger picture

Various comments noted that climate change adaptation was in many ways a subset of broader ideas and challenges. Comments included these kinds of phrases:

- *learn to work with the complexity of social-ecological systems:*
- *support systems thinking, and interdisciplinary and integrative problem solving*
- *be more effective communicators, leaders, and collaborators.*
- *A basic and unified definition of climate change adaptation.*
- *Need to frame this around a regenerative future, not doom and gloom*
- *Need to integrate the environmental, economic and social issues, impacts and aspects*
- *existing hazard/risk. This is the core competency that needs to be developed (risk management, liability, ethics) before you can talk about adaptation, which is a gradual increase in existing natural hazards.*
- *essential to understand how the dots are connected - from how we cause climate change, to how it impacts us, to how we can and must urgently mitigate and adapt to it and how the future in a low carbon, resilient and equitable world will be so much better than what we have now.*

Professionalism

While only a few responses, this one comment stood out:

- *As a component of CPD, this is a professional reliance issue. With the College of Applied Biology, how will climate change adaptation integration, which by its nature is dynamic and open to varying interpretation, be applied with respect to Codes of Ethics/Practice. This is a slippery slope where Professionals are potentially being required to conform to political based policy/positions as opposed to "formulate and present opinions, conclusions and recommendations from an impartial and factual science base" (CAB Code of Ethics). Who gets to decide what is acceptable CPD and what is not?*

The full set of identified comments are segmented by professional group in the appendix.

Part 2 of the question asked: *Have you participated in a CPD course that you thought was excellent? Can you provide the name of the course and by whom it was offered?*

Summary

- Almost every respondent noted a different course. This reflects the variance in the jobs that these professionals do and the impacts of climate change on their particular work area.
- It also indicates that there are lots of courses already offered – looking for gaps will be a challenge at this aggregate level, although it is true that responses when segmented by professional association also noted the high numbers of courses and their variety. Rather than look to developing new courses, an alternative approach might be to identify courses which meet certain criteria and promote these through some kind of integrative learning framework.

Detailed responses to both parts of this question are presented in the Appendix G.

IMPLICATIONS

The survey received excellent response from over 700 members of the seven professional organizations. Those results painted a vivid picture of the needs and desires of members for continuing professional development courses focused on climate change adaptation. In particular the richness of response to the qualitative questions will provide the Adaptation Learning Network Project with evidence-based information that helps to address four key questions:

1. What would be the features/characteristics of an excellent CPD course?
2. What on the priority practice areas for CPD course development?
3. What are the priority climate change adaptation challenge areas that should inform the design of a consistent organizing framework for all CPD courses?
4. What are the barriers to adequately addressing firstly CPD course development and delivery, and secondly, in the broader context, climate change adaptation more generally?

Characteristics of Excellent CPD Courses

Respondents noted the following characteristics:

- Be practically oriented, such as including case studies or be delivered on site or in a location where there can be practical hands on learning.
- Have a skilled facilitator and include high levels of interaction
- Be strongly science based
- Be interdisciplinary
- Provide useful tools and resources to take away and share with colleagues
- Be intensive in terms of time and content – generally short courses one or two day max
- Well priced.

Priority Practice Areas

Respondents noted the following priority practice areas:

- Water management-planning
- Ecosystem management-planning
- Wildfire management-planning
- Building/construction design
- Forest management-planning
- Sea level management-planning
- Agriculture management-planning

CPD Course Content/Organizing Framework

Respondents noted the following organizing framework:

- Data challenges
- Knowledge challenges
- Frameworks, processes and tools (best practices) and integration related challenges
- Policy-regulation, standards-guidelines related challenges
- Cultural change / skepticism related challenges

Barriers to activating CPD courses and more generally addressing climate change adaptation

Respondents noted the following barriers that would need to be overcome:

- Costs, resources, time, scope, and network related challenges
- Cultural change / skepticism related challenges
- Client reception to the climate change adaptation challenge
- Leadership related challenges
- Climate change skepticis

Appendix - Table of Contents

Appendix A. Scoping Study	29
Appendix B. Kresge Foundation Survey	33
Appendix C. Survey Questions	34
Appendix D. Other Organizations	43
Appendix E. Priority Issues Coding Results and Scheme	47
Appendix F. Facing Challenges Coding Scheme and Results	64
Appendix G. Excellent CPD Courses	91

Appendix A. Scoping Study

The *Adaptation Learning Network: Inspiring Climate Action Project* builds upon the findings from a scoping study of Continuing Professional Development (CPD) for climate change adaptation, conducted by the Pacific Institute for Climate Solutions (PICS) in collaboration with the Adaptation to Climate Change Team (ACT) at Simon Fraser University. Below is a brief summary of that report highlighting information that forms an important component of the foundation for this current project.

Summary

The *Continuing Professional Development For Climate Change Adaptation: Scoping Study* took its cue from a 2018 report of the Auditor General of BC which examined the province's performance in addressing climate change risks through adaptation and mitigation.¹ That report recognizes the role professionals play in climate change adaptation and the need to develop continuing education programs focussed on the impact of climate change and how it will affect the day-to-day work of these practitioners. Similarly, previous work by ACT concluded that education is an important opportunity for moving forward on addressing climate change.² The study was also informed by a Professional Reliance Review by the Province, which recommended required Continuing Professional Development for natural resource professionals.³

Funded by the Climate Action Secretariat of the BC Ministry of Environment and Climate Change Strategy, the study examined how practicing professionals could be better prepared to consider climate change adaptation as they design and plan infrastructure and services in British Columbia. While this work begins to address the complex question -- *What constitutes a well-educated professional when it comes to climate change adaptation?* -- the more immediate objective of the study was to determine whether and how CPD could be used to educate BC professionals on climate change adaptation.

¹ Auditor General of British Columbia. (2018). *Managing Climate Change Risks: An Independent Audit Report*.

² Crawford, E. & Raftis, C. (2018). *Professionals' Best Practices for Low Carbon Resilience: Summary of Phase One Engagement of Professionals and Professional Associations and Proposed Research Agenda*. Adaptation to Climate Change Team (ACT). Report.

³ M. Haddock (2018), *Review of Professional Reliance in Natural Resource Decision-Making*. Independent Report Prepared for the Government of British Columbia.

Project components

The study undertook three complementary activities to generate data to answer its organizing question. First, the study collected and analyzed professional associations' CPD requirements and available course offerings related to climate change adaptation to identify current best practices in BC, Canada, and other jurisdictions. The analysis of CPD requirements from 35 different professional groups showed similar requirements in terms of the amount of CPD but very different approaches to compliance. What qualifies as CPD tends to be defined rather liberally.

The scan focussed on professional groups with direct contact with climate change adaptation issues such as engineers, planners, architects, landscape architects, foresters, biologists, as well as supporting professions such as accountants and lawyers. While the research did not find any comprehensive training on climate change adaptation, it identified numerous *one-off* courses. These courses use a range of delivery modes, varying approaches to evaluating participant performance, and differing scopes and lengths of curricula. While not exhaustive, the material reviewed was representative. This component of the study concluded that there is “a lack of education and training designed to help professionals gain core adaptation knowledge and upgrade existing qualifications and skills [in climate change adaptation]” (p. 7) and that general education on climate change adaptation education is by specific professions as well across disciplines. Such educational material is not currently available in British Columbia or common in Canada or other jurisdictions.

The second study component was a day-long workshop that brought together representatives of professional organizations and key sectors as well as continuing education experts to assess the potential for using CPD to provide education on climate change adaptation to a range of BC professionals. The workshop, entitled *Continuing Professional Development: Building Capacity For Climate Action*, involved 28 participants primarily from the Lower Mainland in discussions of what education is needed and how best to provide that education. Discussions included preferred form, content, key principles, and delivery options for climate change adaptation education and clarified that professional organizations do not see themselves as leaders in educating in this area but support the development of curriculum for continuing professional development. A central and important tension that emerged was between discipline-specific training and multidisciplinary education. Workshop participants emphasized the importance of highlighting the benefits of professional development for course participants, the need to motivate interest in CPD programs, the importance of establishing a relationship between

participants and educators, a preference for short modules and practice-based case studies, and the need to foster communities of continuous learning.

The third and final part of the project involved telephone interviews with 26 practicing BC professionals with questions designed to test the conclusions derived from the workshop. Although constrained by the time of year (summer) and availability of participants, the interviews solicited considerable information about climate change adaptation and attitudes towards continuing professional development generally and CPD on climate change adaptation. Participants expressed a need for both general curriculum and more in-depth profession-specific education. Significantly, a multidisciplinary approach to learning about climate change adaptation was seen as providing a more comprehensive perspective necessary to all planning and development. Local delivery of CPD was seen as desirable; however, annual conferences were also noted as venues for this learning.

Recommendations and Next Steps

While the project was constrained by time and size, the small but representative sample of participants provided adequate and consistent data on which to base a set of recommendations. In general, the study concluded thus:

By combining expert oversight with design from continuing education and content development and delivery with and by experts, we are confident a strong core of educational material on climate change adaptation can be created that will serve the province of British Columbia extremely well and which may be extended to serve the needs of other jurisdictions in Canada.

In addition to the overall conclusion that CPD general and sector-specific courses on climate change adaptation be developed and delivered in collaboration with professional associations, the project recommended that such CPD course offerings:

- build in learner motivation as part of course design and emphasize the benefit of CPD to professionals
- be delivered both locally and centrally, as part of professional organizations' annual events
- be presented as a set of courses ranging from general knowledge to profession specific with

the option to gain certification on completion of a specified set of offerings

- build on existing CPD programs and professionals' areas of interest and expertise

- demonstrate to professionals how their existing skills are relevant to the climate change adaptation
- foster a community of continuous learning for participants with ongoing access to resources and data

Next Steps: Adaptation Learning Network project

The current project, *Adaptation Learning Network: Inspiring Climate Action*, will build from the findings of this exploration by:

- 1) surveying a broader sample of professional association members to validate and extend the study findings;
- 2) engaging key stakeholders, many of whom participated in the study, in a dialogic process to work with the study findings and the survey to develop a prioritized list of CPD topics, training modalities, and climate change adaptation competencies to inform the design and delivery of climate change adaptation CPD training offerings in BC; and support a professional community of learning focused on climate change adaptation.

Appendix B. Kresge Foundation Survey

Themes

- Professionals listened to their peers, suggesting a need to find champions within each profession.
- Competing priorities were perceived as more imminent, limiting climate action.
- Most viewed climate change within a sustainability frame or a disaster preparedness/resilience frame.
- To enable professionals to act, it is necessary to bridge the science-policy divide and educate the public to demand more climate action.
- Professionals tend to have a depth of knowledge in one area but lack the breadth of knowledge to deal with wicked problems.
- Larger reports were less likely to be used than concise, interactive, ‘pithy’ resources based on professionally relevant information.
- Young professionals, and a small subset of progressive members, were often drivers of climate and sustainability work.
- Professional organizations collaborate extensively.
- Water was predominant among climate issues.
- Professionals hungered for metrics/indicators and standards of practice for resilience and climate work.

Recommendations

- Create a “standard-bearer road show”, identifying members doing exemplary work and providing them with a platform to share their stories with peers;
- Create a mechanism for stories to be collected and shared;
- Create a professional society peer learning network, to promote peer learning across organizations (e.g., Society of Adaptation Professionals);
- Regularly survey memberships to understand their current knowledge base around climate change, what climate-related resources they are using, what resources they need and want, and what they are individually doing around climate resilience.
- Invest in peer networking, through existing channels and creating new spaces.

Detailed findings are available at https://kresge.org/sites/default/files/library/env1007-psreport-0117_revised_11917.pdf

Appendix C. Survey Questions

Adaptation Learning Network: Inspiring Climate Action is an initiative led by Royal Roads University in collaboration with Natural Resources Canada and the BC Climate Action Secretariat.

We greatly value your input and ask that you take the time to complete the following survey (which builds on an earlier survey undertaken in 2018 by [Pacific Institute for Climate Solutions](#)).

Responding to the survey should take approximately 15 minutes.

Purpose: The Adaptation Learning Network Survey is intended to gather information from BC working professionals about their current understanding of climate change adaptation, and their interest in continuing professional development on this topic. Understanding training needs related to climate change is essential for increasing our shared capacity to respond effectively to climate change, now and in the future.

Benefits & Risks: You will receive no direct benefits from participating in this research study. In participating, you will have an opportunity to affect change in how continuing professional development for climate change adaptation is designed, distributed, and used. There are no foreseeable risks involved in participating in this study other than those encountered in day-to-day life.

Confidentiality: Your survey answers will be sent to a link at SurveyMonkey.com where data will be stored in a password protected electronic format. SurveyMonkey does not collect identifying information such as your name, email address, or IP address. Therefore, your responses will remain anonymous. All the responses gathered through this survey will be aggregated such that no responses will be identifiable by individual.

Contact: If you feel you have not been treated according to the descriptions in this form, or that your rights as a participant in research have not been honored during the course of this project, or you have any questions, concerns, or complaints that you wish to address you may contact the Research Office at Royal Roads University at 250-391-2600; or the Project Lead Dr. Robin Cox at 250-391-2600, extension 4855 or by email at robin.cox@royalroads.ca



You the professional

1. I belong to the following professional association(s):

- Applied Science Technologists and Technicians of BC
- BC Institute of Agrologists
- College of Applied Biology
- Planning Institute of BC
- Association of Professional Engineers and Geoscientists (Engineers and Geoscientists BC)
- Association of BC Forest Professionals
- BC Society of Landscape Architects
- Other (please specify)

2. I have been a member of my professional association for (years):

- <5
- 5-10
- 10-15
- 15-20
- 20-25
- 25-30
- >30

3. I currently work for the following types of organization(s) (select all that apply):

- First Nations Government
- Federal Government
- Provincial Government
- Municipal Government
- Regional District
- NGO
- Private Sector Company
- Independent Consultant
- Academic Institution
- Other (please specify)

4. My primary role is:

- Principal/senior management
- Supervisory/middle management
- Non-supervisory/non-management
- Consultant
- Mentor
- Other (please specify)

5. My primary job responsibilities are (select the top 3 that apply):

- Administrative/contract administration
- Business development
- Community engagement
- Construction services
- Design and development
- Field work
- Field work oversight
- Government liaison
- Planning
- Policy development
- Proposal preparation
- Project management
- Regulatory oversight
- Research
- Technical document preparation
- Other (please specify)

6. My job title is:

7. I have professional experience working with and/or for Indigenous Nations, communities or organizations.

Not at All To a Great Extent

8. My work focuses primarily in the following geographic area(s) (select all that apply):

- East Kootenay
- Central Kootenay
- Kootenay Boundary
- Okanagan-Similkameen
- Fraser Valley

- Metro Vancouver
- Capital
- Cowichan Valley
- Nanaimo
- Alberni-Clayoquot
- Strathcona
- Comox Valley
- Powell River
- Sunshine Coast
- Squamish-Lillooet
- Thompson-Nicola
- Central Okanagan
- North Okanagan
- Columbia-Shuswap
- Cariboo
- Mount Waddington
- Central Coast
- North Coast
- Kitimat-Stikine
- Bulkley-Nechako
- Fraser-Fort George
- Peace River
- Stikine
- Northern Rockies
- Entire Province
- Across Canada



Continuing Professional Development (CPD)

9. I learn about Continuing Professional Development (CPD) offerings primarily through (check all that apply):

- Opportunistic (happen upon)
- My association
- My employer
- Discipline-related mailing lists
- Local/regional college/university calendars
- Social Media (Twitter, Facebook, LinkedIn)
- Colleagues in my discipline
- Conference related brochures
- Other (please specify)

10. On average, I (or my employer) will spend this amount on my CPD annually:

- \$0
- \$1- \$100
- \$100-\$300
- \$300 - \$800
- More
- Unsure
- My employer supports annual CPD through paid time off to attend course(s) and/or provides a stipend to pay for course(s)

11. I primarily decide on my CPD by:

- Looking through university/college calendars and selecting training that interest me
- Looking at conference proceedings and select related workshops
- Developing an annual plan based on the calendar or fiscal year (on my own/or with employer)
- Looking for CPD that does not require travel
- Looking for CPD that requires travel
- Other (please specify)

12. My preferred approach to learning is (check all that apply):

- Independent and self-paced
- Team-based
- Interdisciplinary
- Credential-based (i.e., provides a certificate or other credential)
- Intensive or focused time to learn deeply
- Other (please specify)

13. If I were to participate in CPD where cost is NOT an issue, I would prefer (select your top 3 choices):

- Brief online course (e.g., 1 hour)
- Online short course (e.g., 1 day)
- Multi-day online course
- Self-directed online learning
- Massive Open Online Course (MOOC)
- Short (e.g., 1 hour) live webinar with opportunity to ask questions and hear others' questions
- Long (e.g., 3 hour) live webinar with opportunity to ask questions and hear others' questions
- Recorded webinars or podcasts
- One-off in-person lecture/class
- Series of in-person lectures/classes (multiple days over a few weeks or months)
- In-person workshop (e.g., half day)
- In-person workshop (e.g., full day)
- In-person workshop associated with a professional conference (half to full day)
- Multi-day intensive in-person course
- Full credential course
- Diploma or degree

14. If I were to participate in CPD where cost IS an issue, I would find the following options the most preferable (select your top 3 choices):

- Brief online course (e.g., 1 hour)
- Online short course (e.g., 1 day)
- Multi-day online course
- Self-directed online course
- Massive Open Online Course (MOOC)
- Short (e.g., 1 hour) live webinar with opportunity to ask questions and hear others' questions
- Longer (e.g., 3 hours) live webinar with opportunity to ask questions and hear others' questions
- Recorded webinars or podcasts
- One-off in-person lecture/class
- Series of in-person lectures/classes (multiple days over few months)
- In-person workshop (e.g., half day)
- In-person workshop (e.g., full day)
- In-person workshop associated with a professional conference (half to full day)
- Multi-day intensive in-person course
- Full credential course
- Diploma or degree

15. When thinking about taking CPD focused on climate change adaptation, I would find these of greatest interest (select your top 3 choices):

- Basic concepts, principles and processes of climate change and adaptation
- Application of **basic** principles, concepts, processes of climate change adaptation specific to my profession
- Application of **advanced** principles, concepts, processes of climate change adaptation specific to my profession
- Technical and sector specific knowledge and practices
- Training in the use of specific adaptation tools
- Cross disciplinary scenarios/experiences focused on sharing knowledge and practices
- Sector specific regional/local case studies
- Multi-sector regional/local case studies
- Sector-specific provincial case studies
- Multi-sector provincial case studies

16. I am motivated to understand and consider the impacts of climate change in my current work/profession.

- Yes
- No

17. I am motivated to take climate change adaptation CPD:

- Yes
- No

18. If you said yes to Q17, what is your motivation to take climate change adaptation CPD? (select top 3 choices):

- To take one or more courses as part of professional learning
- To take one or more courses to advance my firms competitive advantage
- To meet my employer's requirements for current job
- To meet my employer's requirements for promotion
- By desire for further professional credentialing (e.g., certificate)
- To develop and participate in a **discipline specific** learning community focused on climate change adaptation issues and practices
- To develop and participate in an **interdisciplinary** learning community focused on climate change adaptation issues and practices



Knowledge of Climate Change Adaptation

19. I would rank my understanding of climate change as:

Poor	Fair	Moderate	Good	Excellent
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

20. I have participated in climate change adaptation CPD previously:

Yes
 No

21. I believe my work requires, or will require, an understanding and integration of climate change adaptation.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

22. I currently integrate a consideration of climate change adaptation in my work.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

23. I am aware of climate change adaptation-specific tools and frameworks relevant to my field.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

24. I think the most effective climate change adaptation CPD would bring professionals together within my discipline/sector.

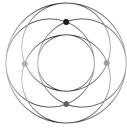
Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

25. I think the most effective climate change adaptation CPD would bring professionals together from multiple disciplines/sectors.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

26. I would take climate change adaptation CPD in the next 1-3 years if it were available.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



INSPIRING CLIMATE ACTION
BC PROFESSIONALS
ADAPTATION NETWORK

Inspiring Climate Action: BC Professionals Adaptation Network Survey

Open Ended Questions

27. What specific challenges do you face in integrating a consideration of climate change risks and adaptation in your work? [limit 150 characters]

28. What issues related to climate change adaptation do you see as a priority for your profession and/or for your discipline? [limit 150 characters]

29. Have you participated in a CPD course that you thought was excellent? What specifically made that course effective? Can you provide the name of the course and by whom it was offered? [limit 150 characters]

30. Is there any other information that you think would be important to know about climate change adaptation CPD? [limit 150 characters]

Appendix D. Other Organizations

Name of Association	Responses
Alberta Institute of Agrologists	2
Alberta Society of Professional Biologists	2
American Fisheries Society	
American Society of Heating, Refrigerating and Air-Conditioning Engineers	3
Appraisal Institute of Canada	
Architectural Institute of British Columbia	3
Association of Professional Biologists	3
Association of Professional Engineers Ontario	
Association of the Chemical Profession of British Columbia	
Board of Canadian Registered Safety Professionals	
British Columbia Institute of Technology	
British Columbia Association of Kinesiology	
British Columbia Landscape and Nursery Association	
British Columbia Water and Waste Association	3
Building Officials Association of British Columbia	2
Canadian Association of International Development Professionals	
Canadian Environmental Certifications Approval Board	
Canadian Fire Alarm Association	
Canadian Hospital Engineers Society	
Canadian Information Processing Society	
Canadian Institute of Quantity Surveyors	
Canadian Society of Landscape Architects	
Certified Ecological Restoration Practitioner	
Certified Electrical Safety Compliance Professional	
Community Energy Association	
ECO Canada	2
Ecological Society of America	
Environment Institute of Australia and New Zealand	
Environmental Operators Certification Program	
Fire protection	
Institute of Transportation Engineers	
International Coach Federation	
International Institute of Building Enclosure Consultants	
International Organic Inspectors Association	
Leadership in Energy & Environmental Design	
Licensed Electrician	
Ontario Association of Certified Engineering Technicians and Technologists	
Ontario Association of Landscape Architects	

Name of Association	Responses
Project Management Institute	2
Project Management Professional	
Registered Onsite Wastewater Practitioner	
Royal Architectural Institute of Canada	
Saskatchewan Applied Science Technologists and Technicians	
Society for Ecological Restoration	
Sports fishing advisory Committee	
The Association of Science and Engineering Technology Professionals of Alberta	
The Wildlife Society	

Appendix E. Priority Issues Coding Results and Scheme

Table 1. Coding results, part 1. For respondents belonging to more than one organization, responses are recorded for each organization (i.e., they are duplicated). "Other organizations" are not included. Results for learning priority issues are provided in Table 3.

Priority Issues	Prof Org	n Mentions	Total	Sample Comment
Agriculture	ABCFP	1	26	changing crops and the varieties that grow in the region
	BCIA	22		
	BCSLA	1		
	CAB	1		
	PIBC	1		
Air quality	ASTTBC	1	4	air quality, air quality management
	BCIA	1		
	BCSLA	1		
	CAB	1		
Clients	BCIA	2	3	"ensure clients see that CCA is a "must-do" and not a "nice to have"
	EGBC	1		
CCM/CCM-CCA	ABCFP	2	17	"complete, unequivocal focus on regenerative agriculture and food systems that seeks to mitigate CC, restore ecological integrity while adapting to inevitable climate change"
	ASTTBC	6		
	BCIA	7		
	CAB	2		
	PIBC	1		
Cost \$ of action, inaction	ABCFP	3	35	"Costs for home owners and businesses" "General economic downturn related to societal costs (e.g., flood damage, agricultural and food security, public health, etc.)"
	ASTTBC	10		
	BCIA	10		
	BCSLA	3		
	CAB	5		
	PIBC	4		
Discipline-related, interdisciplinary	ASTTBC	1	19	"ensuring professionals communicating about CCA do not stray into areas that are beyond their scope of practice/understanding" "finding ways to integrate disciplines in a meaningful way. CC will affect everything and transdisciplinary collaboration will be critical."
	BCIA	3		
	BCSLA	2		
	CAB	7		
	PIBC	6		
Drought	ABCFP	1	29	drought
	ASTTBC	4		
	BCIA	14		
	BSCLA	4		
	CAB	4		
	EGBC	2		
Ecological, biological impacts and management	ABCFP	18	114	"Landscape-level connectivity. Identification and protection of climate refugia. Forecasting ecosystem change. Identification of vulnerable species"
	ASTTBC	2		
	BCIA	27		
	BCSLA	13		
	CAB	53		
	EGBC	2		
	PIBC	2		
Emergency response	ABCFP	2	10	natural hazard preparedness

Priority Issues	Prof Org	n Mentions	Total	Sample Comment
	BCIA CAB PIBC	5 1 2		
Energy	ASTTBC BCIA EGBC PIBC	19 2 1 1	23	“Need for more education among professionals to understand how to deliver energy efficient buildings without adding significant cost and design fees”
Extreme weather	ABCFCP ASTTBC BCIA BCSLA CAB EGBC PIBC	2 7 3 3 5 1 1	22	storm intensity, frequency
Flooding	ABCFCP ASTTBC BCIA BCSLA CAB EGBC PIBC	1 8 6 2 1 1 2	21	flooding
Forests, forestry	ABCFCP BCIA BCSLA CAB EGBC PIBC	19 3 3 6 2 1	34	timber production
Human health	ASTTBC	1	1	“additional burden CC will put on an already over taxed health care system”
Indigenous	BCIA CAB	3 1	4	“habitat change affecting Indigenous harvesting rights for fish, wildlife, migratory birds and vegetation. Community trauma from catastrophic fires, flooding”
Indoor comfort and safety	ASTTBC BCSLA	4 2	6	design and operation of heating, ventilation, air conditioning and refrigeration (HVAC&R) systems
Infrastructure (not transport), buildings	ASTTBC BCIA BCSLA CAB EGBC PIBC	14 1 2 3 3 1	24	infrastructure upgrading
Land base constraints	BCIA CAB PIBC	1 1 1	3	“plan for reducing climate risks by removing forcings of fossil-fuel derived...land use change...”
Landscape design	ABCFCP ASTTBC BCIA BCSLA CAB	1 1 3 2 3	7	“knowing how to use land resources to adapt to different crops and conservation methods” “changing the way development happens”
Mandate, leadership	ABCFCP	1	8	“Integrating adaptation... needs

Priority Issues	Prof Org	n Mentions	Total	Sample Comment
direction	ASTTBC BCIA CAB PIBC	2 1 2 2		better management understanding of the general issue, and better facilitation of sector experts to do their own thing."
Materials	ASTTBC BCIA BCSLA	6 1 4	11	"materials use (reusing or requiring minimal materials in landscape design) - less plastic, more organics"
Norms	ASTTBC BCIA CAB PIBC	1 1 2 1	5	"Our ability to focus investment, time and effort at new, novel initiatives instead of economic safety nets such as oil and gas"
Outdoor recreation	BCIA BCSLA	1 1	2	mountain resorts with skiing
Pests, invasive species	ABCFCP ASTTBC BCIA BCSLA CAB PIBC	1 1 6 2 5 1	16	insect infestations
Phenology? Seasonal change	ASTTBC BCIA	1 1	2	early/late spring and fall
Politics	ASTTBC BCSLA CAB EGBC PIBC	2 2 1 1 2	8	"actually concentrating on things that are really important than political fluff" lack of champions in government
Regulations	ABCFCP ASTTBC BCIA BCSLA CAB EGBC PIBC	5 11 8 3 8 2 4	41	"We need to have all levels of government to work together on different ways to regulate what we can to affect change." "Some municipalities are pushing for step [code] 3 sooner that [sic] industry can provide the technology."
Sea level rise	ASTTBC BCSLA CAB EGBC	10 8 4 2	24	sea level rise impact on infrastructure
Scope and scale	ABCFCP ASTTBC BCIA BCSLA CAB PIBC	3 2 1 1 2 1	10	"small scale- designing with the future in mind (plant material, potential flooding, erosion, heavy rains) on a larger scale advocating for prevention/mitigation" "Adapt technologies from elsewhere in world to our situation in BC."
Social (not including Indigenous-specific)	ASTTBC BCIA BCSLA CAB EGBC PIBC	5 7 2 3 3 3	23	"Things won't change unless the impact is understood by all." climate refugees uncertainty and public trust
Substrate management	ASTTBC BCIA BCSLA	1 1 1	5	"mapping/preparing/linking extreme weather events to how they affect terrain stability (e.g. flooding, rain on

Priority Issues	Prof Org	n Mentions	Total	Sample Comment
	EGBC	2		snow events, severe drought, forest fires, rapid snow melt, etc. causing landslides, severe erosion, washouts, etc.)”
Substrates	ASTTBC BCSLA CAB	2 1 1	4	soil characteristics change due to structural damage, dramatically affecting hydraulic conductivity of soil and exacerbating replenishment of sub-surface watersheds
Temperature	ASTTBC BCIA BCSLA CAB PIBC	2 4 4 3 1	14	heat island effect
Time	ABC FP ASTTBC BCIA BCSLA CAB EGBC PIBC	1 4 3 3 2 2 2	17	“the overwhelming emotional/mental toll of those in the field who care passionately about the CC issue but are finding it hard to advance the deep changes at a pace that is necessary to stop catastrophic CC”
Vehicles, transport infrastructure	ABC FP ASTTBC BCSLA EGBC PIBC	1 4 1 1 1	8	vehicle fleet conversion extreme weather and its implications on transportation infrastructure
Waste	ASTTBC BCIA EGBC	11 1 1	13	“amount of disposable products, only new can be used in patient devices and many services”
Water availability	ABC FP ASTTBC BCIA BCSLA CAB EGBC	1 3 12 1 4 2	23	seasonal distribution
Water cycle - other	ASTTBC BCIA CAB EGBC	1 3 2 1	7	evaporation changes
Water - Ecosystems, spp (impacts, management)	ABC FP ASTTBC BCIA CAB EGBC	1 1 1 2 2	7	“appropriately managing freshwater and marine riparian areas such that they are resilient to increased water levels and flooding frequencies”
Water - Socio-economic impacts	ABC FP BCIA CAB EGBC	2 5 1 2	10	drought and flooding in agricultural operations
Water management	ASTTBC BCIA BCSLA CAB EGBC	7 11 14 5 2	39	“Water stewardship and protection needs [sic] to be at the forefront of every decision.”
Water quality	ABC FP	1	7	contaminant transport

Priority Issues	Prof Org	n Mentions	Total	Sample Comment
	ASTTBC BSCLA CAB EGBC	2 2 1 1		
Water research, data needs	ASTTBC BCIA ABCFP CAB EGBC	2 2 2 1 3	10	“figuring out how CC will affect water quality models used for mine closure planning”
Water treatment	ASTTBC BCSLA	2 1	3	“planning for the retention, detention and sizing treatment systems to account fo the rainfalls that are now much higher than the design criteria”
Wildfire - Ecological impacts	BCIA CAB EGBC	1 3 1	5	forest habitat destruction
Wildfire management	ABCFP ASTTBC BCIA BCSLA CAB	2 2 5 1 4	14	interface fire treatments
Wildfire research, data needs	BCIA	1	1	Accounting for forest volume for future harvesting that may be impacted by wildfires
Wildfire - Socio-economic impacts	CAB EGBC PIBC	2 1 1	4	risks to infrastructure
Wildfires	ASTTBC BCIA BCSLA CAB EGBC	3 5 3 3 2	16	urban wildfire

Table 2. Coding scheme, part 1. Coded segments or ‘mentions’ within responses may be assigned to more than one category (e.g., forest resilience in ecological category and forestry category). The coding scheme for learning priority issues is provided in Table 4.

Priority Issues	Criteria
Agriculture	<p>agriculture/food sustainability, food production, food supply, impacts to agriculture, drought and agriculture, flooding in agricultural operations, water security and drought resilience in agriculture, resilience of agricultural systems and practices, range ecology, effects on seed, allocating forage</p> <p><u>Management</u>: changing crops and varieties, adaptation of crops and cropping systems, making crops more robust against severe weather occurrences (rather than expecting crop insurance), incorporating CC metrics in food products (such as food miles), educating producers and the public about CC impacts to agriculture, manage soils for climate stress, pest and disease management, adaptation of grazing practices, agricultural practices, adjusting feeding regimes, developing micro-algae technologies (carbon capture and high value animal feed), pasture</p>

Priority Issues	Criteria
	management, grassland management, practices that improve production and reduce or capture emissions, regenerative agriculture and food systems
Air quality	air quality, air quality management, sulphur dioxide poisoning. [few specifics mentioned, e.g., wildfire smoke]
Clients	ensure clients see CCA as a must-do and not a nice to have, professionals to apply a CC lens on their work and provide recommendations to clients, make clients aware of liability to their holdings and adjoining properties
CCM/CCM-CCA (mitigation, adaptation)	consider CCM in CCA solutions (e.g., albedo, off-gassing, N fertilization); less slash burning in the agricultural sector; emissions; GHG emissions; reduce emissions; emission mitigation, low C resilience, GHG emission reduction strategies, carbon capture/sequestration; integrating CCM into projects we design, build and maintain; GHG emissions regulations; methane emissions from oil and gas production facilities; no evidence of lessening our dependence of fossil fuels; limitation of GHG emission, agricultural practices that reduce or capture emissions
Cost \$ of action, inaction	Funding, dedicated funding and resources to advance CC risk assessments and adaptation work, focus investment at novel initiatives, “placing profits/economics over social and environmental considerations, triple bottom line is really a hard nut to crack”; sustaining current production levels and quality parameters with sustainable resource use and keeping company in profit; removing fear of cost, develop strategies to help clients manage high costs, reducing the monetary cost, cost, product cost, competitive consulting fees, taxes, liability from climate impacts, general economic downturn related to societal costs (e.g., food security)
Discipline-related, interdisciplinary, networks	“getting all professionals on-board”, transdisciplinary collaboration, profession’s lack of education and understanding to..., meeting interdisciplinary objectives, asserting competency rather than delegating to other disciplines, working with colleagues to share best practices, integrating disciplines to reach consensus on management goals; integrative, interdisciplinary problem-solving network for stewardship of complex social-ecological systems; integration of ecology and engineering; understanding tools, policies from multiple sectors; working across sectors to develop a unified vision, develop an effective multi-disciplinary information-sharing network; communities and regions that have experienced wildfires, flooding and erosion, drought, and other impacts document and share knowledge and recommendations; up to date knowledge on CCA within my discipline and cross-disciplinary, creating cross-sector management criteria/tools, working with industry to change how business is done, implementation with contractors
Drought	drought, dry periods, summer drought, seasonal drought, extreme drought, drought resilience
Ecological, biological impacts and management, part 1	<u>Impacts to ecosystems:</u> effect of CC on the landscape and on trees in particular, wildlife habitat change, landscape level impacts (vegetation/ fauna shifts), species sustainability, species shifts, species loss and resiliency, species adaptation, species ability to adapt, unknowns with how species will respond, forest health, forest resilience, impacts on hydrology and forest ecology, range ecology, habitats and ecology; holistic, long-term approaches to avoid unintended consequences of CCM/CCA efforts; forest habitat destruction by fires, change in plant and wildlife distribution, ecosystem change, water temperatures and associated chemistry changes (e.g., dissolved oxygen concentrations), forestry and carbon, impacts to critical habitat, risk to populations and

Priority Issues	Criteria
	<p>communities, marine and freshwater habitat changes, soil health, ocean acidification, impacts to natural disturbance regimes (e.g., wind, fire, pest), changing ocean conditions related to food availability for species</p>
<p>Ecological, biological impacts and management, part 2</p>	<p><u>Ecosystem management</u>: integrate CC into initial design of projects, especially in sensitive ecosystems; protecting ecosystems and habitat, ethics of engaging in projects (subdivisions) which removes habitat, ecosystem management (novel ecosystems), long-term sustainability in forest tenure system, silviculture, fuel breaks - best practices in different conditions, maintaining ecosystem resiliency, understanding ecosystem resiliency, give a helping hand to species and ecosystems to ensure best chance of survival, adapting landscape-level planning to movement of tree species outside of their historic habitat/unprecedented abiotic disturbance, changing timber supply, increased number of managed forests, assisted migration (e.g., tree seedlings), better management before harvesting, conservation in planning, maintain linked refugia, identify and protect climate refugia, habitat protection, strategies to increase resilience in managed forests (plantations), considerations of stand dynamics in silviculture practices, loss of natural environment to climate adaptations (e.g., hardening infrastructure), revegetation/reclamation of industrial sites, planning for resilience and adaptation of species and their habitats, learn from other jurisdictions, retain habitats for species at risk (SAR), understand changes to flora and fauna and how to assign cause and effect, predict changes to wetlands, conservation and recovery of endangered populations, overall plan for CCA for species in my region, landscape level connectivity, forecast ecosystem change, identify vulnerable species and species-specific CCA/CCM, biodiversity monitoring, management of natural ecosystems, integrate ecology and engineering to understand impacts to environment and modify infrastructure; understand relationships between CC, SAR, invasive species movements; address flooding and fire impacts to species and ecosystems at risk, predicting changes in species abundances and compositions, linking future climates to changes in locations of critical habitats, finding mechanisms to ensure available habitats as climate envelopes shift, management/conservation of stressed/sensitive ecosystems, looking at ways natural systems have evolved to CC, managing freshwater and riparian areas to increase resiliency to increased water levels and flooding frequencies, habitat modelling, knowing how to use land resources to adapt to different crops and conservation methods, managing for shifts to natural disturbance regimes, management of soils to optimize performance for climate stress, integrate with SAR recovery, identifying species of succession that will thrive, data collection and adaptation strategies for ocean acidification, Biogeoclimatic Ecosystem classification (BEC), biodiversity conservation, management of downstream effects</p>
<p>Ecological, biological impacts and management, part 3</p>	<p><u>Ecosystem services</u>: protection of existing ecosystem services, enhancement of ecosystem services in each new development; resource availability, timber production, forest volume, forest industry, fisheries</p> <p><u>Plants</u>: plant selections, plant choices, what trees to grow where, revegetation prescriptions, planting plans, better understand how plants adapt, trees, vegetation pattern changes, loss of plant species, tree species management, vegetation shifts, trees unable to adapt, vegetation management, productivity, tree canopy cover</p>

Priority Issues	Criteria
	<p><u>Animals:</u> aquatic fauna, fauna pattern changes, fauna shifts, water conditions for fish and aquatic systems, salmon management; spawning and incubation periods, migration timing; effects on fish and fish habitat, impacts to first year survival of fish at sea and how migration patterns will impact survival</p> <p><u>Cumulative effects:</u> cumulative effects, compounding of drought stress with new or more vigorous pathogens, forestry affecting watershed functions, urban expansion, recreational demands, “impacts to riparian zones and development that impact ground water infiltration”</p>
Emergency response	FireSmart; fuel breaks, best practices; hazards; addressing hazard and risk in planning, not just engineering; “resiliency community protection”, resilient community planning, emergency management, natural hazard preparedness, wind hazards, fire risk and abatement
Energy	conservation, efficiency, local power generation, sustainable power sources, alternate (non-carbon) energy, getting industry to change from fossil fuels to clean energy, “electricity consumption in lighting control systems, energy consumption in the construction industry, use analysis, reduction strategies”, “energy consumption, emissions and embodied energy of materials”, power generation, back-up energy solutions (as opposed to diesel generators), energy consumption to recycle, energy efficient equipment, safe energy with LED lights, wind, solar/sun, wave, hydro, biofuel, renewable energy, limitation of GHG emission and energy consumption, passive energy methods over HRV incubator systems, CC impact to hydroelectric power generation, carbon footprint of electric heat, step code costs and technology
Extreme weather	storm intensity, damage/impacts, stochastic nature of weather events - increase in extreme cycles, storm frequency, extreme drought, weather variability, wind hazards, wind events, unprecedented high frequency of extreme weather events, flood frequencies, magnitude of storms, storm management
Flooding	flooding, flooding effect on land use and infrastructure, high water impact
Forests, forestry	<p>tree canopy cover, impact on trees, forest health (insects and disease), timber production, forest volume, changing timber supply, increased number of managed forests, trees unable to adapt (to drought particularly), drought/floods impacting ability to meet legal reforestation obligations, forest fires, forest fires/floods impacting BC’s timber supply (reducing Annual Allowable Cut), forest resilience, how stand dynamics will be altered with CC, impacts on hydrology and forest ecology, forest interface conditions with more wildfires threatening homes, “effect on intermittent permafrost, trees and bank slumping”. forest habitat destruction, forestry and carbon, forest industry, water security and drought resilience in forestry</p> <p><u>Management:</u> tree species management, FireSmart on the urban/forest interface, incentives for sustainability in forest tenure system, landscape-level planning in response to movement of tree species outside of their historic habitat, tree seedling movement, better management before harvesting to reflect changing climate, determining effective strategies to increase forest resilience in managed forests, towing/moving timber via water/sorting wood in the Fraser River, silviculture practices do not produce resilient stands when they are largely focused on getting stands past regulatory free-growing benchmarks, licensees are assessed on reforestation performance but no cumulative checks are in place, enhanced monitoring of forest</p>

Priority Issues	Criteria
	systems, “what trees to grow where for a long period, how to build in ecosystem resilience”, CC not in FRPA objectives, raise awareness of the link between CC and forest health, intense forestry affecting watershed functions, current forest practices
Human health	additional burden CC will put on an already over taxed health care system
Indigenous	reconciliation, impact to FN cultural sites, supporting Indigenous communities to prepare, habitat change affecting Indigenous rights, community trauma from fires and flooding
Indoor comfort and safety	liveability (human comfort), design and operation of heating, ventilation, air conditioning and refrigeration (HVAC&R) systems; “reduced heating and cooling, more natural ventilation, plumbing fixtures with reduced water flow, energy efficient equipment, safe energy with LED lights”, passive energy methods over HRV incubator systems, quickly escalating cooling loads for buildings
Infrastructure (not transport), buildings	construction processes, structural standards, increasing resiliency of built infrastructure, “harden” infrastructure options used too often, adaptation of the infrastructure that provides essential services to our clients (EGBC), municipal infrastructure, modifying infrastructure, risks to infrastructure in response to flood regimes and wildfire events, resiliency of infrastructure, destruction of engineered structures near waterways from flooding, how we can improve existing buildings and make them self sufficient, extreme weather creating higher demands on civil infrastructure, identifying risks for existing infrastructure, location of electrical rooms, durability of buildings, coastal preparation to protect infrastructure, infrastructure upgrading, better the design of building and construction methodologies, finding ways to perform infrastructure -related construction work in a manner which is climate friendly, preventing thermal bridging across the steel frame, planning for capital works projects; water supply, sea level rise impact on infrastructure, “some municipalities are pushing for step 3 (step code) sooner than industry can provide the technology”, impact on civil infrastructure (e.g., flooding, landslides)
Land base constraints	recognize planning decisions often exacerbate CC and fail to respond to challenges (e.g., support for rural and suburban development), understand historical floodplain development context
Landscape design	protecting ecosystems and habitat, “adapting landscape response to wide swings in temperature and rainfall [and] changing seasonality”, resilient community planning, planting appropriate species, develop rationale objectives for land management; where to mitigate, where to strategically retreat, more climate resilient land use planning by local governments, landscape level planning in response to movement of tree species outside of their historic habitat, landscape level connectivity, climate refugia, follow Transition Town principles ^[1] _[SEP] (see also Ecological - Ecosystem management)
Mandate, leadership direction	support from managers, organization, sector, government, bureaucracy
Materials	construction materials, materials used, “materials use (reusing or requiring minimal materials in landscape design), less plastic, more organics”, “supplementing [promoting?] projects that use innovative materials and systems, making products more cost efficient and readily available”, removing fear of supply restrictions, more eco friendly products in construction, materials usage and assembly of building envelopes, materials selection in building construction; “current use of steel, concrete, and timber unlikely to change much”, manufacture of

Priority Issues	Criteria
	cement, use less concrete and more geopolymer type materials
Norms	work with industry to change the way business has been done, current forest practices, no issues - “every company has to run cleaner now”, transition from fossil fuels
Outdoor recreation	growing impact on outdoor recreation, mountain resorts with skiing
Pests, invasive species	forest health (insects and disease), insect infestations, management of invasive species, the appeal of quick-growing non-native species rather than native; understanding relationships between CC, SAR and invasive species movements; exotic species, exotic pests, invasive species, pest and disease management, invasive plant prevention, displacement of native plant species, warming temperatures bringing in different pests
Phenology? Seasonal change	early/late spring and fall; different lengths of seasons to do installations, unseasonable weather events;
Plant cover	tree canopy cover, forestry affecting watershed functions
Politics	lack of champions in government, need for lobbying for change, political will (e.g., re: hardened infrastructure v retreat), political apathy, leadership from senior levels of government, support from politicians
Regulations	regulations, policy, regulatory and legislative changes required, clear government direction with mandatory requirements and measurable outcomes, permitting rewards, concrete standards/rules to tackle CC, structural standards, CC not in FRPA objectives, no incentive for long term sustainability in forest tenure system; silvicultural practices are largely focused on getting stands past regulatory free-growing bench marks (v. producing resilient stands), licensees are assessed on reforestation performance but no cumulative checks are in place; mandating standardized adaptation applications, no regulatory requirements, legislative requirements are linear and CCA is often non-linear and requires an adaptive management approach that is difficult to integrate into land use regulation and policy, translate adaptation into policy and implement via bylaw, require consideration of consequences of climate modelling in resource decision-making, long term predictions for reclamation prescriptions are based on pre-disturbance vegetation (v. what it will be like in the future), improved existing regulations (e.g., Riparian Area Regulation), clarity on how policies are applied through regulatory mechanisms, “inability to implement landscape level action without loopholes that render actions ineffective”, stronger construction standards, develop policies [and] enforce businesses to comply; no model or tool to help regulators understand what may be a realistic reclamation plan, consistent approach for all industry; lack of consensus on how severe permit restrictions should be; integrating CC as a first step, basic consideration in program and policy decisions, ensuring fairness in standards, reluctance by some to meet new government mandated regulations, developing and implementing bylaws that protect the environment, change of building codes and practices, GHG emissions regulations, staying up-to-date on code requirements, educating people about benefits of upgrading lights to industry acceptable standard, better public policy mandating implementation of relevant technologies in the built environment, policy that isn’t swept aside for the sake of business, slow moving government specifications. drought/floods impact ability to meet legal reforestation obligations
Sea level rise	sea level rise (SLR), sea level adaptation, SLR mitigation, SLR adaptation planning, rising sea level, seawater level change, flood mapping and... high tides, coastal preparation to protect infrastructure, retreat options, foreshore protection

Priority Issues	Criteria
Scope and scale	emphasis on scope - "non-coastal adaptation considerations" emphasis on scale - small scale, large scale, internationally, globally, North American, nationally, provincial, BC, landscape level impacts [Design - landscape is a different code]
Social (not including Indigenous-specific)	climate refugees and democracy, equity, individual responsibility, eliminating defeatist/apathetic attitudes, uncertainty and public trust, public trust in CC policy, public acceptance and involvement, voter apathy, individual behaviour change, public education, public awareness, public engagement, public support, public buy-in, placing profit/economics over social considerations, social safeguards, getting public to adopt greener fuel choices for commuting; positive, persuasive information to the public
Substrate management	sediment management, "mapping/preparing/linking extreme weather events to how they affect terrain stability (e.g. flooding, rain on snow events, severe drought, forest fires, rapid snow melt, etc. causing landslides, severe erosion, washouts, etc.)", erosional control, preparing for landslides related to extreme weather
Substrates	erosion, landslides, bank slumping; soil characteristics change due to structural damage, dramatically affecting hydraulic conductivity of soil and exacerbating replenishment of sub-surface watersheds
Temperature	increased summer temperatures, heat islands, heat, heat island effect, permafrost, warming temperatures bringing in different pests and other challenges (droughts, wildfires), warmer winters, warmer weather means heavier and possibly more snow, temperature trends, direct impact on mountain resorts with skiing as the primary resort offering, urban temperature management, mitigating heat island effect
Time	"changing [client] practices to not always look at the cheaper solution but look at long term gains of proper and best practices in planning and design to address CC", "in landscape architecture and urban design, CC considerations can be integrated from the initial design of projects, especially in sensitive ecosystems", "all future design should integrate CC adaptation", pace of CC, "Why is it so slow to implement?", focus on long range (multi generational) policy development, time, long term thinking (greater than life of one government), balancing urgency with logistics, time frames for change, habitat modelling/supply through time, long term effects of our present day actions, "CC will not likely be a priority relating to projects during my career", understanding long term impacts of CC
Vehicles, transportation infrastructure	taking cars off the streets, road infrastructure designs and future maintenance issues, "sustainable modes of transportation, electrify transit, rail and marine networks", extreme weather impacts on transport infrastructure, "more energy efficient heavy duty equipment and vehicles", vehicle fleet conversion
Waste	"waste, materials choice", less use of paper, waste reduction, "issues surrounding waste reduction and waste management, landfill gas, anaerobic digesters, circular economy", reduce plastic and styrofoam packaging for electrical items, end of product life consideration, amount of disposable products, using plumbing fixtures with reduced water flow consumption, using energy efficient equipment, increase in recycled aggregates alternative product, tools and equipment in land development that do not pollute, energy consumption to recycle healthcare and IT products (see also Materials)
Water availability (see also drought)	volume, timing of precipitation, seasonal distribution, distribution, rainfall pattern, supply, quantity, receding water flows - dams can't operate, lower annual precipitation, reduction in snow pack and

Priority Issues	Criteria
	glaciers; streamflow rates and timing, particularly in small mountainous watersheds; water scarcity, wetter conditions, water requirements, timing impacts, water resources demand and availability, water security; glaciers are melting and less lowland water, timing and volumes of runoff, water shortage; increase in rainfall leading to increase in river flow, flood frequency/intensity, water level
Water cycle - other	evaporation changes, "hydrology", weather patterns, alteration of rain patterns, changing hydrological regimes, hydrology changes, changes to the natural water cycle
Water - Ecosystems, spp.(impacts, management)	water conditions for fish, aquatic systems, habitats, ecology; hydrology and forest ecology, impacts of flooding, "appropriately managing freshwater and marine riparian areas such that they are resilient to increased water levels and flooding frequencies", environmental flow needs
Water - Socio-economic impacts	drought/flood impacting ability to meet legal reforestation obligations, towing/moving timber via water/sorting wood in Fraser R, flooding and risks to infrastructure/built infrastructure, drinking water: drought and agriculture, revegetation/reclamation, drought and flooding in agricultural operations, water security and drought resilience in forestry/agriculture, destruction of engineered structures near waterways from flooding
Water management	conservation, efficiency, water use/usage, stormwater/rainwater management, managing runoff, irrigation (e.g., cemetery lawns), low impact development (LID) urban water management, water resource management, water management related to drought and flooding, flood mitigation; managing changes in water quality, quantity and timing of flows; freshwater management; "addressing flooding, with attending impacts to shoreline development, species and ecosystems at risk, water quality, etc.", watershed management, flood control, drought management, drought adaptation; storing, retaining, releasing water, filtration on and off-site; preparing for flooding and general water level fluctuations, deal with more intense rain fall and impacts on stormwater infrastructure, ensure [water] sustainability, water quality management, water stewardship; foreshore protection, creek protection; water harvesting
Water quality	water quality, pollution, contaminant transport, clean drinking or freshwater
Water research, data needs	[projected] hydrology for larger channels, changes to hydrographs in [predicting] floods, effects of CC on groundwater resource availability, changes in surface water - groundwater interaction, contaminant transport in water, "figuring out how CC will affect water quality models used for mine closure planning", more climate and hydrometric stations across BC, historical floodplain development context, understand natural weather events and prepare for them, determine future storm intensity to properly size drainage utilities
Water treatment	cleansing detention, loading within the treatment system; planning the retention, detention and sizing treatment systems to account for higher rainfalls
Wildfire - Ecological impacts	environmental impacts of wildfire, "effects on habitat and aquatic resources", forest habitat destruction
Wildfire management	fire management, fire prevention, planning, fuel breaks, best practices in different conditions, "wildfire suppression increasing risk of catastrophic changes on a local scale", interface fire treatments, fire risk and abatement
Wildfire research, data	Accounting for forest volume for future harvesting that may be

Priority Issues	Criteria
needs	impacted by wildfires (and other CC-caused natural disasters)
Wildfire - Socio-economic impacts	Economic, social, health, community impacts, forest interface conditions with more wildfires threatening homes, risks to infrastructure
Wildfires	wildfires, relationship to drought, urban wildfire, forest fire

Table 3. Coding results, part 2 – Learning priority issues

Q. 28 Priority Issues - Learning	Prof Org	n Mentions	Total	Sample Comment
Lack of data	ABCFP	4	29	effects of CC on groundwater, surface water, and surface water-groundwater interaction, also contaminant transport in water
	ASTTBC	2		
	BCIA	6		
	CAB	14		
	EGBC	3		
Lack of knowledge	ABCFP	5	59	“Need for more education among professionals to understand how to deliver energy efficient buildings without adding significant costs and design fees”
	ASTTBC	9		
	BCIA	22		
	BCSLA	3		
	CAB	13		
	EGBC	2		
	PIBC	5		
Messaging, communication	ABCFP	1	26	“communication with municipal bodies that we are capable of doing the right thing and sometimes experiments are required” public awareness
	ASTTBC	1		
	BCIA	9		
	BCSLA	3		
	CAB	7		
	EGBC	4		
	PIBC	1		
Professional accountability	EGBC	1	1	“ensure all professionals have a moderate level of CCA knowledge”
Tools, models	ABCFP	2	11	[For revegetation of disturbed areas:] “There has to be easily workable tools to help decision makers plan for species selection based on future models.”
	ASTTBC	2		
	BCIA	5		
	CAB	1		
	PIBC	1		

Table 4. Coding scheme, part 2 – Learning Priority Issues

Q. 28 Priority Issues - Learning	Criteria
Professional accountability	“Ensuring that all professionals have a moderate level of climate change adaptation knowledge and that they incorporate this into their daily work”
Lack of data	<p><u>General:</u> accurate data, better data, “get on with implementing, trialing, etc. action”, “long-term field data to well support the direction of change... real, repeated measures”, technical, “availability of current and evolving research as well as regional trends and metrics”, how to design experiments with green chemistry in mind and practices constantly evolving</p> <p><u>Specific:</u></p> <p>Ecosystems and species</p> <ul style="list-style-type: none"> • “enhanced monitoring of forest systems to measure biotic and abiotic changes and associated impacts” • prediction in changes to wetlands • data and adaptation strategies for ocean acidification • “understanding changes to flora and fauna and how to assign cause and effect” • anticipating changes to vegetation communities • “species adaptation and biodiversity monitoring” • “understanding relationships between CC, SAR and invasive species movements” • linking future climates to changes in locations of critical habitats and finding mechanisms to be ensure habitats will be available for conservation as climate envelopes shift • how species will respond to CC • “controlled experimentation at broader scales (e.g., field manipulation of climatic condition, testing of climate changed informed species selection)” • habitat modelling, habitat supply through time • model or other tool to help regulators understand what may be a realistic plan for potential changes in reclamation planning • data and models to inform long-term reclamation prescriptions that consider shifting climate conditions and conditions distant in time (as opposed to prescriptions for 2065 that are based solely on pre-disturbance vegetation) • identifying hot spots for change <p>Water</p> <ul style="list-style-type: none"> • more climate and hydrometric stations across BC • determining hydrology for larger channels • changes to hydrographs in determining high water floods in the future • effects of CC on groundwater, surface water, and surface water-groundwater interaction, also contaminant transport in water <p>Weather</p> <ul style="list-style-type: none"> • more climate and hydrometric stations across BC • mapping, preparing, and linking extreme weather events (e.g., flooding, rain on snow events, severe drought, forest fires, rapid snow melt, etc.) to how they affect terrain stability (landslides, severe erosion, washouts, etc.) <p>Other</p> <ul style="list-style-type: none"> • develop micro-algae technologies (carbon capture and high value animal feed) • consequences of climate modelling in resource decision-making

Q. 28 Priority Issues - Learning	Criteria
Lack of knowledge - what	<p><u>General:</u></p> <ul style="list-style-type: none"> • training, knowledge, “understanding of all the facets of CC and how it would apply to my profession”, tools to apply a climate change lens, lack of scientific knowledge • “The problem is not really more adaptation expertise, it is integrating adaptation into most aspects of local government. This needs better management understanding of the general issue, and better facilitation of sector experts to do their own thing.” • “My company, and industry at large, are very aware of potential ways to combat CC” • staying up to date, up-to-date knowledge on CCA within my discipline as well as cross-disciplinary, “understanding application of tools, policies from multiple sectors” • “better understanding of adaptation, mitigation, and risks across the board for the profession” (PIBC) • “deciphering CC data into applicable methods and strategies” • adapt technologies from elsewhere in the world to our situation in BC, develop technologies • best available technology and site/location specific adaptation to consider future changes in site/location from CC • general awareness of the effects of our industry on the environment (ASTTBC) • integration of CC risk assessment and practical adaptation techniques in the education system and correspondingly, in early stages of professional employment (orientation) • “Like any issue, raise the level of awareness... how they can contribute to CC, how CC can impact them and what they can do about it” • “We don’t know what we can do” <p><u>Specific:</u></p> <p>Concepts</p> <ul style="list-style-type: none"> • low carbon resilience <p>Skills</p> <ul style="list-style-type: none"> • wildfire management expertise in BC <p>Economic</p> <ul style="list-style-type: none"> • economic review • economic costs of growth (e.g., sprawl), and alternative scenarios • hazards and costs, freely available to local governments <p>Ecosystems and species</p> <ul style="list-style-type: none"> • what trees to grow and where, • “applicability of adaptation scenarios to a wide variety of species” • Biogeoclimatic Ecosystem classification • geotechnical training specific to analytical chemistry to support risk mitigation strategies • mapped changes in land cover for land managers, to help predict impacts to ecosystems and species
Lack of knowledge - how	<p>Planning - general</p> <ul style="list-style-type: none"> • how to apply to specific scenarios • how businesses adapt • how to deal with extremes <p>Design - built environment</p> <ul style="list-style-type: none"> • how design can help with CCA - especially materials use • how CC affects road infrastructure designs and future maintenance issues

Q. 28 Priority Issues - Learning	Criteria
	<ul style="list-style-type: none"> • how to deliver energy efficient buildings without adding significant cost and design fees • how to plan industrial projects for a changing climate <p>Landscape planning and adaptive management</p> <p><u>General</u></p> <ul style="list-style-type: none"> • how to build resilience into sector (i.e., management of water resources to help sector adapt) (BCIA) • how future state will change, how risks to different values will increase, and what can be done to mitigate those risks, to asses proposed development projects <p><u>Ecosystems and species</u></p> <ul style="list-style-type: none"> • most effective strategies to increase resilience in managed forests • how impacts and efforts interact, and whether these are beneficial over the long term (e.g., albedo and tree planting, fertilization of trees and widespread NOx) • how to build ecosystem resilience - to provide a buffer for complex systems amid the uncertainty of climate change • “how to proactively manage conservation lands and populations/species to ensure best outcomes” • how natural systems have evolved to address CC • [for the person who said, “none, CC is not relevant to contaminated sites”, explain how it is relevant] <p><u>Water</u></p> <ul style="list-style-type: none"> • how CC will affect water quality models used for mine closure planning <p>Most or all of these may require additional data. See also messaging, communication.</p>
Messaging, communication	<p>communication, raise awareness, public awareness, changing perceptions in regards to adaptation, “communication with municipal bodies that we are capable of doing the right thing and sometimes experiments are required”, pushing restorative design paradigm (instead of grey solutions), stop talking and get on with action, push for change, “everyone and every organization should understand how they can contribute, how CC can impact them and what they can do about it”, eliminate defeatist/apathetic attitudes, ensure people see CCA as a must-do and not a nice-to-have, recognize planning decisions exacerbate CC and fail to respond to the challenges (e.g., support for rural and suburban development, old growth logging, fossil fuel projects), raise awareness of the link between CC and forest health, “fake news, the media, a systematic approach of ignorance”, “sharing experiential knowledge of wildfire impacts, pests, flooding and erosion, drought, species range shifts and disaggregating ecosystems”, public communication of change effects, communicating to high risk industry workers, clearly communicate costs and risks, clarify how government policy statement are applied through regulatory mechanisms, how to communicate decisions to stakeholders, “science knowledge that address issue rather than the feel good buzz words/strategies that are floating around”, “encouraging agricultural producers to adopt practices which improve their production and reduce or capture emissions”, “make clients aware/acknowledge incremental liability to their holdings and adjoining properties” from CC effects, ensure professionals (or others who pretend to be professionals) communicating about CCA do not stray into areas that are beyond their scope of practice/training”, public acceptance and involvement, removing fear fo cost increase or</p>

Q. 28 Priority Issues - Learning	Criteria
	supply restrictions, educating people about the benefits of upgrading lights to an industry acceptable standard
Tools, models	tools, new methods, cross-sector management criteria/tools, "application of tools, policies from multiple sectors", "capacity building of the tool box", planning tools, training and tools for professionals to apply a CC lens, FireSmart on the urban/forest interface, "CC/carbon modellers often trained at such a high level, they cannot provide useful input to operational or application research needs", complexity and uncertainty merit system thinking over longer time scales (See also Lack of data to explore need for tools and models.)

Appendix F. Facing Challenges Coding Scheme and Results

Table 1. Coding results, part 1. This table uses the structure developed for the “Priority Issues” question (Appendix E) to enable later coding comparisons from one open-ended question to another. Challenges in blue are specific to the “Facing challenges” question.

For respondents belonging to more than one organization, responses are recorded for each organization (i.e., they are duplicated). “Other organizations” are not included. If a person belongs to more than one *participating* organization, the comment will be added for each organization and the totals reflect this (rather than the total number of mentions). The total number of different comments are in brackets. If it’s larger than the first number, there are comments from Other organizations. If it’s smaller, there are comments from people who are members of more than one organization.

Results for learning challenges are provided in Table 3.

Challenge	Prof Org	n Mentions	Total	Sample Comment
Agriculture	BCIA	7	7 (7)	“Impact of climate change on crops produced and grazing management and winter feeding requirements”
Air quality	ASTTBC BCIA BCSLA	1 1 1	3 (3)	“Quality of Air and smoke particulates”
Client barriers	ASTTBC ABCFFP BCIA BCSLA CAB EGBC PIBC	9 1 6 15 12 4 1	38 (44)	“My challenge is in knowing specific measures that I can integrate into my work so that the measures will be accepted by my clients. I.e. I must provide clear, concise, measurable approaches to climate change that are cost effective and known in my industry. Regardless of my landscape architecture designs, I must know that construction companies can implement my designs.”
Clients				
CCM/CCM-CCA	BCIA CAB	2 2	4 (3)	“Actors accepting the real challenge presented in climate change and an unwillingness to do what is really needed, including mitigation. Your survey is a case in point. Adaptation is absolutely not enough, but it seems we have decided that we don't have any responsibility to mitigate anthropogenic climate change”
Cost \$ of action, inaction	ABCFFP ASTTBC BCIA BCSLA CAB EGBC	1 32 13 10 13 5	79 (80)	“We work primarily on public projects so with limited funding landscape elements that would be beneficial to climate adaption often get dropped if budgets are tight. Convincing people that

Challenge	Prof Org	n Mentions	Total	Sample Comment
	PIBC	5		designing holistic spaces which incorporate environmental, economic and social goals is worth planning and investing in"
Discipline-related, interdisciplinary	ABCFP ASTTBC BCIA BCSLA CAB EGBC PIBC	1 3 9 5 5 2 3	28 (26)	"Working across disciplines is required, yet local government is often siloed"
Drought	ABCFP CAB	2 1	3 (2)	"Finding ways to plan for drought, early spring, late fall, warm winters is key"
Ecological, biological impacts and management	ABCFP ASTTBC BCIA BCSLA CAB PIBC	2 2 10 3 15 1	32 (31)	"not doing a good job of landscape-level planning that incorporates climate change adaptation (connectivity corridors, climate refugia, etc..)"
Emergency response				
Energy	ASTTBC	4	4 (4)	"Energy consumption in the construction industry"
Extreme weather	ASTTBC BCIA CAB	2 2 1	5 (5)	"Weather-related impacts on project sites, such as extreme rainfall, high temperatures, and air quality, and our ability to carry out and complete our work under these circumstances"
Flooding	ABCFP ASTTBC BCIA CAB EGBC PIBC	1 1 4 1 1 1	9 (8)	"Risk to infrastructure from flooding"
Forests, forestry	ABCFP BCIA CAB	4 1 3	8 (7)	"Balancing adaptation with a productive/ economically viable forest"
Human health		0		
Indigenous	BCIA CAB	2 1	3 (3)	"habitat change affecting Indigenous harvesting rights for fish, wildlife, migratory birds and vegetation. Community trauma from catastrophic fires, flooding"
Industry barriers	ASTTBC BCIA BCSLA CAB PIBC	4 3 3 5 1	16 (18)	"Requires close integration with engineering and unless there is an obvious risk the engineers wouldn't see this as a priority."
Indoor comfort and safety				
Infrastructure (not transport), buildings	ABCFP ASTTBC BCIA BCSLA	1 11 1 1	15 (13)	"Impact to Building HVAC&R system design, & operation" [HVAC&R=Heating, Ventilation, Air Conditioning, and Refrigeration]

Challenge	Prof Org	n Mentions	Total	Sample Comment
	EGBC	1		
Irrigation [add to agriculture? bc BCIA?]	BCIA	2	2 (2)	"...by 2050 we will need 10% more water to continue irrigation our current land base"
Jurisdiction as barrier	ASTTBC CAB PIBC	1 1 2	4 (4)	"identifying solutions that can be implemented locally and falls within the realm of local government. (eg. challenges with responding to flooding and or preventing flooding due to prov regulations and approval processes)"
Land base constraints	ABCFFP	2	2 (2)	"not all tenures are area based resulting in reduced incentives for long term stewardship"
Landscape design	-			
Mandate, leadership direction	ABCFFP ASTTBC BCIA BCSLA CAB EGBC	1 4 6 1 4 1	17 (16)	"Changing the minds of those higher up in my own organization. As someone starting out in the industry, how can you convince your superiors that the climate change adaptation plan is a good idea?"
Materials Packaging, cement	ASTTBC	4	4 (4)	"The manufacturer of cement"
Norms	-			
Outdoor recreation		0		
Pests, invasive species	ASTTBC BCIA CAB	1 2 2	5 (5)	"effects on pest behaviour"
Phenology? Seasonal change	-			
Political barriers	ABCFFP ASTTBC BCIA CAB EGBC PIBC	2 7 3 4 1 4	24 (20)	"election cycle drives decision-making, local government elected officials make land use planning decisions for communities and often do not fully understand climate change risks and needed adaptation measures"
Politics				
Professional norms as barriers	ABCFFP ASTTBC BCIA BCSLA CAB	1 2 7 3 1	14 (13)	"It is a much more accepted practice to use hard infrastructure, because it is engineered"
Regulations	-			
Regulatory barriers	ABCFFP ASTTBC BCIA BCSLA CAB	7 9 12 8 11	47 (49)	"Can only regulate/require new construction to building code minimum standards. Regulations/codes need to be able to be revised in a timely manner to counter impacts of climate change."
Risk and barriers	ABCFFP ASTTBC BCIA	2 3 5	16 (13)	"Less acceptance of soft infrastructures due to risk"

Challenge	Prof Org	n Mentions	Total	Sample Comment
	BCSLA CAB PIBC	1 3 2		
Sea level rise	ASTTBC BCIA CAB	1 1 1	3 (3)	"assessing water levels for sea level rise"
Seasons, temperature, precipitation	ASTTBC ABCFP BCIA BCSLA CAB	1 8 5 2 5	21 (20)	"Working as an Erosion and Sediment control Designer and Inspector the rainfall data and how the recognized seasons are becoming either drier longer, or in the fall and winter the rainfalls are of a higher intensity over a longer period of time"
Scope and scale	ABCFP ASTTBC BCIA BCSLA CAB	3 2 1 3 6	15 (13)	"Scope of work on a project is limited. Brought on to a project after key site decisions have been made. Types of projects have limited flexibility for expanding the response to climate change"
Social (not including Indigenous-specific)	-			
Societal barriers	ABCFP ASTTBC BCIA BCSLA CAB EGBC PIBC	2 11 8 1 4 1 2	31 (25)	"There is a "business-as-usual" paradigm in place in too many places. Folks say the climate is changing but, it is so difficult for them to plan for tomorrow. Easier to think in terms of today .. instant gratification, not thinking deeply enough about the environment that we are leaving our children and successive generations."
Substrate management	-			
Substrates	ABCFP ASTTBC CAB EGBC	2 2 1 2	7 (6)	"Lack of data to directly relate terrain instabilities (I.e. landslides) to climate change"
Temperature	-			
Time	ABCFP ASTTBC BCIA BCSLA CAB EGBC PIBC	4 5 12 3 13 2 3	42 (41)	"Current forest management strategies are often focused on the short term. Obviously sequestering carbon in trees/forest soils is important. We also need to account for the long term carbon storage (vs. short term), recognizing the increasing role that wildfire will play (increasing rate/size/impact). Managing for resilient forests that are better able to survive wildfire and are more often within fire control capabilities will pay dividends in the long term (although fire resilient forests may store less carbon in the short term)."

Challenge	Prof Org	n Mentions	Total	Sample Comment
Vehicles, transport infrastructure	ASTTBC CAB	1 1	2 (2)	"Changing to big electric vehicles (Trucks, diesel generators etc...)"
Waste	ASTTBC BCIA EGBC	3 1 1	5 (4)	"As a provincial regulator, I have to work within the government priority framework and climate change is not a priority in waste discharge regulation"
Water, except treatment	ABCFP ASTTBC BCIA BCSLA CAB EGBC	2 7 8 2 4 2	25 (22)	"Challenges in determining how hydrographs will change over time and regionally within BC. Impacts to floods, high water flows and landslides over time are not well documented or predicted"
Water availability	-			
Water cycle - other	-			
Water - Ecosystems, spp (impacts, management)	-			
Water - Socio-economic impacts	-			
Water management	-			
Water quality	-			
Water research, data needs	-			
Water treatment	ASTTBC	1 (1)		"Lack of understanding (as a team) of how climate change will effect the water treatment process"
Wildfire	ABCFP BCIA BCSLA	1 3 1	5 (5)	"We also need to account for the long term carbon storage (vs. short term), recognizing the increasing role that wildfire will play (increasing rate/size/impact). Managing for resilient forests that are better able to survive wildfire and are more often within fire control capabilities will pay dividends in the long term (although fire resilient forests may store less carbon in the short term)."
Wildfire - Ecological impacts	-			
Wildfire management	-			
Wildfire research, data needs	-			
Wildfire - Socio-economic impacts	-			

Table 2. Coding scheme, part 1. Coded segments or 'mentions' within responses may be assigned to more than one category. The coding scheme for learning challenges is provided in Table 4.

Challenges	Criteria
Agriculture	"Impact of climate change on crops produced and grazing management and winter feeding requirements", "preparing for/recovering from extreme heat, flood, fire emergencies; new technologies/processes that inform/assist/prepare ag sector for impacts", "The work that I do is largely focused on developing resilience in the farming landscape to help mitigate and adapt to CC, so it's present in all work I'm involved in. That said, I don't think about it consciously day-to-day", "Timing for Range Use Plans, i.e. Turnout", "Adapting farm business practices", "How to integrate changes to current practices in ranching and farming, while still maintaining reasonable costs", "Understanding how CC may affect grazing opportunity for livestock"
Air quality	"Quality of Air and smoke particulates", "Implications of CC on working environment (hot smokey summers)", smoke
Client barriers	"how it will be received by the client", "lack of client support and understanding", "most of our clients are part of the development industry. some are progressive about climate change adaptations but a lot are not, and are profit driven", lack of client interest, perceived high cost to client, "Resistance to change from client and regulatory agencies", unwilling clients, getting client buy-in, "lack of awareness in client and construction communities", "lack of education on both client and practitioner", client understanding and budget limitations, "concern from clients about increased development costs related to implementing adaptation recommendations", "adapting CC influences into building design and having them accepted by our clients", client aversion to cost, cost thresholds of clients, "Convincing developers of the need for greening of stormwater management and integration of native plants into the landscape", "client doesn't want to change practices because they don't understand medium and long term implications or over-react to perceived risks", "I design Agricultural equipment and as such deal with a very conservative client base, reluctant to change"
Clients	
CCM/CCM-CCA (mitigation, adaptation)	"Most of my work is centred around mitigation of climate change in the creation of sustainable agricultural systems, and projected outcomes in soil cycling, soil moisture, crop yield and ghgs. But not as much is said about adaptation separately from mitigation practises", "I don't know where to start (i.e. quantifying carbon emissions, estimating carbon capture potential from a number of projects I have in mind - to determine which would be most effective in reducing CO2 emissions", "Actors accepting the real challenge presented in climate change and an unwillingness to do what is really needed, including mitigation. Your survey is a case in point. Adaptation is absolutely not enough, but it seems we have decided that we don't have any responsibility to mitigate anthropogenic climate change", "Difficulty of organizations and governments to enact proactive climate change mitigation into their policies"
Cost \$ of action, inaction, part 1	<ul style="list-style-type: none"> costs, cost issues, monetary cost, budget constraints, budget limit, budget limitations, cost increases, "Cost has a huge play in the integration", "Cost associated with integration", Capital cost, "often viewed as costly and procedural-heavy", "Cost and buy in- cost limits the extent and getting people to agree on doing it is difficult",

Challenges	Criteria
	<p>funding, "The potential costs involved is the biggest factor", "Budget and availability of local projects", "the cost of CC consideration into a project", "adapting to changing climate patterns costs money"</p> <ul style="list-style-type: none"> costs to the client, perceived high cost to client, costs associated for client, client aversion to cost, "client understanding and budget limitations", "concern from clients about increased development costs related to implementing adaptation recommendations", cost thresholds of clients, "Limited client budgets with scope that restricts including risk and adaptation related to CC", "Perceived cost or loss of revenue by clients", client budgets, "on the edge of being required by clients and therefore not paid for", "Lack of willingness from clients to pay for added costs", "getting client buy-in to the higher costs relating to applying best practices to projects", "Clients generally have their own internal CC policies, so for consultants, it's a hard sell to management to implement policies that can't be reimbursed.. Unless there's a driver for obtaining contracts", "Potential increased design and construction costs", "Additional development cost incurred", "transferring cost to developers", "We recently had to switch to Tier4 final engine packages (less emissions) as legally required. These engines cost more....", "the ability to effectively complete work projects within significant cost implications to projects", "interdisciplinary issues that require input from expensive consultants", "I must provide clear, concise, measurable approaches to CC that are cost effective and known in my industry", "we burn modified bitumen products at the demand of industry standards. if we change, we dont meet spec, placing us outside of tender/bid range. if the world wanted a change, they would pay for it. but it is not priced accordingly. take cpd development money, lobby political parties for environmental change. its better than educating the educated", "cost-related business interruption", "cost of practice integration into new projects", "In B.C. it creates unnecessary planning fatigue, and increased costs for very little return for the owner unless the project is large enough to benefit. For a single family home owner it is still fairly insignificant individually but collectively it may be fine. It is actually another reason other than taxes for a decline in economy here which is real estate. Absolute backfire!", "Increased costs associated with road construction in permafrost environments", "Balancing adaptation with a productive/economically viable forest", "How to integrate changes to current practices in ranching and farming, while still maintaining reasonable costs", "budget to implement adaptation practices (eg. stormwater planning in developer design)", "balancing costs imposed by more strict permit requirements"
<p>Cost \$ of action, inaction, part 2</p>	<ul style="list-style-type: none"> "Lack of dedicated funding to do this work. Not captured in strategic plan of organization" "Projects focus on short term costs with future impacts not adequately incorporated into project economics and decision making" "financial restrictions (municipal budgets)", "Cost... restraints at the municipal level", "We work primarily on public projects so with limited funding landscape elements that would be beneficial to climate adaption often get dropped if budgets are tight", "Although CC Mitigation and Adaptation is a high priority for elected officials, it is not yet a high priority for senior management or employees, resulting in a lack of staff and financial resources to advance this work", "Adaptation will require significant investments from senior governments", "Municipal governments do not have unlimited

Challenges	Criteria
	<p>funding and it is sometimes difficult to support these implementations with solid business cases”, “Political will - at the moment it is strong, but it is competing with other political priorities like affordability and the opioid crisis”</p> <ul style="list-style-type: none"> • “The costs to implement are apparent, but the costs not to implement are more difficult to quantify”, “Convincing people that designing holistic spaces which incorporate environmental, economic and social goals is worth planning and investing in”, “mainstreaming adaptation via asset management and cap planning”, “budget/funding to implement physical and behavioral changes”, “Trying to integrate the real risk/costs of climate change adaptation into the communication or discussion of "normal" or currently expected beneficial management practices” • “Profit is prioritized over efficiency or public benefit”, “Buy-in from contractors and industry where the main consideration is profit”, “short term profit motive of industry operating on the landbase”, • “limited data - costs of data”, “Being able to justify the payback with data”, “cost and understanding of which items will have the greatest impact”, “economics is often more important than environmental protection”
Discipline-related, interdisciplinary	<ul style="list-style-type: none"> • “lack of linkages with allied disciplines”, “Silo effect - non interdisciplinary application”, “Discipline specific actions and techniques are limited in their application”, “Working across disciplines is required, yet local government is often siloed”, “Current institutional arrangements create silos, therefor limiting the extent of adaptation work”, Development of silos, “There is a general lack of expertise in adaptation amongst professionals. Where there is expertise it tends to be narrowly focused on an individuals particular discipline”, “Lack of interdisciplinary communication and support limits us to implement the most solutions”, • “Not understanding how my decisions effect other disiplines in the area” • “Lack of understanding in how climate change will impact various sectors” • “Interdisciplinary issues that require input from expensive consultants”, • “Working with colleagues in other departments that don't have the same level of background understanding of the imperative”, “Recognition that LAs have something to contribute beside plant knowledge. Explaining our science and art plus the understanding we glean from self-study and reading continuously, continuing to participate in significant groups that addressing climate change adaptation”, “Other disciplines not recognizing or being familiar with landscape architecture as a profession and excluding us from some course options (example: sediment controls and storm water management)”, “Limited understanding among other professionals of immediacy of climate-related risks”, “other project team members lower level of knowledge and sense of urgency in climate adaptation”, “Requires close integration with engineering and unless there is an obvious risk the engineers wouldn't see this as a priority”, “Lack of knowledge about CC among my colleagues. E.g., electrical and electronics grads know very little, if anything about chemistry or biology”, “necessity of working with other disciplines, in particular for municipal projects, but other disciplines do not apply systems thinking appropriately”, “other practitioners do not take it seriously”, “Limited

Challenges	Criteria
	<p>sector specific knowledge available”, “CC Adaptation Program... adoption of adaptation into other programs in and outside of the ministry”</p> <ul style="list-style-type: none"> • “many sectors influence adaptation and limited resources to reach, train and motivate all in appropriate directions”, “Basically, integration/collaboration of all disciplines involve with the Project Design in considering climate change”. • “How do we work together to build healthy adaptive management goals”, “moving from planning to action and applying expertise that I do not possess (i.e. social implications)”,
Drought	<p>“Finding ways to plan for drought, early spring, late fall, warm winters is key”, “many of the fish species that we manage on coastal BC require an element of freshwater life history. In recent years drought stress on watersheds has become a major challenge”</p>
Ecological, biological impacts and management, part 1	<p><u>Impacts to Ecosystems:</u></p> <ul style="list-style-type: none"> • “on a small scale there is the effect on ecologies and plant life”, forest ecology, “Soil erosion and groundwater diminished supply”, “habitat change affecting Indigenous harvesting rights for fish, wildlife, migratory birds and vegetation”, “Effects on habitat from drier summers, higher spring freshet events and changes to food availability to species I protect”, tree mortality • “None really at the moment as I deal mostly with contaminated sites (soil and groundwater)” <p><u>Impacts to Fish:</u></p> <p>“many of the fish species that we manage on coastal BC require an element of freshwater life history. In recent years drought stress on watersheds has become a major challenge”</p> <p><u>Cumulative Impacts:</u></p> <p>“Trying to understand cumulative impacts associated with climate change”, “I don't fully understand the extent of the risks that climate change has impacted the wildlife value that I am currently work on. I understand that there are significant impacts from CC related to what my current focus is, but separating them from other impacts on the land base is not always clear or easy to decipher [Note this is BCIA, so likely applies to the entire landscape]”</p>
Ecological, biological impacts and management, part 2	<p><u>Ecosystem Management:</u></p> <ul style="list-style-type: none"> • “Need to focus on species habitat conservation in the moment (climate here and now) to safeguard habitat. Considerations for how the habitat use characteristics will change in the future are out-of-scope and difficult to assess”, “forest... management incl. urban forestry”, “not doing a good job of landscape-level planning that incorporates climate change adaptation (connectivity corridors, climate refugia, etc.)”, “Improving situation, but to be effective we need: to respond to CC & loss of biodiversity (interconnected issues)”, “predicting how climate change will impact species and ecosystems that are at risk now and may become at risk due to climate change”, “Need to focus on species habitat conservation in the moment (climate here and now) to safeguard habitat. Considerations for how the habitat use characteristics will change in the future are out-of-scope and difficult to assess”, “Species at Risk recovery planning”, “unpredictability of the effects of climate change on aquatic systems”, “Balancing adaptation with a productive/ economically viable forest”, “Current forest management strategies are often focused on the short term. Obviously sequestering carbon in trees/forest soils is important. We also need to account for the long term carbon storage (vs. short term), recognizing the increasing role that wildfire will play

Challenges	Criteria
	<p>(increasing rate/size/impact). Managing for resilient forests that are better able to survive wildfire and are more often within fire control capabilities will pay dividends in the long term (although fire resilient forests may store less carbon in the short term)", "challenge is reclaiming disturbed sites in a way that favors native vegetation, limits invasive species but also predicts which flora will be dominant in the future", "Appropriate plant selection / specification while satisfying municipal expectations", "Local policies that haven't been updated to address new best practices (tree planting and management, stormwater retention and management, sedimentation, etc)",</p> <ul style="list-style-type: none"> • "Understanding how CC may affect grazing opportunity for livestock and the wildlife requirements for food shelter and water", "Understanding how habitat functioning for specific species will be affected by CC", "lack of specifics for varying life histories and vulnerabilities", "the unknown. How to quantify possible changes that may occur and understand how mines should prepare for possible ecosystem changes in reclamation planning""Working in an urbanized environment which is less flexible/resistant to change than a rural or undeveloped area. Not knowing what the objectives should be for habitat during this time of change", cumulative impacts <p><u>Fish management:</u> "inertia in salmon management", "Forecasting salmon runs, species abundances for food availability in future for FN treaty negotiations", LACK OF CLIMATE RELATED IMPACTS DATA ON FISHERIES RESOURCES</p> <p><u>Ocean acidification and marine health:</u> "Understanding the scope of ocean acidification impacts to the marine environment and broader "ocean health""</p>
Ecological, biological impacts and management, part 3	
Emergency response	-
Energy	<p>"Wind loading and energy consumption", "To reduce the footprint of buildings - commercial, institutional, residential. Build with better insulation, windows, to use clean energy and natural ventilation", "Energy consumption in the construction industry", "I predominantly work building renewable energy sources which contribute to the reduction of CC, we generally don't consider the impacts of our work, only the result of the project"</p>
Extreme weather	<p>storms, "Work in Agriculture so staying abreast of work that assists the sector is preparing for/recovering from extreme heat, flood, fire emergencies" "Preperation for the design of materials and items that can accommodate severe storms and heat control mechanisms", "Implications of climate change on working environment (hot smokey summers) as well as impact on civil infrastructure eg. flooding", "Weather-related impacts on project sites, such as extreme rainfall, high temperatures, and air quality, and our ability to carry out and complete our work under these circumstances"</p>
Flooding	<p>"identifying solutions that can be implemented locally and falls within the realm of local government. (eg. challenges with responding to flooding and or preventing flooding due to prov regulations and [1] approval processes)", "Impacts to floods, high water flows and landslides over time are not well documented or predicted", "Work in Agriculture so staying abreast of work that assists the sector is preparing for/recovering from extreme heat, flood", "Risk to infrastructure from flooding", "The lack of regulatory requirements</p>

Challenges	Criteria
	<p>needed to consider climate change impacts (to address things like sea level rise, anticipated higher in-stream flows and flooding frequencies)", "Implications of CC on working environment (hot smokey summers) as well as impact on civil infrastructure eg. flooding". "catastrophic fires, flooding", "Obtaining data that can be used for probabilistic risk assessment (e.g. flood maps that show annual return period flood extents for future scenarios). Lack of hydrologic modelling that can be used as input to hydraulic modelling. Lack of good exposure data to conduct risk assessments (e.g. building footprints, critical infrastructure, census data that includes First Nations on and off reserve, flood damage costs)"</p>
Forests, forestry	<p>"Balancing adaptation with a productive/ economically viable forest", tree mortality, "forest ecology and management incl. urban forestry", "forest recidivism", "Current forest management strategies are often focused on the short term. Obviously sequestering carbon in trees/forest soils is important. We also need to account for the long term carbon storage (vs. short term), recognizing the increasing role that wildfire will play (increasing rate/size/impact). Managing for resilient forests that are better able to survive wildfire and are more often within fire control capabilities will pay dividends in the long term (although fire resilient forests may store less carbon in the short term)", "Limited by government policies of what you can plant (forestry), and few government incentives to try anything different", "Lack of support for innovative practises within the forest industry and forest legislation. Not enough region specific trials to support adaptive practises used elsewhere"</p>
Human health	
Indigenous	<p>"First Nation", "Indigenous" "Forecasting salmon runs, species abundances for food availability in future for FN treaty negotiations", "I work with Indigenous communities and provincial natural resource agencies (i.e. Ministry of Forests and Lands) and climate change is often not considered in the planning projects that I oversee", see also example comment</p>
Indoor comfort and safety	Infrastructure includes buildings
Industry barriers	<ul style="list-style-type: none"> • industry understanding, "opposition to CC adaptation by industry", "no one cares about it. We're a steel fabrication shop", lack of awareness in client and construction companies, lack of knowledge by development application reviewers, lack of concern in the construction and real estate industry, "CC issues are only of tertiary concern in the realm of health and safety", "Buy-in from contractors and industry where the main consideration is profit", "short term profit motive of industry operating on the landbase", "unless there is an obvious risk the engineers wouldn't see this as a priority", "Working for clients whose work inherently causes climate risk (e.g. oil and gas sector) means ability to meaningfully incorporate climate risk to biological and human systems is compromised" • "I must provide clear, concise, measurable approaches to climate change that are cost effective and known in my industry", "Impact on industry such as delay in approvals, cost, monitoring for impact One player or industry working within guidelines while others are not" • "Heathcare and Information Technology is a very disposable and consumable industry" • "Changing the paradigm of the industry sectors I'm working in", "lack of consensus within industry about best practices", "Consistency in definition, approach and implementation between industry,

Challenges	Criteria
	regulatory approval processes and municipal/provincial/federal government policy”, “Lack of industry specific frameworks to anticipate, report, regulate, monitor results
Infrastructure (not transport), buildings	<p><u>Impacts:</u></p> <ul style="list-style-type: none"> • “Risk to infrastructure from flooding, fires, etc.”, impact on infrastructure, “impact on civil infrastructure eg. flooding” • “Increased costs associated with road construction in permafrost environments”, <p><u>Design:</u></p> <ul style="list-style-type: none"> • “What design factors to use in bridge and road construction projects”, “Impact to Building HVAC&R system design, & operation”, “Design of drainage utilities”, “DESIGNING MORE ROBUST INFRASTRUCTURE”, “Preparation for the design of materials and items that can accommodate severe storms and heat [sic] control mechanisms”, “Incorporating CC into future infrastructure modelling. Updating our IDF curves for CC” • “To reduce the footprint of buildings - commercial, institutional, residential. Build with better insulation, windows, to use clean energy and natural ventilation”, • “Not knowing the impacts CC will have on infrastructure and on water supply in the future to assist in planning”
Irrigation	"The changing needs and requirements of irrigation needs and how to reconcile that with old old policies”, “Water shortage. We need storage for the future. Producers can no longer afford to build maintain and be liable for dams in B.C. We estimate by 2050 we will need 10 percent more water to continue irrigation our current land base”
Jurisdiction as barrier	influences outside regional area, “identifying solutions that can be implemented locally and falls within the realm of local government. (eg. challenges with responding to flooding and or preventing flooding due to prov regulations and approval processes)”, “Minimize the Styrofoam packaging, but this needs to happen from the federal level to the manufacturers not to package goods this way”, “Limited authority/mandate of Regional Districts”
Land base constraints	area-based tenures reducing incentives for long term stewardship, “when there are not alot of alternative options for landscape development, it is difficult to add another layer of constraint”
Landscape design	
Mandate, leadership direction	<ul style="list-style-type: none"> • “management and political views” • “Lack of mandate - strictly optional and up to the whims of decision makers”, “upper level management is not as involved in making this a priority”, “It is simply omitted from consideration to a large degree, so there is no direct way to evaluate or promote climate change positive adaptation in my work”, “support from managers, understanding from managers”, “It is not considered an important topic by senior environment management in my department”, “My position does not allow for dealing with CC considerations”, “lack of support / direction / understanding from my team lead and program director”, “Building design is set by Architect”, “lack or directive to bureaucrats to take action”, “Time commitment - need upper management acceptance”, “lack of desire or support from management/leadership”, “I am not in a position to implement CC action or determine what those actions are”, “Buy in from director level”

Challenges	Criteria
	<ul style="list-style-type: none"> “In the recent past, convincing my leadership group that adapting was essential and would create opportunity...now - I will work preferentially with people who are interested\engaged”
Materials Packaging, Cement	<p>“Minimize the Styrofoam packaging, but this needs to happen from the federal level to the manufacturers not to package goods this way”, “The manufacturer of cement”, “Preparation for the design of materials and items that can accommodate severe storms and heat control mechanisms”, “Not sure where any part in the Structural Engineering field fits into anything that could/would affect CC to begin with. Not going back to building with mud and straw?”</p>
Norms	-
Outdoor recreation	
Pests, invasive species	<p>“effects on pest behaviour”, “Predicting the CC effects of invasive alien species”, “My present work focuses on keeping populations of feral horses in the US and Canada within sustainable limits, which includes impacts to native wildlife within acceptable limits”, “Assessing/recommending re-vegetation plans for changing climate conditions (temp, precipitation, pests)”, “challenge is reclaiming disturbed sites in a way that favors native vegetation, limits invasive species...”</p>
Phenology? Seasonal change	
Plant cover	-
Political barriers	<ul style="list-style-type: none"> “political resistance to accepting policy/design that is different”, lack of political will, political agenda, management and political views, “A lack of true Government to the issue”, “misinformation for political motives” political will, political will to accept that change is necessary, acceptance by government, political buy in, “more leaders & more effective leadership”, stronger governance, “political buy in for policy changes that will require behavioral change” “Getting municipal govts on board with new to our region technology that has already been proven elsewhere”, “getting Council buy in to push for Climate Change requirements for Development” “take cpd development money, lobby political parties for environmental change. its better than educating the educated” “carbon modelling that is largely politically driven”
Politics	-
Professional norms as barriers	<ul style="list-style-type: none"> “not always the norm”, “A we've always done it this way attitude and complacency that there haven't been climate related disasters in certain geographical areas yet”, business as usual, “innovated ideas not “welcome” per se. Business as usual”, ‘We have always done it this way’, “There is a “business-as-usual” paradigm in place in too many places..”, “The barrier of a business as usual approach” “It is a much more accepted practice to use hard infrastructure, because it is engineered”, “In traditional manufacturing and residential/commercial/industrial construction there are many climate unfriendly materials and lots of wastes”, “Climate change needs to be applied to current project design to account for changes that will occur. That is a type of assessment of a project that is not common.”, “Area of work has very little connectivity to climate change (not high risk) or adaptation and, to the extent there is a need, some level of consideration already takes place. Full or integration would require advance risk assessment and implementation of appropriate adaptation techniques and it is challenging to justify the

Challenges	Criteria
	time and effort to alter long standing processes”, “Changing current mindset and practices in agriculture”, “Appropriate plant selection / specification while satisfying municipal expectations”
Regulations	-
Regulatory barriers, part 1 (includes legislation, policy, guidelines)	<ul style="list-style-type: none"> • Legislation, “Government guidelines, policies, bylaws”, “regulatory restraints at the municipal level”, “...legislation that enable appropriately incorporating risk into a decision (not just climate change)”, • “There is no or very little regulatory requirement in municipalities to encourage or support CC adaptation”, “No code requirement, requirement not codified or not required in standards, standards and rules of construction, “No clearly endorsed/accepted standards” hence, ignored by all stakeholders”, “Resistance to change from... regulatory agencies”, “regulatory barriers to implementation”, “My agency does not have standard requirements for considering CC risk or adaptation in our work, and there is internal resistance to including such requirements on individual projects without overarching policy guidance”, “lack of municipal bylaws & policy REQUIRING it”, “lack of government policy and direction in how to incorporate CC risk and adaptation in our work”, “lack of strong policies requiring this for industry”, “Consistency in definition, approach and implementation between industry, regulatory approval processes and municipal/provincial/federal government policy”, Outdated City Policy, “Government policy and lack or directive to bureaucrats to take action”, I work with Indigenous communities and provincial natural resource agencies...and CC is often not considered in the planning projects that I oversee”, “Not having the policy in place to legally enforce this”, “legislation does not allow for consideration of ideas or theories in decisions”, “As a consultant, if it is not a necessary step or required provision in the scope of work there will be very little interest in incorporating CC risks and adaptation into the work”, “Lack of industry specific frameworks to anticipate, report, regulate, monitor results” • “no challenges because there're no regulatory requirements” • “Knowing what tools exist, if regulations exist and how to make effective decisions using these tools” • “We recently had to switch to Tier4 final engine packages (less emissions) as legally required. These engines cost more, and required a long development design engineering time that delayed our product schedule”, “The impact of changes to building code and electrical code”, “on the edge of being required by clients and therefore not paid for”, “...Many have rigid standards to design to”, “Balancing costs imposed by more strict permit requirements” • “Best approaches for addressing CC in impact assessment (effects on environmental components including people, effects on projects, effects on mitigation success) Best approaches for managing and mitigating CC effects (e.g., on environmental components)”, “lack of consensus within industry about best practices”, “Local policies that haven't been updated to address new best practices (tree planting and management, stormwater retention and management, sedimentation, etc)”, “There is a proliferation of tools and case studies that are spread out across a variety of groups, but not a single reliable set of “best-practices””, “Getting client buy-in to the higher costs relating to applying best practices to projects”
Regulatory barriers, part 2	<ul style="list-style-type: none"> • “As a provincial regulator, I have to work within the government priority framework and CC is not a priority in waste discharge

Challenges	Criteria
	<p>regulation”, “Tools (designations) for conservation planning, including habitat protection, do not exist that allow incorporation of CC adaptation. Legislation needs to change to allow inclusion of this objective”, “The changing needs and requirements of irrigation needs and how to reconcile that with old old policies”, “The main challenge is the lack of guidelines related to assessment of effects of CC on groundwater quantity and quality”, “The lack of regulatory requirements needed to consider CC impacts (to address things like sea level rise, anticipated higher in-stream flows and flooding frequencies)”, “regional and provincial specifications are old and don’t allow recycle products”, “Limited by government policies of what you can plant (forestry), and few government incentives to try anything different”, “government approved stocking standards don't allow for innovate solutions to CC”, “Lack of support for innovative practices within the forest industry and forest legislation”, “The province needs to take the lead as not all tenures are area based resulting in reduced incentives for long term stewardship”, “The regulatory backing and budget to implement adaptation practices (eg. stormwater planning in developer design)”, “My job is to support resort development on Crown land by helping proponents meet their obligations to the Province. Although I can encourage proponents to include CC actions in their development plans, I am not in a position to implement CC action or determine what those actions are”</p>
Risk and barriers	<ul style="list-style-type: none"> • “unless there is an obvious risk the engineers wouldn't see this as a priority”, “Currently CC issues are only of tertiary concern in the realm of health and safety (ie, safety issues around servicing of electric fleet vehicles)”, “Area of work has very little connectivity to climate change (not high risk)... Full or integration would require advance risk assessment...”, “Trying to integrate the real risk/costs of CC adaptation into the communication or discussion of "normal" or currently expected beneficial management practices” • “Less acceptance of soft infrastructures due to risk” • “inherent challenge of garnering attention for issues that are ^{low}low probability and high consequence” • “See climate change as a risk management issue more than a scientific one”, “-research available on climate change risks -risk is usually integrated but I think there should be more focus on integrating solutions and research into work”, “I don't fully understand the extent of the risks that climate change his impacted the wildlife value that I am currently work on. I understand that there are significant impacts from climate change related to what my current focus is, but separating them from other impacts on the land base is not always clear or easy to decipher” • “Lack of knowledge - what are the risks? How evaluate proposals...”, “Knowledge specific to analytical chemistry and how the data analyzed can help firms make appropriate risk mitigation strategies”, “Better understanding and information on risk”, • “Tools/understanding/legislation that enable appropriately incorporating risk into a decision (not just climate change)”
Sea level rise (SLR)	<p>“SLR”, “assessing water levels for SLR”, “The lack of regulatory requirements needed to consider climate change impacts (to address things like sea level rise...)”</p>
Seasons, temperature, precipitation	<p><u>Impacts:</u></p> <ul style="list-style-type: none"> • “Changes in precipitation and runoff”, “Lower annual precipitation; reduction in snow pack and glaciers; impacts to riparian zones and development that impact ground water infiltration”,

Challenges	Criteria
	<p>“Working as an Erosion and Sediment control Designer and Inspector the rainfall data and how the recognized seasons are becoming either drier longer, or in the fall and winter the rainfalls are of a higher intensity over a longer period of time”,</p> <ul style="list-style-type: none"> • “Changes in growing conditions for vegetation I am trying to establish”, “Soil erosion and groundwater diminished supply”, “Water shortage...”, flooding, “Effects on habitat from drier summers, higher spring freshet events and changes to food availability to species I protect” • “Implications of climate change on working environment (hot smokey summers”, “impact on civil infrastructure eg. flooding”, “Weather-related impacts on project sites, such as extreme rainfall, high temperatures, and air quality, and our ability to carry out and complete our work under these circumstances”, <p><u>Management:</u></p> <ul style="list-style-type: none"> • “Finding ways to plan for drought, early spring, late fall, warm winters is key”, “Assessing/recommending re-vegetation plans for changing climate conditions (temp, precipitation”, “assessing storm water/stream flow for future conditions”, “Water Resources supply and management”, “The lack of regulatory requirements needed to consider climate change impacts (to address things like... anticipated higher in-stream flows and flooding frequencies)”, “We need storage for the future. Producers can no longer afford to build maintain and be liable for dams in B.C. We estimate by 2050 we will need 10 percent more water to continue irrigation our current land base”, “Local policies that haven't been updated to address new best practices (tree planting and management, stormwater retention and management, sedimentation, etc)”, water usage, • “Not knowing the impacts CC will have on infrastructure and on water supply in the future to assist in planning”, “e.g. prediction of water flows due to unpredictable precipitation events, snowpack”,
Scope and scale	<ul style="list-style-type: none"> • scope constraints, “not currently (directly) in scope. Always peripheral”, “Scope of work on a project is limited. Brought on to a project after key site decisions have been made. Types of projects have limited flexibility for expanding the response to climate change”, “Small size of my current projects”, “Limited client budgets with scope that restricts including risk and adaptation related to CC”, “Work is generally short-term and task focused”, “Scope of work rarely includes such long term considerations”, Scope and budget limitations, • “Difficult to tackle a global issue at a local scale” • “The limited scope of climate change. Not only are we facing climate change issues, we also put ourselves in the way of it” • “As a consultant my biggest challenge is getting folks to think about the big picture and how everything is inter-related” • “The problem is so large and do not know where to start” • “A lot of projects are not very flexible because our work responds closely to architecture or client desires. If the work was more collaborative, more meaningful strategies could be employed.
Social (not including Indigenous-specific)	
Societal barriers	<ul style="list-style-type: none"> • Apathy, Denial, “Societal inertia and opposition to climate change adaptation by industry and political interests”, “public... buy in for policy changes that will require behavioural change”, greater social acceptance, “limited understanding to denial...”, people believing it does not exist, resistance from stakeholders, “basic awareness of

Challenges	Criteria
	<p>different stakeholders”, people not wanting to implement it, “public unwilling to change behavior - consumer marketing encourages waste and excess”, “public understanding, education”, “The ability for people to change their behaviours and do things differently”, lack of interest, “Actors accepting the real challenge presented in climate change and an unwillingness to do what is really needed”</p> <ul style="list-style-type: none"> • “fake news, the media, a systematic approach of ignorance” • convincing people, changing publics mind, “Changing staff and public mentalities around the simple steps to reduce climate impact”, “getting folks to think about the big picture and how everything is inter-related” • lack of public engagement
Substrate management	
Substrates	<p>“Lack of data to directly relate terrain instabilities (I.e. landslides) to CC”, “Impacts to floods, high water flows and landslides over time are not well documented or predicted”, “Most of my work is centred around mitigation of climate change in the creation of sustainable agricultural systems, and projected outcomes in soil cycling, soil moisture, crop yield and ghgs. But not as much is said about adaptation separately from mitigation practises”, soil erosion, “None really at the moment as I deal mostly with contaminated sites (soil and groundwater)”, “Obviously sequestering carbon in trees/forest soils is important”</p>
Temperature	-
Time	<ul style="list-style-type: none"> • “long-term commitments needed”, “the relevance of including it in reports where short term effects are evaluated”, “client.. short-term view”, “work plans are short term and determining how to adapt to climate change is longer term - e.g., managing for changing flow regimes, vegetation, storms”, “lack of long-term vision”, “Professional Reliance pushes professionals to focus on short term... client doesn't want to change practices because they don't understand medium and long term implications...”, “balancing many competing immediate/short term risks so integrating/considering longer term uncertain risks could be challenging”, “work is generally short-term and task focused”, “Forestry has very long timelines that limit the ability to determine efficacy of prescriptions”, “current management regimes are static. Forestry and wildlife management requires a paradigm shift looking forward to future climate scenarios”, “no requirements to look any further than 5 years into the future”, “planning on long (5+year) time scales” • “time to figure out the most relevant information”, time constraints, lack of time, “multiple pressures and juggling multiple priorities resulting in limited time to fully understand”, “Lack of time and resources to develop/adapt tools”, time commitment, “[low emission] engines...required a long development design engineering time that delayed our product schedule”, time increases, “no time to create and implement”, delay in approvals • “timing of field trips to capture particular streamflow target flow magnitudes”, “timing for Range Use Plans” • “slow pace of organizational change to meet climate risks”, “is not a priority in my organization at this time”, “inertia in salmon management”, “Limited understanding among other professionals of immediacy of climate-related risks”, “clients and other project team members lower level of knowledge and sense of urgency”, “regulations/codes need to be able to be revised in a timely manner to counter impacts of climate change”

Challenges	Criteria
	<ul style="list-style-type: none"> “Wasted time on general climate change “courses””
Vehicles, transportation infrastructure	“Changing to big electric vehicles (Trucks, diesel generators etc...)”, Traveling by gas truck long distances”
Waste	waste, “As a provincial regulator, I have to work within the government priority framework and CC is not a priority in waste discharge regulation”, “In traditional manufacturing and residential/commercial/industrial construction there are many climate unfriendly materials and lots of wastes”, “budget/funding to implement physical and behavioral changes - public unwilling to change behavior. - consumer marketing encourages waste and excess”
Water availability (see also drought) Water categories overlap.	“The main challenge is the lack of guidelines related to assessment of effects of climate change on groundwater quantity and quality”, “Lower annual precipitation; reduction in snow pack and glaciers; impacts to riparian zones and development that impact ground water infiltration”, “Water Resources supply and management”, groundwater diminished supply”, “Water shortage. We need storage for the future. Producers can no longer afford to build maintain and be liable for dams in B.C. We estimate by 2050 we will need 10 percent more water to continue irrigation our current land base”,
Water cycle - other	"timing of field trips to capture particular streamflow target flow magnitudes”
Water - Ecosystems, spp.(impacts, management)	"many of the fish species that we manage on coastal BC require an element of freshwater life history. In recent years drought stress on watersheds has become a major challenge”,
Water - Socio-economic impacts	"Water shortage. We need storage for the future. Producers can no longer afford to build maintain and be liable for dams in B.C. We estimate by 2050 we will need 10 percent more water to continue irrigation our current land base”, “Understanding how climate change may affect grazing opportunity for livestock and the wildlife requirements for food shelter and water”
Water management	“The changing needs and requirements of irrigation needs and how to reconcile that with old old policies”, “Convincing developers of the need for greening of stormwater management”, "assessing storm water/stream flow for future conditions”, “Water Resources supply and management”, “The lack of regulatory requirements needed to consider climate change impacts (to address things like... anticipated higher in-stream flows and flooding frequencies)”, "timing of field trips to capture particular streamflow target flow magnitudes”, “The main challenge is the lack of guidelines related to assessment of effects of climate change on groundwater quantity and quality”, “Challenges in determining how hydrographs will change over time and regionally within BC. Impacts to floods, high water flows and landslides over time are not well documented or predicted”, “Lack of understanding (as a team) of how climate change will effect the water treatment process”, "None really at the moment as I deal mostly with contaminated sites (soil and groundwater)", Water shortage. We need storage for the future. Producers can no longer afford to build maintain and be liable for dams in B.C. We estimate by 2050 we will need 10 percent more water to continue irrigation our current land base”, “Local policies that haven't been updated to address new best practices (tree planting and ^{SEP} management, stormwater retention and management, sedimentation, etc) 2. Other disciplines not recognizing or being familiar with landscape architecture as a profession and excluding us from some course options (example:

Challenges	Criteria
	sediment controls and storm water management”, “The regulatory backing and budget to implement adaptation practices (eg. stormwater planning in developer design)”, water usage, “Understanding how climate change may affect grazing opportunity for livestock and the wildlife requirements for food shelter and water”
Water quality	“The main challenge is the lack of guidelines related to assessment of effects of climate change on groundwater quantity and quality”
Water research, data needs	“Lack of streamflow data, particularly in ungauged and small watersheds. You can't account for climate change if you don't understand the baseline”, “What factor to raise hydrology analysis in watersheds for climate change”, “Challenges in determining how hydrographs will change over time and regionally within BC. Impacts to floods, high water flows and landslides over time are not well documented or predicted”, “Lack of understanding (as a team) of how climate change will effect the water treatment process”, “Not knowing the impacts CC will have on infrastructure and on water supply in the future to assist in planning”, “Obtaining data that can be used for probabilistic risk assessment (e.g. flood maps that show ¹¹ annual return period flood extents for future scenarios). Lack of hydrologic modelling that can be used as input to hydraulic modelling. Lack of good exposure data to conduct risk assessments ¹¹ (e.g. building footprints, critical infrastructure, census data that includes First Nations on and off reserve, flood damage costs)”, “Understanding how climate change may affect grazing opportunity for livestock and the wildlife requirements for food shelter and water”, e.g. prediction of water flows due to unpredictable precipitation events, snowpack”
Water treatment	“Lack of understanding (as a team) of how climate change will effect the water treatment process”
Wildfire - Ecological impacts	
Wildfire management	
Wildfire research, data needs	
Wildfire - Socio-economic impacts	
Wildfires	

Table 3. Coding results, part 2 – Learning challenges

Learning Challenges	Prof Org	n Mentions	Total	Sample Comment
Accessibility	ABCFP	1	4 (3)	“Finding convenient opportunities such as webinars, lectures and field trips”
	BCIA	2		
	CAB	1		
Accreditation	BCSLA	1	1 (1)	“integrating climate change adaptation materials into accreditation standards”
Availability	PIBC	1	1 (1)	“lack of CPD available for climate adaptation”
Competencies	ABCFP	1	3 (2)	“more effective problem solving (integrative, adaptive)”
	CAB	2		
Complexity	ABCFP	1	5 (5)	“BECs and site series are effectively changing but not in simple linear
	ASTTBC	1		

Learning Challenges	Prof Org	n Mentions	Total	Sample Comment
	BCIA CAB	2 1		ways" BEC=biogeoclimatic ecosystem classification
Cost of training	BCIA	1	1 (1)	"I only work part time and on a quite limited basis so personally the costs of training and opportunity for work are limited"
Effectiveness	ABCFP ASTTBC BCIA BCSLA CAB PIBC	4 3 5 1 1 1	15 (15)	"Uncertainty about actions' effectiveness"
Lack of data	ABCFP ASTTBC BCIA BCSLA CAB EGBC PIBC	1 4 2 2 2 1 2	14 (14)	"Lack of streamflow data, particularly in ungauged and small watersheds. You can't account for climate change if you don't understand the baseline"
Lack of direction - move to table above	ABCFP ASTTBC BCIA	1 1 3	5 (4)	"lack of evidence-based direction"
Lack of knowledge	ABCFP ASTTBC BCIA BCSLA CAB EGBC PIBC	9 21 33 8 12 5 3	91 (82)	"Lack of specifics for varying life histories and vulnerabilities"
Messaging, communication	ABCFP ASTTC BCIA CAB PIBC	1 1 3 1 1	7 (7)	"How to frame the message and discuss concerns while advocating for positive change. For example when discussing EV adaption, the questions become about the batteries being bad for the environment"
Models	ABCFP ASTTBC BCIA CAB EGBC PIBC	5 7 15 17 6 1	51 (45)	"Uncertainty regarding climate change projections"
Networks	ATTBC BCIA CAB	1 1 2	4 (4)	"community of practice"
Professional accountability				
Tools	ABCFP BCIA BCSLA CAB EGBC PIBC	2 6 3 5 1 1	18 (16)	"Climate change adaptation is not built into the tools that we use for conservation right now; lack of specific technical knowledge about climate change adaptation in the organization"

Table 4. Coding scheme, part 2 – Learning challenges

Learning Challenges	Criteria
Accessibility	“Finding convenient opportunities such as webinars, lectures and field trips”, “In order to attend a conference we have to give a paper/poster. Otherwise we can't attend”, “The distance I would have to travel (specifically the amount of time it would take)”
Accountability	
Accreditation	“integrating climate change adaptation materials into accreditation standards”
Availability	“lack of CPD available for climate adaptation”
Competencies	“more effective problem solving (integrative, adaptive)”, “Wasted time on general climate change "courses" or by inexperience of climate change experts on other subject matter”
Complexity	“BECs and site series are effectively changing but not in simple linear ways”, “Trying to think of and incorporate all possible mitigation measures when developing recommendations. Not wanting anything left out”, “CC is only one element. To strike the appropriate balance and “best” integration of a number of key elements. Working landscape planning that incorporates biodiversity, impact of CC impact of urbanization or population growth, impact of landscape health, ^[SEP] economic health, just to name a few”, “I don't fully understand the extent of the risks that climate change his impacted the wildlife value ^[SEP] that I am currently work on. I understand that there are significant impacts from climate change related to what my current focus is, but separating them from other impacts on the land base is not ^[SEP] always clear or easy to decipher”, “The problem is so large and do not know where to start”
Cost of training	“I only work part time and on a quite limited basis so personally the costs of training and opportunity for work are limited”
Effectiveness	“Uncertainty about actions' effectiveness”, “Uncertainty of implications”, “Uncertainty around process/outcome”, “Lack of precedent. Uncertainties in effectiveness of mitigation/adaptation actions”, “Uncertainty Doesn't really arise as a real consideration for which there is much practical management response”, “Achievable goals and objectives”, “Belief effort will result in effect”, “I predominantly work building renewable energy sources which contribute to the reduction of climate change, we generally don't consider the impacts of our work, only the result of the project”, “identifying feasible policies and actions”, “Need to be operational”, “cost and understanding of which items will have the greatest impact”, “not that knowledgeable about adaptations that are practical and effective”, “measuring or tracking of results and quantifying in the short term”, “Forestry has very long timelines that limit the ability to determine efficacy of prescriptions”, “How to avoid unintended consequences of well meaning actions”
Lack of data	<ul style="list-style-type: none"> • “We're still at the garbage-in/garbage-out stage - poor baseline information”, “limited data - costs of data”, “Being able to justify the payback with data”, “Limitation of good data”, “Lake of credible data”, “Lack of well curated, long term data sets to inform decisions”, “My work is very focused on data and I am not sure how to integrate consideration into it”, “measuring or tracking of results and quantifying in the short term”, “Lack of pertinent local data”

Learning Challenges	Criteria
	<ul style="list-style-type: none"> • “Safety factors needed in design calculations for HVAC and Structural. Some of these have changed for structural but information on temperature and snowfall trends (direction of up or down in regards to specific tedious and districts) are not easily attainable or even available” • “Lack of specific knowledge ie/ which tree species will be adapted in the future, which materials have lowest carbon footprint”, • “Lack of data to directly relate terrain instabilities (I.e. landslides) to climate change” • “Lack of streamflow data, particularly in ungauged and small watersheds. You can't account for climate change if you don't understand the baseline” • “LACK OF CLIMATE RELATED IMPACTS DATA ON FISHERIES RESOURCES”
Lack of direction	<p>“lack of clear direction/goal”, “Limited resources and understanding on how to implement resources for adapting to climate change”, “ack of direction as to how to consider climate change risks - how is it different from business continuity planning?”, “lack of evidence based direction”</p>
Lack of knowledge - general, what - part 1	<ul style="list-style-type: none"> • Knowledge, lack of knowledge, Limited knowledge, skill limitation, “maintaining sufficient knowledge of research findings in CC adaption”, “Lack of knowledge, “lack of specific and reliable technical knowledge and tools”, “lack of understanding of tools, techniques”, “knowing where to access resources and training”, “Lack of knowledge limits my ability to connect funders with "good" projects. There seems to be a great deal of funding available now, but implementing effecting and lasting projects is difficult”, “Lack of knowledge by development application reviewers”, “Post-parental leave, refresher for what is current as well as upgrading to include practical application of climate adaptation”, “Lack of knowledge to impart information to people I mentor”, “lack of specific technical knowledge about CC adaptation in the organization”, “Being on top of the current applicable information”, “Leverage and knowledge”, “lack of evidence based direction” • “To be honest I am unfamiliar with what the process would be like”, “DO NOT CLOSE LIBRARIES AND SHRED OLD BOOKS. 1975 SURVEY OF LAKES from CHURCHILL TO RESOLUTE WAS GOING TO BE SHREDDED. I HAVE THE ONLY TWO COPIES. USEFUL FOR CLIMATE CHANGE COMPARISONS. 3 YEARS WORK AND MILLIONS SPENT TO COLLECT DATA.TERRIBLE WASTE”, “Understanding what the risks are and its impacts”, “Better understanding and information on risk”, “Lack of understanding in how climate change will impact various sectors”, “Not enough region specific trials to support adaptive practises used elsewhere”, “Navigating the many overlapping and contradictory definitions and perspectives re the current and future state of the climate. Until then risk identification, and application are much more challenging”, “There is a general lack of expertise in adaptation amongst professionals. Where there is expertise it tends to be narrowly focused on an individuals particular discipline”, “Lack of understanding of what CC is and how it affects me everyday personally and professionally”, “moving from planning to action and applying expertise that I do not possess (i.e. social implications)”, “There is also lots of high level information out there but very little specific/tangible information that people can take and utilize”, “Limited sector specific knowledge availalbe”, “not

Learning Challenges	Criteria
	<p>that knowledgeable about adaptations that are practical and effective”, “Lack of available data to determine the direction of change”, “The problem is so large and do not know where to start”</p>
<p>Lack of knowledge - what, part 2</p>	<ul style="list-style-type: none"> • “product knowledge and availability” • “Lack of builder knowledge of advanced construction techniques, materials, etc.” • “Not knowing the impacts CC will have on infrastructure and on water supply in the future to assist in planning” • “Knowledge specific to analytical chemistry and how the data analyzed can help firms make appropriate risk mitigation strategies” • “I don't know where to start (i.e. quantifying carbon emissions, estimating carbon capture potential from a number of projects I have in mind - to determine which would be most effective in reducing CO2 emissions” • “Lack of specifics for varying life histories and vulnerabilities”, “I don't fully understand the extent of the risks that climate change his impacted the wildlife value that I am currently work on. I understand that there are significant impacts from climate change related to what my current focus is, but separating them from other impacts on the land base is not always clear or easy to decipher”, “Understanding the scope of ocean acidification impacts to the marine environment and broader "ocean health", “Effects on habitat from drier summers, higher spring freshet events and changes to food availability to species I protect” • “Best approaches for addressing CC in impact assessment (effects on environmental components including people, effects on projects, effects on mitigation success) Best approaches for managing and mitigating CC effects (e.g., on environmental components)”, “My work is limited to enforcement of municipal bylaws as it relates to development. There is not enough information as it relates to my specific work on the effects of CC and how to mitigate” • “The challenge is to understand the impact climate change has on my profession and to have others understand the impact”, “I work in the environmental consulting industry, and sometimes it doesn't focus enough on our company's environmental footprint/effects/improvement abilities and I would like to learn more both on a professional level and for myself personally”, • “Timing for Range Use Plans, i.e. Turnout”, “Appropriate plant selection / specification”,
<p>Lack of knowledge - how</p>	<ul style="list-style-type: none"> • “how evaluate proposals wrt climate?”, understanding how our field of work impacts climate change”, “Need to incorporate more specifics into project planning, but uncertain how to make connections” • “I do not understand how I can integrate it into contaminated site investigations”, “Resources for green chemistry materials and methods”, Lack of understanding (as a team) of how climate change will effect the water treatment process”, “identifying feasible policies and actions”, “Understanding how CC may affect grazing opportunity for livestock and the wildlife requirements for food shelter and water”, “Understanding how habitat functioning for specific species will be affected by climate change”, “Balancing adaptation with a productive/ economically viable forest” • <u>Choosing from options</u>: “So much material, processes and frameworks, so deciding which ones to use is difficult”,

Learning Challenges	Criteria
	<p>“Determining appropriate data to use from various websites”, “Determining what aspect of the project in terms of management, operation or construction could be modified to make a meaningful reduction in direct and indirect causes of CC”, “Which scenario to use”</p>
<p>Lack of knowledge - educating others, enlightenment</p>	<p><u>Educating others</u> “Having to educate others on what the impacts are and how to consider this in our work”, “Lack of education on both client and practitioner”, “Education - not everyone understand or have access to education on the impact of our actions in the long term effect in earth”, “clients and other project team members lower level of knowledge and sense of urgency in climate adaptation”, “In my field of work the biggest challenge is convincing people that the new lights we are installing has no effect on them”, “Clients need more education”, “Lack of knowledge about CC among my colleagues. E.g., electrical and electronics grads know very little, if anything about chemistry or biology”, “Public understanding Education at any level “, “basic awareness of different stakeholders”, “Polarization of viewpoints even in the scientific community is disturbing”, “Climate adaptation has not been sufficiently mainstreamed”</p> <p><u>Member Enlightenment</u> “None really at the moment as I deal mostly with contaminated sites (soil and groundwater)”, “None, climate change is not relevant to contaminated sites”, “See climate change as a risk management issue more than a scientific one”, “Little or no place for this in my research work (legal and historic)”, “Counter points from US presidential office”, “Not sure where any part in the Structural Engineering field fits into anything that could/would affect climate change to begin with. Not going back to building with mud and straw?”</p>
<p>Messaging, communication</p>	<ul style="list-style-type: none"> • “How to frame the message and discuss concerns while advocating for positive change. For example when discussing EV adaptation, the questions become about the batteries being bad for the environment”, “As a consultant my biggest challenge is getting folks to think about the big picture and how everything is inter-related”, “Trying to integrate the real risk/costs of CC adaptation into the communication or discussion of "normal" or currently expected beneficial management practices” • “I work within the hydrocarbon industry, CC is a taboo subject”, • “sorting the misinformation spread by some on the Web from facts”, “misinformation for political motives” • “Climate adaptation has not been sufficiently mainstreamed”
<p>Models, part 1</p>	<ul style="list-style-type: none"> • “Uncertainty regarding climate change projections”, “uncertainties of the CC brings to decision and policy development...”, “Integrating the uncertainty of CC impacts is the primary challenge”, “Uncertainty as there is no real precedent”, “level of certainty currently available when making decision 20-50 years out”, “Uncertainty Doesn’t really arise as a real consideration for which there is much practical management response”, “uncertainty of models and regional specific application”, “The limited certainty of the GCMs. The limitations of the GCMs in British Columbia [GCM=General Circulation Model]”, Scientific Uncertainty • “Lack of agreement on how to measure and evaluate long term climate change both in relation to magnitude and impacts”, “Climate models are not accurate and do not predict current

Learning Challenges	Criteria
	<p>observations without significant manipulation of the data. This contradicts basic scientific principles. How does one implement predictions of a model that can't predict the current or past situations?", "A general lack of understanding of modelling and the role assumptions play in development of models. Poor understanding of niche; both functional and realized, and carbon modelling that is largely politically driven", "Poor availability of Future Climate data and application guidance", "Lack of empirical data that support climate change predictions. A science based approach to climate change predictions that considers all variables", "The science behind it seems be changing all the time. It's hard enough trying to keep up at the best of times", "Lack of confidence of understanding", "Do not know if previous climate data will be relevant going into the future", "Navigating the many over-lapping and contradictory definitions and perspectives re the current ^{SEP} and future state of the climate. Until then risk identification, and application are much more challenging"</p> <ul style="list-style-type: none"> • "Framework to build on. Hard to know where to start. If the project does not include a climate-related study, what predictions should I use to consider climate change risks for my discipline?"
Models, part 2	<ul style="list-style-type: none"> • "Lower annual precipitation; reduction in snow pack and glaciers; impacts to riparian zones and development that impact ground water infiltration", "timing of field trips to capture particular streamflow target flow magnitudes", "Limited information about specific drainage areas a project is occurring in. I rely on models with 10, 20, and 30 year predictions completed by professionals", "Assessing/recommending re-vegetation plans for changing climate conditions (temp, precipitation, pests); assessing storm water/stream flow for future conditions; assessing water levels for sea level rise", "Incorporating climate change into future infrastructure modelling. Updating our IDF curves for climate change [IDF=Intensity-Duration-Frequency]", "What factor to raise hydrology analysis in watersheds for climate change", "peak flow calculations currently used do not account for climate change", "Obtaining data that can be used for probabilistic risk assessment (e.g. flood maps that show annual return period flood extents for future scenarios). Lack of hydrologic modelling that can be ^{SEP} used as input to hydraulic modelling. Lack of good exposure data to conduct risk assessments (e.g. building footprints, critical infrastructure, census data that includes First Nations on and off reserve, flood damage costs)", e.g. prediction of water flows due to unpredictable precipitation events, snowpack, "Challenges in determining how hydrographs will change over time and regionally within BC. Impacts to floods, high water flows and landslides over time are not well documented or predicted" • "predicting how climate change will impact species and ecosystems that are at risk now and may become at risk due to climate change", "unpredictability of the effects of climate change on aquatic systems", "Need to focus on species habitat conservation in the moment (climate here and now) to safeguard habitat. Considerations for how the habitat use characteristics will change in the future are out-of-scope and difficult to assess", "the unknown. How to quantify possible changes that may occur and understand how mines should prepare for possible ecosystem changes in reclamation planning"

Learning Challenges	Criteria
	<ul style="list-style-type: none"> • “Trying to predict the level of impact climate change will have on my work and trying to adjust accordingly”, “Presently work in field decision are made for present day conditions. There very little information available to consider future condition”, • “Which scenario to use”
Models, part 3	<p><u>Model to ground</u> “transferring vague or modelled climate knowledge to on-the-ground situations”, “succinct details regarding forecasted impacts of climate change in the context of factors which affect my business”, “it is hard to come up with tangible mitigations and on-the-ground actions. most seem to be at higher policy levels”, “There is also lots of high level information out there but very little specific/tangible information that people can take and utilize”, “moving from planning to action and applying expertise that I do not possess (i.e. social implications)”, “Drilling down projections into localized and “real” numbers that can be integrated into design and policy”, “field based verification of models towards informed use”, “Forecasting salmon runs, species abundances for food availability in future for FN treaty negotiations”, “Not enough region specific trials to support adaptive practises used elsewhere”</p>
Networks	“Networking with scientists up and down West Coast”, “lack of networking with canadian agricultural research”, “Lack of knowledge limits my ability to connect funders with “good” projects”, “community of practice”
Tools	<ul style="list-style-type: none"> • “Access to tools that I can integrate into my work flow”, “lack of specific and reliable technical knowledge and tools”, “lack of understanding of tools, techniques”, “lack of quantitative tools, lack of scientific rigor in quantitative tools”, “Lack of knowledge of applicable tools”, • “opportunities to learn specific useful tools are inconsistent or unavailable”, “access to practical tools”, “Lack of knowledge and specific tools”, “BC has very poor tools that track changes in landcover through time. So we cannot look back in time to see how vegetation has changed in order to predict what will happen in the future”, “Lack of tools to adapt to changing rangelands”, “tools for scenario runs”, “Climate change adaptation is not built into the tools that we use for conservation right now; lack of specific technical knowledge about climate change adaptation in the organization” • “Tools/understanding/legislation that enable appropriately incorporating risk into a decision (not just climate change)”, “Knowing what tools exist, if regulations exist and how to make effective decisions using these tools” • “Lack of time and resources to develop/adapt tools” • “There is a proliferation of tools and case studies that are spread out across a variety of groups, but not a single reliable set of “best-practices”

Appendix G. Excellent CPD Courses

This Appendix organizes the responses to the question, “Have you participated in a CPD course that you thought was excellent? What specifically made that course effective? Can you provide the name of the course and by whom it was offered?” Tables 1 through 7 show these responses for each organization.

Note: Respondents rarely provided web links/urls and some provided links were broken. The research team added links for your convenience, respecting the intent of the original content.

Table 1. ABCFP

Course provider	Subject	Comments
BC		
ABCFP	conference, climate based seed transfer https://abcfp.ca/web/ABCFPConference/	
ABCFP	March 10 Webinar, SK case study by recent PhD grad	
ABCFP	webinars	
EGBC, BC MOTI, FP Innovations	Public Infrastructure Engineering Vulnerability Committee (PIEVC), application of principles	
BC MFLNRORD Climatologist, North Area, Vanessa Foord Completed through work.	Climate Change Education	discussion of case studies, openness to questions. no climate change doubters present in course.
UBC	Climate Literacy: Navigating Climate Change Conversations, MOOC http://flexible.learning.ubc.ca/news-events/climate-literacy-mooc-launches/	
Unknown		
[Columbia University climate scientist] James Hansen; [University of Colorado climate scientist] Jim White [James W.C. White]	Antarctica is thought to become unstable at between 600ppm ... 800ppm of carbon dioxide (currently 406ppm), a level potentially reached later this century(*) and leading to a global temperature anomaly of +2.2C ... +3.7C in the same time period. These levels of warming open up many Climate change feedbacks so temperatures will continue to rise in the following centuries to much higher levels.	has some excellent videos
		no, Nope, n/a, NONE, none that actually presented concrete ideas, “No, I have not. Often to broad/basic at macro level”, “Many years ago - sorry no details”, “no, but there are some researchers that provide excellent data which does not

Course provider	Subject	Comments
		seem to receive much attention”, “haha.... Reading new science papers and latest publications are the best source of information, there is not a good CPD course which can teach you. If the information or knowledge you want to gain, already in a format of textbook or a course stage, nothing new at all, do not need to look at, either information repeats or waste of time... “

Table 2. ASTTBC

Course provider	Subject	Comments
BC		
BC MFLNRORD Climatologist, North Area, Vanessa Foord Completed through work.	Climate Change Education	discussion of case studies, openness to questions. no climate change doubters present in course.
BC Building Envelope Council (BCBEC)	2018? Annual Conference https://bcbec.com/events/past-events/agm-conferences/2018-conference-and-agm/	gave a great overview of changes to BC Building Code (BCBC) and how Step Code and energy efficiency will be required of buildings
BC Centre on Substance Use (BCCSU)	Fourier Transform Infrared spectroscopy (FTIR) training http://www.bccsu.ca/drug-checking/	While its main goal was to include varying levels of skill in its scope, it covered program statistics, harm reduction info, and networking opportunities.
BCIT	field electrical trade courses	I like my field trade courses, i.e., electrical trade knowledge to update myself with today’s technology. BCIT has good courses, evening 1 day events.
BCIT, Architectural and Building Technology diploma program	2007 course called building synthesis or something like that https://www.bcit.ca/study/programs/7140dipma#courses	We had to come up with a site specific building and integrate at least 2 energy saving systems. We used about 5 which included sun shades on windows that had photovoltaics (pv) to lower heat gains in summer and pv to produce energy, hallways with skylights to daylight, heating gained through sewer water and cooled by stream water. PVs on roof as well as solar collectors for heating. and other integrations. It is something that we should all strive for but in the mean time

Course provider	Subject	Comments
		we are still building for a 25 year lifespan.
BC Water and Waste Association (BCWWA)	conference presentations https://www.bcwwa.org	
Bluetooth, Bluetooth Special Interest Group (SIG)	Some recent CPD activities: UnPlugFest 62 https://www.bluetooth.com/news-events/events/2019/unplugfest-62 Webinar: Launch Preview – Bluetooth Core Specification v5.1 Bluetooth SIG member relations (www.bluetooth.com)	UPFs provide an opportunity to connect, test and debug your devices while discussing issues with other companies. Event management was very good and provided an excellent means of company to company interaction. Webinars are a good means for me to keep up with industry trends and changes. I feed this info back sometimes to management.
Canada Green Building Council conference. Presented by Zachary May, Government of B.C.; Brad Liljequist, International Living Future Institute (ILFI); Ralhp Dinola, New Buildings Institute	2017 Building Lasting Change conference: From Ready to Zero: Towards Zero Energy Buildings in Canada and the United States https://www.cagbc.org/CAGBC/Conference/Program.aspx includes description	
Canada Green Building Council and Climate Action Secretariat	case studies [CGBC offers Leadership in Energy and Environmental Design (LEED) training] https://www.cagbc.org	
Capital Regional District (CRD)	2009 course, Low Impact Development	
Engineers Canada	Public Infrastructure Engineering Vulnerability Committee (PIEVC) https://pievc.ca	
Engineers Canada	Public Infrastructure Engineering Vulnerability Committee (PIEVC) training	
Fraser Basin Council	Climate Change Adaptation for Local Governments, 6 years ago	
Master Municipal Construction Documents (MMCD) Association or Public Works Association of BC (PWABC)	MMCD Inspection workshop https://www.mmcd.net/training/	A must attend for any inspectors or potential CAs [contract administrators?]
MMCD	Contract Admin	
National Water and Wastewater Benchmarking Initiative	workshops on climate change https://www.nationalbenchmarking.ca	
Natural Resources Canada (NRC), Senior Research Scientist at Canadian Forest Service Dr. Werner Kurz	The potential role of the forest sector in CC mitigation [see 2016 webcast at https://pics.uvic.ca/events/potential-role-forest-sector-climate-	was extremely eye opening

Course provider	Subject	Comments
	change-mitigation, 2017 description at https://pacificclimate.org/news-and-events/seminars/potential-contribution-bc-forest-sector-climate-change-mitigation	
Royal Roads University? Certified Management Consultant (CMC) and Project Management Professional (PMP) Dale Christenson	project management fundamentals https://secure.royalroads.ca/cscourses/dale-christenson Project Management Centre of Excellence https://pmcoe.ca	strong, engaging presenter is the key to any course. dale christenson was a very good presenter.
Shift Collaborative	CPD course, Risks and Opportunities of a Changing Climate, Dawson Creek/Pouce Coupe https://shiftcollaborative.ca	
SFU Faculty of Environment	Successful Resource Projects: A Primer on the Latest Developments in Aboriginal Law and Policy http://www.sfu.ca/fenv/programs/professional-programs/workshops-and-short-courses/successful-resource-projects.html [June 27, 2019, 10-1:30]	
UBC: Dr. Tara Ivanochko UBC Department of Earth & Ocean and Atmospheric Sciences UBC Dr. Michael Lipsen, UBC Department of Earth & Ocean and Atmospheric Sciences	Webinar and seminar, Climate Measurement and Analysis. Local climate time series collection and analysis. Retrieval and analysis of on-line climate data and model output. <small>[SEP]</small>	Lots of feedbacks [sic] and intellectual discussion on climate change and specific environmental measurements and data analysis from historical meteorological data from Environment and Climate Change Canada.
UBC	2014 Decision Making for Climate Change, online certificate	
Woodworks!BC	Life Cycle Assessment in the Buildings Industry. Demonstrated the use of Athena LCA software http://wood-works.ca/bc/ <small>[SEP]</small> [Canadian Wood Council has an eLearning Centre with CPD and Open Learning at https://woodworkselearning.com]	Was not a CPD course
National		
University of Manitoba	Introduction to Climate Change [this one? GEOG 3390 at http://umanitoba.ca/faculties/environment/departments/geography/media/GEOG_3390_A01_Winter_2017.pdf]	
International		

Course provider	Subject	Comments
American Concrete Institute	Sustainable Concrete https://www.concrete.org/topics/inconcrete/topicdetail/sustainability	
Coursera, University of Pennsylvania	Design of Artifacts in Society (MOOC) https://www.coursera.org/learn/design	I thought it was excellent.
Erickson International Coaching	Art and Science of Solution Focused Coaching https://erickson.edu/art-science-of-coaching-program	leadership
[ESC Engineering?], Colorado, Professor Harding	ESC designers course	
Mindedge	Introduction to Six Sigma https://www.mindedge.com/page/six-sigma/	technical
[?Washington State Department of Ecology, Coastal Training Program]	Forage fish sampling offered in Washing State - one day with both class and field http://www.coastaltraining-wa.org/event-2180810	with an expert and lots of opportunities for discussion and questions. Great take-home resources. Interdisciplinary group participation.
Unknown		
		Speaker must be entertaining and knowledgeable about their subject (sometimes harder to find than you think) and use practical examples to show how the principles discussed can be implemented.
	Fall Restraint-End User, H2S Alive	Both incorporate desktop training and practical, and instructors are very knowledgeable.
International Municipal Signal Association (IMSA)	I am taking technical sessions with IMSA twice a year. https://www.imsasafety.org/IMSA/Default.aspx	They provide variety of sessions you can choose from. Topics were related to my field [sic] of work.
Hosted by my employer for work with a client, external facilitator	Incident Command System, in-class, 2 day course http://www.icscanada.ca	Facilitator with many years experience. A very outgoing facilitator.
Facilitated and paid by company...		
		I have been on a number of courses and workshops by psychologists about reality and being human and taking responsibility for stewardship of this planet.
		People believing it does not exist
	CO2 sequestration for use in Enhanced Oil Recovery (EOR)	

Course provider	Subject	Comments
Skystone	2018 Above Ground Storage Tank course	They did amend the course a bit to cater it to my employer and the participants, which I thought was effective and efficient. A course with an engaging instructor, color pictures and videos throughout the presentation made it interesting and enjoyable.
	Early distribution of materials.	Reference slides of examples. Not reading directly from slides. Engagement with audience.
	case studies for energy reduction	
		Relevant topic, great presenter, applied learning, future learning
		The instructor makes the course. Better instructor equals better learning.
		Comments from other respondents: none that actually presented concrete ideas, no, NO, NO!, n/a, none, not yet, "yes. confidential", N/a at this point in time, "no, never", no I have not, not applicable, no courses, "I have not. Have found most to be inadequate + disappointed with having attended them", "No funding for worth while career advancement for professionals all for new migrant students now", "Its funny how all theses so called people who are concerned about climate change end up flying, driving to these meetings causing more pollution by getting there", "Wouldn't waste the time", "No, they have all been pretty average", "No - the University of Waterloo seminar (recently held at Microsoft Conference Centre in Vancouver - Fall 2018) was biased - no balanced", never been to a course, "No Never one I would call excellent"
	Only online articles /videos discussing the effects of CC	

Table 3. BCIA

Course provider	Subject	Comments
BC		
ABCFP	March 10 Webinar, SK case study by recent PhD grad	
BC Agriculture & Food Climate Action Initiative	Presentation https://www.bcagclimateaction.ca	I saw a great presentation by (see link) a few years ago on the interesting adaptation work they are doing, but I am not sure if they are still operating.
BC Climate Action Team [?]		Think the work being done by the climate action team is excellent
BC Government		I often present at workshops. My ministry does a lot of Climate change funding.
BC Government	one online course by BC public service	
BCIA - Internally we do training. City of Calgary staff member	Calgary staff member spoke about policy and process for incorporating CC	very informative and inspiring
BC Lung Association (BCLA)	Air Quality and Health workshop https://bc.lung.ca/protect-your-lungs/air-quality-lung-health/air-quality-health-workshop	
BC Ministry of Agriculture	series of brainstorming sessions bringing operators and gov't, private consultants to the table.	
BC MECCS	climate change course	
BC MFLNRORD Climatologist, North Area, Vanessa Foord Completed through work.	Climate Change Education	discussion of case studies, openness to questions. no climate change doubters present in course.
BC FLNRORD Technical Advisor, Climate Change Kathy Hopkins	Climate Change Adaptation training	
Columbia Mountains Institute of Applied Ecology (CMI)	My favorite courses have been focused on new methods or ideas in my field. http://cmiae.org	CMI has done a number of these over the years but they have repeated the same courses too and they are always less interesting later on.
Columbia Mountains Institute of Applied Ecology (CMI), with Selkirk College (soil refresher), Botanist Jamie Fenneman (willow ID)	Soil Refresher course, Salix Identification course	Good mix of classroom and hands-on learning.
Kwantlen Polytechnic University, Dr. Michael Bomford (Faculty, Sustainable Agriculture & Food Systems)	Lecture about CC research that they are doing at the 2018 Certified Organic Associations of BC (COABC) conference	
SFU Adaptation to Climate Change Team (ACT)	https://act-adapt.org	This group is doing great work on issues of governance and green infrastructure .
University of Victoria	Atmospheric Sciences EOS 340 https://web.uvic.ca/calendar2019-01/CDs/EOS/340.html	was amazing, combining modelling with observations

Course provider	Subject	Comments
National		
Canadian Adaptation Community of Practice [?or CCA CoP]	webinars	
Centre for Natural Hazard Research (CNHR), Natural Resources Canada (NRC), SFU ACT	2016, Feb 22, Hazard Change Caused by Climate Change workshop, Vancouver https://www.sfu.ca/climatechange/pics-sfu/initiative/hazard-change-caused-by-climate-change.html	
Gowen Environmental Ltd	Contaminated Sites and Hazardous Waste Management [Contaminated and Hazardous Waste Site Management?] http://www.contaminatedsite.com/	
University of Manitoba	Introduction to Climate Change [this one? GEOG 3390 at http://umanitoba.ca/faculties/environment/departments/geography/media/GEOG_3390_A01_Winter_2017.pdf]	
International		
International Biochar Initiative	webinars https://biochar-international.org	
International Council for Local Environmental Initiatives (ICLEI)	Possibly ICLEI??? Likely +/-10y ago. Lectures in the morning, eye-eye-opening workshop in the afternoon https://www.iclei.org http://www.icleicanada.org	delegates chose the group they wanted to brainstorm with, groups (10-12? health, env't, econ, etc) debated issues and prioritized those to bring to gov't leaders. Every single group had important issues that demanded gov't attn. HOW could leaders decide where to focus resources? (lots of overlap/opportunity for complementary programs).
NORM & Natural Radiation Management North America	2018 Naturally Occurring Radioactive Materials North America conference, Dallas, TX	All key N America regulators and professionals attended, good presentations, excellent networking. Would have been better if written papers were required of presenters.
ClimateEducation.net [security warning on page], material from Oxford University and the Hadley Centre Met Office	2015, An Introduction to the Science of Climate and Climate Change, online	
US Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), forestry extension [US Forest Service?]	webinars	
Wageningen University, Netherlands	Think Climate Smart Landscapes, 5-day course with 20 other young professionals under 40	Wageningen University offers cutting-edge adaptation training, which was relevant to my work

Course provider	Subject	Comments
	[See recent courses at https://www.wur.nl/en/Research-Results/Research-Institutes/centre-for-development-innovation/short-courses/Courses-about-Climate-Environment-1.htm]	and provided me with tools for facilitating adaptation planning with stakeholders. I really enjoyed the aspect of creating a community of practice with my co-hort. ^[1] _[SEP]
Washington State University Cooperative Extension, College of Agriculture [College of Agricultural, Human, and Natural Resource Sciences Extension Learning Library?]	tree fruit entomology, arthropod pest management, multi-week, intensive course http://pubs.cahnrs.wsu.edu/learn/	
Unknown		
	interdisciplinary workshops, webinars	I have found interdisciplinary workshops helpful to consider the full range of impacts of climate change. Webinars are very effective, especially when recorded so one can listen in if the event is missed.
		Often good courses are engaging and interactive.
	several webinars. workshops	They were effective because they were 1-3 hrs long, had a great line-up of speakers/presentations, and allowed for questions and discussion. I've also taken workshops where we work with data and learn new tools and analyses to understand climate change models, and how to create useful information.
		Mostly through my own undergraduate degree.
		"Combined science and adaptation", "I generally get the most out of scientific conferences"
	compost operating course, last fall	I liked that they covered the theory the first day, then the following days they focused on practical (hands-on) aspects of the course. With Climate Change I find discussions more often than not focus on the worst-case scenarios, almost with a religious end-of-days fervour. I already believe there's climate change happening and don't need to be converted, so if I was paying for a CPD I'd want to learn practical things I can do, within my control that would be beneficial.

Course provider	Subject	Comments
		basics stuff that can be related to practical application
		I enjoy courses that have a mix of classroom based/field based content. Either hands on learning or viewing real life examples of what has worked and what has not worked.
		n/a, no, none, nope, not yet, no it was at least 7 years ago, can't recall specifics, "No, I haven't", not really, have not done a CPD course, never took part in a CPD course been to various lectures - but not a course per se, "Not really .. I have worked in various capacities as a project economist, taken an EA course 101 from Athabaska [sic] University, worked as Team Leader on a World Bank Environmental and Social Management Framework (ESMF), Resettlement Policy Framework (RFP), Social Assessment for proposed undertakings across several countries. But, that is all learning on the job", "haha.... Reading new science papers and latest publications are the best source of information, there is not a good CPD course which can teach you. If the information or knowledge you want to gain, already in a format of textbook or a course stage, nothing new at all, do not need to look at, either information repeats or waste of time... ", "Yes.. added to my skill base... can't remember the courses cause they were many over time"

Table 4. BCSLA

Course provider	Subject	Comments
BC		
BCSLA	2008? Water in the City conference, Victoria, BC - specific to stormwater	Expert presenters didn't use just local knowledge, from N America. Talks were targeted to very specific topics with real world examples and actual data. Not just hypothetical.
Stewardship Centre for BC	Green Shores http://stewardshipcentrebc.ca/Green_shores/training/	
Township of Langley	Township of Langley is running a three session course/seminar on climate adaptation with staff to determine the necessary policies and technical responses to climate change in our region.	
National		
Engineers Canada	Public Infrastructure Engineering Vulnerability Committee (PIEVC)	
International		
International Association for Public Participation (IAP2), based in Colorado	https://www.iap2.org	IAP2 courses have generally been well-delivered.
Rocky Mountain Institute, based in Colorado	don't remember course names https://rmi.org	the courses provided strong rationales to convince government to encourage CC action
Unidentified US university	90 day free course - don't remember course name	strong background providing history on climate change, challenges, solutions, discussion between disciplines
Unknown		
		good combination of theory, first principles and ample current, geographically useful examples
		Company workshops presided by very competent professionals.
		no, n/a, "no, can't help with this", unfortunately no, "none come to mind. sorry", not to date, "Actually I found LEED green associate to be a complete waste of time, with much of my climate change knowledge gained through interdisciplinary projects and research over the years both within and outside of academia (in particular through international design competitions). I plan on taking the restoration design course at UVIC soon"

Table 5. CAB

Course provider	Subject	Comments
BC		
BCSLA	2008? Water in the City conference, Victoria, BC - specific to stormwater	Expert presenters didn't use just local knowledge, from N America. Talks were targeted to very specific topics with real world examples and actual data. Not just hypothetical.
BC Wildlife Federation	Wetlands Institute	
CAB and Indigenous Corporate Training, Bob Joseph	Creating an Indigenous engagement plan, course at the 2018 AGM https://www.ictinc.ca/training/creating-an-indigenous-engagement-plan	
Fraser Basin Council		
Natural Resources Training Group (NRTG)	Electrofishing https://www.nrtraininggroup.com/nrtg-course-schedule	hands-on component, knowledgeable instructors, well-paced course, lots of time for questions
Province of BC	training (e.g., project management)	
SFU, Carl Schwartz (retired)	Mark-recapture and statistical-trend methodology (two courses)	
SFU, School of Resource and Environmental Management		Almost anything provided by the SFU School of Resource and Environmental Management
Stewardship Centre for BC	Green Shores http://stewardshipcentrebc.ca/Green_shores/training/	hands on and practical
Stewardship Centre for BC	Green Shores	
UNBC	Political Ecology	I taught it.
National		
International Biochar Initiative	webinars https://biochar-international.org	
Ontario RAC Webinar Series, University of Toronto, Dr. Philip Byer	Webinar, Addressing the Effects of Climate Change in Environmental Assessments, presenting proposed best practices for incorporating climate change into Environmental Assessments. Available online at: https://mirarco.adobeconnect.com/a813213423/ptehoccm56vc/?launcher=false&fcsContent=true&pbMode=normal	The reason I found it so effective is that it was extremely relevant to my work, in addition to being clear and well thought-through.
University of Manitoba	Introduction to Climate Change [this one? GEOG 3390 at http://umanitoba.ca/faculties/environment/departments/geography/media/GEOG_3390_A01_Winter_2017.pdf]	

Course provider	Subject	Comments
US Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), forestry extension [US Forest Service?]	webinars	
VOI Training Group	Environmental Monitoring for Construction Projects https://www.voitraining.com/em-desc	High level of engagement and well done case studies ^[1] _[SEP]
International		
Conservation Northwest and Cascadia Partner Forum	Wildlinks annual conference with attendees from BC and Washington State, and two strong themes of climate change and ecosystem connectivity. https://www.conservationnw.org/our-work/habitat/wildlinks-conference/	Much of what I understand about climate, came from attending this conference for the past decade and from the relationships I have built with the people who deliver this conference and attend it.
EdX (MOOC platform, at (https://www.edx.org), UBC, U of Queensland, AU; SDG Academy (SDG=Sustainable Development Goals)	UBC's Climate Change: the science, U of Q's Making Sense of Climate Denial, & SDGA Planetary Boundaries	I've taken 6 courses through EdX. They've all been well-delivered and helpful. The following stand out: (see courses in subject column)
Northern Arizona University, Peter Feinsinger	course Designing Field Studies for Biodiversity Conservation [book, https://www.amazon.ca/Designing-Field-Studies-Biodiversity-Conservation/dp/1559638788]	Intensive, hands-on
Unidentified course in Utah	2017, course in which active researchers presented their research.	
University of Washington, Climate Impacts Group Senior Scientist Meade Krosby	Not a formal course but ongoing, international, series of meeting to co-learn, develop priorities, address priorities with expert support, contact Meade Krosby https://cig.uw.edu/news-and-events/about/people/meade-krosby/	
Washington State Department of Ecology, Coastal Training Program	Forage fish survey methods http://www.coastaltraining-wa.org/event-2180810	Good mix of theory & practical applied learning
Unknown		
Climate Change Task Force of Canadian Council of Forest Ministers (CCFM)	course on the use of their climate change vulnerability assessment guidebook https://www.ccfm.org/english/coreproducts-cc.asp	*Q.30: Reports produced by the Climate Change Task Force of CCFM should be considered as part of any CPD curriculum.
		It was offered by a client in relation to a large development.
	Week-long webinar, Multivariate Data Analysis Using PC-ORD software [for analyzing ecological community data]. Peck,	Professor was excellent with individual help while working through different analyses. ^[1] _[SEP]

Course provider	Subject	Comments
	J.E. 2010. Multivariate analysis for ecologist: Step-by-step. 2010 was the work book used but I think there is a newer one now.	
[possibly BC Wildlife Federation Wetlandkeepers course? at http://www.bcdf.net/index.php/wetlands-sub-1]	years ago, 2 day wetland restoration workshop	We were onsite during wetland construction the whole time, working with an expert.
		no, n/a, not really, sorry, nope, no I didn't participate, "fake news, the media, a systematic approach of ignorance", "no - either not sufficiently advanced to be of any real benefit, or too high-level and abstract to be of much practical use (e.g., models and more models)", can't recall specifics, nothing that was excellent, do not remember details, "many years ago - sorry no details", "No, I have not. Often to broad/basic at macro level", "No but there is an enormous amount of information available and RPBios need to keep up", "I've enjoyed all learning opportunities thus far, can't decide on a favourite"

Table 6. EGBC

Course provider	Subject	Comments
BC		
APEGBC conference presentation by Matthias Jakob, P. Geo	2018 conference presentation, Vancouver. Several relevant case studies	several relevant case studies with excellent visuals. The more visuals (clear and colourful graphs, good photographs with descriptions, professional looking slides) the better, as well as an animated, informed, and clear speaking presenter. The golden rule for a great course or talk: tell them what you're going to tell them, tell them, and then tell them what you told them.
EGBC	Legislated Flood Assessments in a Changing Climate in BC	
EGBC, BC MOTI, FP Innovations	Public Infrastructure Engineering Vulnerability Committee (PIEVC), application of principles	
University of Victoria	Atmospheric Sciences EOS 340 https://web.uvic.ca/calendar2019-01/CDs/EOS/340.html	was amazing, combining modelling with observations
National		
Centre for Natural Hazard Research (CNHR), Natural Resources Canada (NRC), SFU ACT	2016, Feb 22, Hazard Change Caused by Climate Change workshop, Vancouver https://www.sfu.ca/climatechange/pics-sfu/initiative/hazard-change-caused-by-climate-change.html	
		I attended a workshop a few years ago put on by the Centre for Natural Hazard Research at SFU that was very good.
Professional Engineers and Geoscientists Newfoundland & Labrador (PEGNL)	Incorporating Climate Change into Public Infrastructure Planning and Design http://www.pegnl.ca/ProfessionalDevelopment/	The breadth of information presented, as well as the multi disciplinary aspect of the course presented to an engineering audience. The modules aim to increase understanding of climate change in Newfoundland and Labrador and the potential implications for infrastructure planning and development. This includes enhance professionals understanding of the following: The legal, policy, scientific and ethical imperative and rationale for action to integrate climate considerations into design and construction of infrastructure and planning; • The basics of climate change science, how the province is being impacted by

Course provider	Subject	Comments
		<p>climate change, and the implications for infrastructure; • How climate change information is produced, and how to apply it to planning and design practices; and • Existing tools and resources are available to support their work, including resources developed specifically for Newfoundland and Labrador.</p>
International		
American Concrete Institute	Sustainable Concrete https://www.concrete.org/topics/inconcrete/topicdetail/sustainability	
Unknown		
		<p>no, no courses, none, no I have not, "I have not. Have found most to be inadequate + disappointed with having attended them", I have not participated in any climate change adaptation course yet, I will deliver a CPD course that I aim to make effective because it will give participants hands-on experience using a climate change impact tool with the context to understand the tool"</p>

Table 7. PIBC

Course provider	Subject	Comments
BC		
Clean Energy BC	2019, March 20 Webinar Electrification of BC	Excellent speakers and presentations.
Columbia Basin Trust (CBT) and local experts in the Kootenay region	local and regional impacts and tools https://ourtrust.org	
Engineers Canada, APEGBC, PIBC Asset Management, and Climate Resiliency	Public Infrastructure Engineering Vulnerability Committee (PIEVC) workshop https://pievc.ca/documents	
Fraser Basin Council	webinars	some great webinars
PCIC	workshop / presentation / climate impacts information	PCIC provides good information in a variety of formats.
SFU City Program	Some courses from the Urban Design program include Theory and Practice, Economic Fundamentals, Ecological Planning and Sustainable Design, and Studio courses https://www.sfu.ca/continuing-studies/about/program-units/city-program.html	SFU's City Program generally offers excellent CPD courses on a wide variety of subjects... their Urban Design program Theory and Practice, Economic Fundamentals, Ecological Planning and Sustainable Design and studio courses were all very good.
SFU	one day course, Financing Growth [? CITY242, at https://www.sfu.ca/continuing-studies/courses/city/financing-urban-growth.html]	two profs with lots of applied experience teaching through [sic] a combination of exercises and lecturing. Exceptional speakers with lots of experience within their field (ie not academics)
Stewardship Centre for BC	Green Shores http://stewardshipcentrebc.ca/Green_shores/training/	explained concept and gave several examples with professionals who were directly involved
National		
Professional Engineers and Geoscientists Newfoundland & Labrador (PEGNL)	Incorporating Climate Change into Public Infrastructure Planning and Design http://www.pegnl.ca/ProfessionalDevelopment/	The breadth of information presented, as well as the multi disciplinary aspect of the course presented to an engineering audience. The modules aim to increase understanding of climate change in Newfoundland and Labrador and the potential implications for infrastructure planning and development. This includes enhance professionals understanding of the following: The legal, policy, scientific and ethical imperative and rationale for action to integrate climate considerations into design and construction of infrastructure and planning; • The basics of climate change science, how the province is being impacted by

Course provider	Subject	Comments
		climate change, and the implications for infrastructure; • How climate change information is produced, and how to apply it to planning and design practices; and • Existing tools and resources are available to support their work, including resources developed specifically for Newfoundland and Labrador.
International		
Unknown		
		Practicing professionals teaching / facilitating discourse
		Learning as part of the work process (ie. projects with climate change components)
	webinars, workshops	I've participated in several webinars. They were effective because they were 1-3 hrs long, had a great line-up of speakers/presentations, and allowed for questions and discussion. I've also taken workshops where we work with data and learn new tools and analyses to understand climate change models, and how to create useful information.
		n/a, none come to mind, can't think of one, none yet, "No, nothing that could compare to direct experience", "No, would love to"