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CLIMATE RISK: GETTING TO ACTION

Professionals' Perspectives on Climate Change Challenges
First Summary of Discussions

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December 6th, 2016

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ACT (the **Adaptation to Climate Change Team**), based at Simon Fraser University's **Faculty of Environment**, is dedicated to developing and delivering a unique combination of research, outreach and policy innovation designed to benefit Canadian decision-makers, sectors and communities as they work to respond to the challenges posed by climate change. ACT is also affiliated with SFU's **School of Public Policy** and **Centre for Dialogue**.



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EXECUTIVE SUMMARY

AS CLIMATE CHANGE IMPACTS BEGIN to have measurable effects on extreme weather and sea levels that are projected to increase in severity and magnitude, members of many professions are encountering challenges to established standards of practice and disruption of decision-making processes that are based on historical norms. The elevated risk of damages is causing concern around topics such as liability and investment, as well as exposure to short- and long-term impacts and the complex issues they raise for urban development and other sectoral planning approaches.

Professionals often encounter these challenges in the context of client, public, and jurisdictional relationships, adding additional layers of complexity to the challenges of responding to climate changes. Professional relationships and practices in this context can also be compromised by varying levels of common understanding and uncertainty in perceptions of responsibility.

Many professionals are already responding to these combined questions and pressures with changes in their practices, and are discussing and developing resources that will be helpful now and in the future. It is therefore important that professionals who are well versed in climate change responses find ways to communicate with others in their practice areas, and professional associations are increasingly playing a key role in this regard.

Professionals within key practice areas responding to climate change through new approaches have the collective potential to achieve widespread transformation and improve climate resilience throughout multiple sectors. If we do not work with the early adopters and innovators on achieving this goal, however, failure to update best practices and professional approaches in a timely manner may result in increased vulnerability, missed opportunities, and exacerbation of future risks.

Further, policy- and decision-makers could benefit from consultation with professionals during the development of climate change-related policy and regulation to ensure the practicality and applicability of new approaches, given professionals' in-depth expertise and implementation experience.

As the only think tank in North America dedicated entirely to development of policy analysis for a wide range of climate change adaptation challenges, ACT formed the **ACT Professional Advisory Committee (ACTPAC)** in 2014 in order to develop a better understanding of the climate challenges for different professions through engaging with senior representatives of major sectors in BC on key insights into the challenges they face, and solutions they are considering.

Professions represented on the ACTPAC include **engineering, law, agriculture, utilities, forestry, flood management, mediation, accounting, water & wastewater management, real estate, development, policy,** and **planning**. New members are added on an ongoing basis - representatives of the **health, insurance, architecture** and **accounting** professions have joined since the development of this report.

Designed to be a conversation starter rather than an exhaustive analysis of the issues, this report summarizes key ideas on examples of climate change challenges and solutions for selected professions. This information was synthesized from discussions conducted with the ACTPAC over the past two years, as well as insights gained during an ACT workshop with BC thought leaders held in Vancouver on September 9th, 2016, entitled **Climate Risk: Getting to Action**.

Details of the workshop, as well as ACT's contribution to the recent federal consultation opportunity during formation of the upcoming pan-Canadian climate action plan, are included in the Appendices.

It is clear from the results of this process that many professionals are already embarking on new approaches to climate change challenges; however, if they are to respond effectively to the substantive changes anticipated in a world that seems increasingly likely to experience over 2°C of warming by the end of the century, continuous improvement in training, communication, codes and standards, sustainability principles and best practices will be needed.

INTRODUCTION

CLIMATE CHANGE IS INCREASING the risks associated with extreme weather events, and has caused a new problem - the creeping issue of sea level rise. These changes, along with societal impacts leading to biodiversity loss and other systemic challenges, are combining to cause what is called the ‘loss of stationarity’; in other words, extreme events, and the conditions that affect land and water use and the activities of associated sectors, are increasingly occurring outside the normal range of variation on which most professional practices are based. ¹

These shifts are requiring professionals to adjust their expectations, education, and best practices as ‘the new normal’ affects the resilience and effectiveness of sectors that base their practices on historical standards that are becoming obsolete. As the climate changes, the variation in the parameters of extreme weather is projected to increase in severity, magnitude and duration,² necessitating development of new policies and regulatory mechanisms such as updated building standards and zoning. As well, significant shifts in local and global access to, and use of, critical system drivers such as water, food and energy will have practical, economic and legal implications for almost all professions.

Given these pressures, the potential role for professionals as change agents is growing in significance. Further, professionals are increasingly required to maintain flexibility and respond to policy changes that are often difficult to implement. It is therefore urgent that professionals be consulted, both in the formation of policy designed to respond to climate change pressures, and in the development of resources that can assist management of new risks with integrated solutions. ACT formed the ACT Professional Advisory Council (ACTPAC) in response to these needs.

ACTPAC OVERVIEW

In 2014, ACT engaged a group of senior BC professionals – the ACT Professional Advisory Council, or ACTPAC – from a cross-section of key sectors and industries to discuss the climate change challenges and solutions they are encountering in their daily practice. The goal for this work is to

1 McCarl, Villavicencio, and Wu, 2008. “Climate change and future analysis: Is stationarity dying?” *American Journal of Agricultural Economics* 90(5), 1241-1247.

2 National Academies of Sciences, Engineering, and Medicine, Attribution of Extreme Weather Events in the Context of Climate Change, <https://www.nap.edu/catalog/21852/attribution-of-extreme-weather-events-in-the-context-of-climate-change>

identify the types of changes professionals feel may be required as we adapt to a changing climate while reducing emissions, to support the development and application of effective standards, practices, and approaches across multiple professions, and to better understand how policy can assist these responses.

Professions represented on the ACTPAC during development of the information contained in this paper include **engineering, law, agriculture, utilities, forestry, flood management, mediation, accounting, water and wastewater management, real estate, development, policy, and planning**. New members are added on an ongoing basis – representatives of the **health, insurance, and accounting** professions have joined since its preparation.

In response to the results of ACTPAC discussions over the past two years, combined with the group's responses to a survey based on meeting input, ACT convened a workshop with BC thought leaders on September 9th, 2016 - **Climate Risk: Getting to Action** - to discuss key challenges and solutions that the group had identified.

This paper summarizes the results of these combined processes. Section 1 outlines examples of the challenges projected for five key professional focus areas as well as governmental issues identified by ACTPAC members and workshop participants. Section 2 presents some of the ideas they put forward on ways to meet the needs of professionals in the context of these challenges and outlines ways that professionals might help drive solutions while identifying opportunities for helpful governance approaches.

A second paper will be released in April 2017 to provide an update on this material, and present further ACTPAC insights.



SECTION 1
THE CURRENT SYSTEM:
UNCERTAINTIES AND
CHALLENGES

OUR CURRENT RESPONSES TO CLIMATE CHANGE are fragmented and characterized by issues that are largely common across sectors. Examples of these issues, as identified by the ACTPAC and by attendees of the Climate Risk: Getting to Action workshop, are described in brief below:

1. RESPONDING TO CLIMATE CHANGE IS AN URGENT ISSUE

There is an urgent need to respond to and act on climate change. In recent years the global community has been paying more attention to the issue, as evidenced by the 2015 signing of the UN Paris Agreement and Sendai Disaster Risk Reduction Agreement and release of the UN's new Sustainable Development Goals, all of which focus on climate and environmental issues. However, more action needs to be taken as we plan to adapt to climate change impacts that we cannot control while reducing our emissions as fast as possible – and this action will reverberate through all facets of our communities, including the work carried out by professionals.

We are already experiencing measurable climate changes that may represent significant tipping points. September 2016 marked the 379th month in which global temperatures were above the 20th century average.¹ Extreme temperatures that occurred worldwide in July 2016, which was the hottest month ever recorded, showed a combined average temperature over global land and ocean surfaces of 1.57°C above the 20th century average, temporarily exceeding the 1.5°C level set as an aspirational goal by the 2015 Paris Agreement. The El Nino-fueled heat wave during February 2016 may have resulted in global temperatures temporarily exceeding a 2°C increase in temperature over the pre-industrial average.² Overall, global climate change appears to be accelerating, with changes occurring faster than projected, and costs increasing proportionately.

More than ever, time is of the essence. As we begin to take climate change seriously as an issue that requires planned responses, it would also be wise to explore solutions that address the overlapping issues it exacerbates – for instance, converging pressures and trade-offs at the nexus of water, food, energy and biodiversity. By addressing these issues in a coordinated fashion and recognizing their interdependencies, our responses have the potential to be comprehensive and effective. Professionals are already developing solutions; however, it is crucial that future plans and developments be not only resilient and carbon-neutral, but also restore the health of the natural environment wherever possible. This paper explores ways to achieve these goals.

1 National Oceanic and Atmospheric Administration, <http://www.ncdc.noaa.gov/sotc/global/201607>

2 FiveThirtyEight, <http://fivethirtyeight.com/features/when-will-the-world-really-be-2-degrees-hotter-than-it-used-to-be/>

2. UNCERTAINTY AND RISKS FOR KEY INDUSTRY SECTORS

A warmer atmosphere leads to a more energized weather system that carries more moisture and is less predictable. As a result, climate change is increasing the likelihood of more frequent and intense weather events, as well as sea level rise, posing significant risks for economic sectors and communities alike. In BC, five specific sectors were identified as being of special concern to the ACTPAC: agriculture, development, infrastructure, insurance, and planning. The principal climate change issues of concern for the ACTPAC for each of these sectors are discussed below.

A. AGRICULTURE

As food production around the world becomes more challenging due to hydro-climatic change, local food security is likely to continually rise in importance. Healthy soil is a crucial resource for food production, water retention, and carbon storage, and it provides a variety of other environmental services that underpin the health and resilience of connecting ecosystems.

Climate change will impact soil health and farming practices in a variety of ways. More



frequent and severe hot, dry periods in the summer will result in increased water demand, putting more pressure on already-strained freshwater resources. In BC, reduced winter snowfall will likely also impact the amount of water available for agriculture. Conversely, increased intensity of precipitation could result in more flooding, runoff, and erosion on agricultural lands. Finally, more climate variability will mean unpredictable production windows, temporal changes in pest populations, and shifting crop varieties, leading to management issues for farmers and producers.

B. DEVELOPMENT

Developer interest in, and knowledge about, projected climate change impacts is becoming more substantial. ACTPAC member Jeff Fisher, Vice President and Senior Policy Adviser at the Urban Development Institute, explained at the Climate Risk: Getting to Action workshop that industry members seek market certainty in investments with an interest in ensuring resilience in their projects, as well as security for investment in land that may take years to pay off. Therefore, developers need to know more about hazards such as sea level rise, wildfires, and flooding prior to land acquisition and development; they also need consistent, reliable regulations and standards to guide development projects. For instance, a lack of up-to-date floodplain maps that incorporate climate projections for flooding and sea level rise, and initiatives currently in place to advance this

mapping, means that developers are becoming unsure as to whether and when the viability of certain locations for development may change.

Furthermore, developers can be constrained by legislation; for instance, in some communities, strata legislation dictates what can be developed. Some coastal BC municipalities now require new Flood Construction Levels (FCLs) based on BC sea level rise guidelines, but interpretation of the data varies and there are inconsistencies emerging in the requirements set by jurisdictions. The BC Building Code provides guidance for developers, and now includes guidelines on seismic resilience; however, it does not include information about building with low carbon resilience in mind.³

There is general agreement that climate-smart cities will require greater densification; however, local community associations often oppose densification in order to maintain the existing character and built form of the community, and because of potential impacts on single family property values.

C. INFRASTRUCTURE

Traditional thinking and approaches related to infrastructure standards and development may neglect or dismiss the potential benefits of resilience, which require flexible planning and development strategies that can accommodate and adapt to future climatic uncertainty at the regional level. For example, a city may have a need for low-impact, natural drainage systems, such as bioswales; however, municipal engineering departments may be concerned that the prescribed infrastructure may not have sufficient long-term capacity, so they may build in traditional ‘hard’ infrastructure alternatives that exacerbate the amount of stormwater runoff. This may overtax any future natural drainage systems, potentially resulting in lost effectiveness, higher overall cleanup, maintenance, and replacement costs, and loss of savings that might otherwise have been achieved.



D. INSURANCE

The frequency and severity of extreme weather events is straining the insurance sector, which could significantly raise premiums as climate change impacts, especially flooding, increase in

3 More information on low carbon resilience is provided in ACT’s report, “[Low Carbon Resilience: Transformative Climate Change Planning for Canada](#)”, released on June 27, 2016.

magnitude, severity and duration. Under the leadership of the Insurance Bureau of Canada (IBC), the industry is looking ahead and preparing for projected risks. As Lapo Calamai, IBC's Director of Catastrophic Risk, explained at the Climate Risk: Getting to Action workshop, one in five BC homeowners are now at risk from climate-related effects. IBC is undertaking in-house floodplain mapping to inform premium pricing, and some companies are using this to offer overland flood insurance for the first time in Canada; however, this mapping does not include climate change projections. The insurance industry requires support; for instance, many municipal governments are continuing to develop in floodplains and other high-risk areas and insurers cannot assume full responsibility for driving resilient development.

E. PLANNING

Many professional planners are familiar with the measures required to achieve resilience-based decision-making, and are often well versed in solutions to many climate change challenges. However, political push-back and public acceptance can be a barrier to responsible climate change action. For example, it can be difficult for the city councils many planners are affiliated with to shift priorities away from urban development, even in at-risk areas. Restricting development of residential structures in flood plains may be perceived as a negative action by municipal governments, whose primary source of income is property tax and who must also respond to the wishes of local voters who may not fully understand or support the rationale for, and the benefits that would accrue from, pro-active climate action strategies.

3. NEW CHALLENGES FOR GOVERNMENTS

A. INCREASING COSTS

Extreme weather events are costly for both governments and insurers. Alberta's recent Fort McMurray wildfires cost insurers \$3.58 billion, while the Calgary 2013 flood had a total price tag of \$6 billion, \$1.7 billion of which was insured losses.⁴ Toronto's 2013 rainstorm, the most costly natural disaster in Ontario's history, cost insurers more than \$850 million.⁵ In British Columbia,

4 CBC, "Fort McMurray wildfire costliest insured disaster in Canadian history", <http://www.cbc.ca/news/canada/edmonton/fort-mcmurray-wildfire-costliest-insured-disaster-in-canadian-history-at-nearly-3-6b-1.3668602>; CBC, "Alberta flood: By the numbers one year later", <http://www.cbc.ca/news/canada/calgary/alberta-flood-by-the-numbers-one-year-later-1.2676657>

5 The Star, "Toronto's July flood listed as Ontario's most costly natural disaster", https://www.thestar.com/business/2013/08/14/july_flood_ontarios_most_costly_natural_disaster.html

2015's critical drought led to extensive wildfires. The province had allocated \$63 million for wildfire fighting that year, but spent \$297 million – more than four times its budget.⁶

Preparing in advance for extreme weather, in contrast, can produce significant cost-efficiencies. By some estimates, reducing greenhouse gases to stabilize the climate at 450 parts per million (ppm) would range from 0.02 to 1% of average global GDP per year; by comparison, the cost from environmental degradation alone if we do not act on climate change could total 7% of global GDP by 2050.⁷ This does not take into account costs from increased extreme weather events, flooding, and agricultural impacts, much less associated socio-economic impacts such as increased migration and health risks.⁸ While it may be costly to increase community resiliency and adaptive capacity proactively, it is likely far more expensive to take a reactive planning approach and pay for the damages after they occur.

Furthermore, extreme events are often traumatic for communities and have a variety of subtle, long-lasting effects on matters ranging from mental health to property values to productivity, and these impacts may not be adequately accounted for in assessments of short-term physical damages.

B. LIMITED RESOURCES

Climate change impacts directly affect local governments, as municipalities are on the front lines of extreme weather events and sea level rise. Using climate data to project risk and implementing the results requires considerable investment of time, money and expertise. Local governments are also expected to take on more of the climate change adaptation and mitigation burden due to downloading of responsibilities from provincial and federal governments. However, local governments, especially smaller municipalities, tend to lack the human and financial resource capacity needed to tackle these challenges. Since local governments have limited sources of income – for instance, they receive only eight cents of the Canadian tax dollar, income that is linked to property taxes and therefore also relies on development – smaller municipalities in particular may not be able to employ the required staff to focus exclusively on adaptation and resilience, nor to upgrade their community infrastructure proactively.

6 Global News, “Interactive: The cost of B.C. wildfires over the past decade”, <http://globalnews.ca/news/2101720/interactive-the-cost-of-b-c-wildfires-over-the-last-decade/>

7 Beatriz Rodríguez-Labajos, 2013. “Climate change, ecosystem services, and costs of action and inaction: scoping the interface.” WIREs Climate Change 4, 555-573.

8 No study can yet project these total costs accurately in dollar amounts.

C. POLITICAL INERTIA

Climate change is commonly characterized as a future problem despite the fact that measurable impacts are already affecting countries worldwide, including Canada. At the same time, political inertia often occurs when governments are faced with complex problems, especially when different political actors have conflicting ideas as to what to do about the problem, or when high costs are involved. Climate change meets all these criteria. Therefore, even when it does make it onto the political agenda, the issue is difficult to address. This can result in small, short-term actions being prioritized over more cost-effective, long-term planning actions, which may be unpopular in some political settings.

Some professionals already encounter challenges when proposing climate resilient projects because of the added investment and unfamiliar, non-standard approaches that may be required. Professionals such as consultants therefore sometimes fear the risk of losing clients and projects if they propose innovative solutions that stray from the ‘old standard’, resulting in a tendency to revert to traditional solutions. This inertia is evident within governments as well, as decision makers are often most motivated to enact short-term planning that aligns with election timeframes, and to avoid the risk of losing voter support by proposing innovative yet unfamiliar ideas. Short-term, risk-averse approaches are often driven by emphasis on the financial bottom line, and this is accompanied by a lack of understanding of the long-term benefits of innovative climate solutions. Continued reliance on this approach is concerning, since the lifespan of most infrastructure stretches well into timescales within which major climate impacts are projected.

Overall, it seems that the threshold for taking risks in the public sector may be too low, given the “new normal” of climate instability. There is an increasing need for professionals and governments to be able to take a higher level of risk as we work through potential solutions.

4. THE NEED FOR PUBLIC AWARENESS

While the public is well aware of the term ‘climate change’, many people may not understand exactly what it means. More specifically, people may not understand how global climatic changes affect their individual lives, as the cumulative effects of global changes are not always easy to understand. For instance, since our grocery stores are well supplied and British Columbians have some ability to grow crops and raise livestock, people commonly assume that there is no shortage of food or agricultural land, nor will there be in the future. However, according to climate projections, food insecurity is a clear risk for crop viability, particularly in areas that BC relies

on for food imports; for example, BC imports more than 67 percent of its salad and vegetables from the United States; over half of these products come from California,⁹ where harsh droughts have affected agricultural exports and are projected to intensify in the future. Local and international droughts in conjunction with changing growing seasons may affect the availability of a variety of foods we are accustomed to buying in grocery stores year-round, from fruit to coffee. As people become accustomed to eating seasonally and locally, they will likely also need to re-think the value of agricultural land in the province.



Water quality and security are critical issues for population health, local, regional, and global food security, and effective operation of all industries and sectors. Canadians are largely unaware of existing and projected threats to this security, and tend to think of our water supply as limitless, despite early evidence of the longer, hotter, drier summers and shrinking snowpacks, and associated loss of natural water storage, projected by climate models. However, extreme events such as the BC drought in 2015 are beginning to raise awareness of climate change risks and these may be seen as windows of opportunity for action and communication.

5. INCONSISTENT COMMUNICATION AND COLLABORATION

A. ...BETWEEN SECTORS

Sectors working on climate change adaptation would benefit from improved communication and collaboration with each other. ACTPAC members point to numerous examples of well-intentioned work taking place in silos, resulting in overlooked risks and missed opportunities for mutual benefits. Non-collaborative approaches can also lead to communication issues, as conflicting messages can cause confusion among homeowners and industry alike.

For instance, the presence of trees may be encouraged on private property for shade purposes and to help cool surrounding buildings, and in other cases may be discouraged due to the risk of trees falling on houses during extreme weather events. Similarly, trees growing too close to homes may prove to be a fire hazard, as in the 2013 Okanagan and 2016 Fort McMurray fires.

9 The Globe and Mail, "California droughts could leave B.C. high and dry on food", <http://www.theglobeandmail.com/news/california-droughts-could-leave-bc-high-and-dry-on-food/article21644937/>

In another example, energy efficiency planning may result in buildings being constructed with sealed windows, resulting in a lack of cooling options for residents during times of extreme heat.

It would therefore be beneficial to develop consistent methodologies for integrated climate mitigation and adaptation thinking that can be applied throughout project planning and execution, and this requires us to consider ways that sectors can communicate and collaborate in a coordinated fashion.

The fact that sectors have typically approached climate change mitigation and adaptation separately has resulted in missed opportunities for co-benefits and synergies. Approaching these two problems separately can lead to increased risks, costs, and time wastage for communities and projects, and these risks can be avoided with intentionally coordinated thinking and project design through integrated thinking that we and others are terming “low carbon resilience.”¹⁰

B. ...BETWEEN GOVERNMENTS

Governments often do not collaborate sufficiently across ministries and between levels to address the risks posed by climate change. For example, ACTPAC members have pointed to examples in recent years of federal and provincial governments downloading responsibilities, such as those related to emergency planning and sea level rise, to municipal governments without providing additional funding or resources.¹¹

At the municipal level, land use policies and other bylaws are often inconsistent across jurisdictions, causing confusion for professionals and residents alike. Neighbouring jurisdictions may have conflicting goals for land use and other plans which impact their shared coastlines or ecosystems, yet, as noted previously, individual municipalities largely lack the capacity to collaborate.

Many of the issues mentioned above could be addressed with improved communication among all governments, both vertically and horizontally. With improved communication, there is greater likelihood of common understanding of the issues and the constraints each government faces. There is also greater potential for innovative breakthroughs on ways governments could share resources and help each other achieve their goals.

10 More information on low carbon resilience is included in Section 2.3A below and in ACT’s report, “Low Carbon Resilience: Transformative Climate Change Planning for Canada”, released on June 27, 2016.

11 Who’s Picking Up the Tab? Federal and Provincial Downloading Onto Local Governments. Robert Duffy, Gaetan Royer, Charley Beresford. Columbia Institute, September 2014. <http://www.civicgovernance.ca/wordpress/wp-content/uploads/2014/09/Whos-Picking-Up-the-Tab-FULL-REPORT.pdf>

6. THE NEED FOR SHARED LANGUAGE

The language used to express climate change challenges and responses is not always consistent, even among actors who are committed to working towards the same goal. This language disparity can lead to miscommunications, misunderstandings, and missed opportunities for collaboration. For example, while many climate change practitioners discuss “mitigation” as a term referring to greenhouse gas reduction, emergency preparedness and disaster risk reduction practitioners use the same word to refer to the reduction of risk in the context of hazards.

Money and valuation is a highly influential shared language; however, ecosystems have traditionally been left out of the discussion due to a lack of articulation of the value they provide in this language’s terms, with the result that they have effectively been valued at zero.

Communication difficulties therefore exist between diverse groups, such as engineers and ecologists, flood insurance professionals and planners, and agriculture land owners and ecologists, not to mention public confusion over the implications of sustainability and climate change. Climate solutions could be strengthened through acknowledgment of these communication gaps, and by striving for clarity through development of a common language.

Beyond specific terms, the way we discuss climate change often fails to speak to peoples’ values in meaningful ways. When people are asked if they support a specific climate change initiative, they may say they do not support it because they may not fully understand it, or they may not see its relevance to their day-to-day lives. These responses might change if the question were framed differently, however. For example, at the Climate Risk: Getting to Action workshop, one attendee pointed out that when people are asked about the kind of communities they want to live in, they often express enthusiasm for walkable communities, smaller but more efficient homes, and affordable housing - all of which are goals that can be achieved through various components of climate change planning.



Governments, practitioners, and members of the public would all benefit from purposeful communications exercises designed to drive a shared understanding of the language, terms, and associated actions required to address climate change challenges. It would be useful to consider how to best communicate climate change planning goals to the public given the confusion associated with this issue.

As well, people are often more likely to act if they are presented with messages of hope and the opportunity to achieve positive outcomes. That said, some audiences are less likely to act if they do not perceive a significant risk or consequence to not acting. We therefore require a variety of messages for different audiences and much more work and investment is required in terms of communication of climate change issues on all these fronts.

The science of climate change is now well known, with an overwhelming consensus on its validity well-established among the vast majority of scientists.¹² The key challenge, increasingly, is not convincing people of the validity of the issues, but mobilizing them to take action.

7. PROFESSIONALS NOT ADEQUATELY INCLUDED IN POLICY-MAKING

As mentioned above, it is increasingly important for professionals to be included in policy formation, as they are largely responsible for the design and implementation of approaches we rely on to respond to and protect against impacts of climate change.

Many professionals and sectors are already showing leadership and taking significant action, such as the members of ACTPAC; however, widespread understanding and large-scale improvement of best practices is still needed.

12 NASA, <http://climate.nasa.gov/scientific-consensus/>



SECTION II CLOSING THE GAP



THIS SECTION REPORTS ON SUGGESTIONS from the ACTPAC and participants at the Climate Risk: Getting to Action workshop on ways professionals and policy-makers might respond to the challenges for key industry sectors and governments identified in Section 1. This is followed by a series of proposed actions for collaboration and awareness-building that could be adopted and promoted by all actors.

1. OPPORTUNITIES FOR KEY SECTORS

A. AGRICULTURE

i. Provide support/incentives for adapting local agricultural practices to new climate conditions

As drought conditions affect other agricultural ‘superpowers,’ including California, and destabilize other international growing areas, it is imperative that BC focuses on adapting current agricultural practices. In order to achieve this, farmers and producers will need adequate support and financial resources to transition their operations.

The agricultural sector’s substantial levels of water consumption also highlights the need for an increased focus on sustainability in farming practices, an issue that is being considered by the BC Ministry of Agriculture, and that requires ongoing support.

ii. Pay farmers and producers to perform and restore ecological services

As an example of the suggestion above, governments can help ensure that farmers and producers have adequate incentives to take adaptation actions. One example might be to provide payments to those who perform or restore ecological services, either through protecting existing land or undertaking new projects. These payments would incentivize further uptake of these actions, improving the capacity for resilience in the future.

iii. Support programs that enhance local research and knowledge transfer

In addition to financial support, farmers and producers would benefit from shared knowledge. Programs that are focused on supporting knowledge transfer between producers and providing labour on the ground can also have a positive impact. As outlined at the Climate Risk: Getting to Action workshop by **Emily MacNair, Manager of Adaptation Planning at the BC Agriculture and Food Climate Action Initiative**, BC is championing this type of work through regional projects, and producing toolkits and decision-making resources for farmers and producers.¹

1 For more information, go to <http://www.bcagclimateaction.ca/farm-level/farm-practices/>

iv. Expand local food production and diversification

In order to support food security, BC could expand local food production. This could be achieved by encouraging mixed-use farming, as this approach tends to create healthier soil and improve environmental landscape health, unlike conventional monoculture farming. In addition, farmers could incorporate climate-smart soil health practices through a variety of techniques such as cover cropping, zero tillage, and the use of perennials. These types of practices have the additional potential to support biodiversity through the use of connectivity corridors and other environmental planning approaches, as well as water conservation and carbon sequestration.

v. Establish agricultural water reserves through the Water Sustainability Act

Securing a long-term water supply by establishing agricultural water reserves through the Water Sustainability Act is paramount in water scarce regions. Water storage is an emerging issue for the agricultural industry, and it would be prudent to ensure that our water is sustainably managed such that farmers and producers will have sufficient access to water reserves into the future. However, reserves can only be secured as a result of designated watershed sustainability plans.

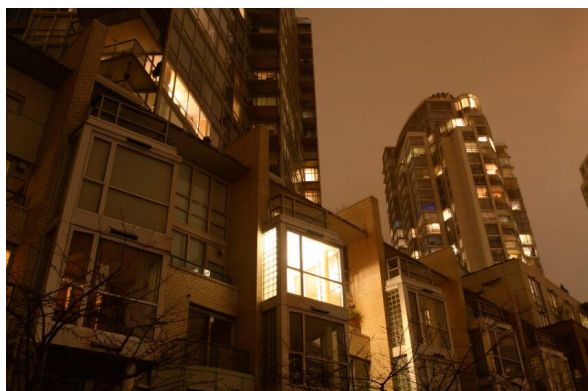
B. DEVELOPMENT

i. Encourage urban density

Traditionally, many North Americans have favoured large, low-density urban dwellings over smaller, high-density units. Given the risks outlined above, it will be increasingly important to contain urban growth via densification, and to preserve agricultural land and ecosystems whenever possible. Most new development in Metro Vancouver until 2040 will be infill, i.e., new development on the current urban footprint, providing densification; however, it would be helpful if this type of urban development was accompanied by stronger education and more innovative public engagement strategies in order to promote the benefits of dense, close-knit, walkable communities.

For instance, densification increases the feasibility of low-carbon resilient district energy systems, and dense areas are often easier to connect via transit, thus reducing the need for high-emission automobile travel. Building on existing urban footprints also takes development pressure off sensitive ecological and agricultural lands; as mentioned above, these lands will become even more integral in the face of future climatic uncertainty. Stronger communication of these benefits to community members could help to reduce the NIMBY (Not in My Backyard) effect, which occurs when residents oppose urban developments in their neighbourhood.

One important caveat is that density cannot be encouraged everywhere, as areas that are



vulnerable to future climate change risks, such as development in floodplains, will become more expensive to protect. Density must therefore be planned in conjunction with adaptation approaches that assess climate risks.

ii. Update the BC Building Code to include climate considerations

As mentioned above, the BC Building Code currently includes guidance for developers on seismic resilience, but not on low-carbon resilience. ACTPAC members are in favour of adding low-carbon resilience measures and standards to the BC Building Code in order to add more certainty to regulations and to improve reliability for future investments. Ideally, developers could be encouraged to build both energy-efficient and climate risk-resilient buildings through policy measures, consumer demand resulting from education, and other incentives.

C. INFRASTRUCTURE

i. Focus on ecosystems as infrastructure, and value them as such

Around the world, as well as in BC, we are losing intact ecosystems and the species that depend on them at an alarming rate, along with the benefits they provide to humans. However, in most current economic models and municipal asset management strategies, ecosystem services are treated as externalities and are valued at zero. Planners and other practitioners are beginning to recognize that ecosystems provide important benefits and services that would be costly, and sometimes impossible, to replace, and that therefore valuing ecosystems as infrastructure more appropriately acknowledges these benefits. Valuation of ecosystem services is an emerging field of knowledge that helps us characterize the benefits bestowed by ecosystems in economic terms.

Ecosystem services include the functions and benefits we gain from natural environments, such as the value of trees purifying the air, or of wetlands storing carbon and buffering against floods. Ecosystem benefits and avoided damage costs are usually greater than those that would be incurred if they were removed and replaced with artificial alternatives, due partly to their many co-benefits, such as enhanced property values and positive effects on physical and mental health. Valuing these services can help incentivize us to protect or enhance ecosystem assets; it also has the potential to assist us in moving beyond the current economic paradigm, which largely values economic gain at the expense of the natural world, upon which all life and all economies ultimately depend.

One of the challenges with this approach is having enough information and adequately sound methodologies in order to generate credible results, but this is improving. The Town of Gibsons, BC, has become a champion in this area by proposing to value ecosystem components such as aquifers, the foreshore, and forests as municipal assets, declaring that nature is its “most valuable infrastructure asset.”²

Assigning value to ecosystems is challenging, as nature has intrinsic spiritual and cultural values that are essentially priceless. In light of this, the goal of the ecosystem valuation approach is to protect, nurture, and restore ecosystems and help decision-makers, residents and professionals become more educated about the benefits they provide, while not suggesting they can literally be replaced with dollars. Another important aspect of ecosystem valuation is simply recognizing tradeoffs; i.e., applying dollar values to ecosystems can sometimes be a useful tool to help recognize the negative repercussions of an ecosystem’s destruction.

Furthermore, protecting and restoring ecosystems will have benefits beyond their role as infrastructure. Ecosystem-based management is an approach to planning that seeks to ensure the coexistence of healthy, fully-functioning ecosystems and human communities. In his presentation at the Climate Risk: Getting to Action workshop, **SFU School of Resource and Environmental Management Associate Professor Sean Markey** argued that urban environments lacking natural elements can produce negative effects such as biodiversity loss, health impacts, and nature deficit disorder. Greening cities is therefore often a ‘no regrets’ idea with many co-benefits.

ii. Invest more, particularly in water and transportation infrastructure

Water and transportation infrastructure are two systems that specifically need attention in the climate change context, as these are more likely than others to be affected by extreme weather events. Extreme weather may prevent people from using transportation amenities, and urban and transportation planning processes could be structured to account for this; emergency planning would also benefit from ensuring that transportation corridors and services are resilient. Support for water sustainability planning and the preparation of organizational water sustainability plans could assist in determining future infrastructure needs. It is also essential that we place emphasis on innovative engineering approaches that feature cyclical resource recovery and integration of nature with design solutions, or we risk wasting significant resources such as waste heat.

In addition, investment in irrigation and drainage infrastructure, both regionally and on individual

2 Gibsons Eco-Asset Strategy, <http://www.gibsons.ca/eco-assets>

farms, is required for farmers to be able to cope with increased flooding and drought events. Agricultural land owners in BC often operate in areas of high ecological importance, and thus a collaborative and educational approach to environmental stewardship in these lands would be beneficial for regional environmental quality.

iii. Ensure infrastructure is built or upgraded to accommodate extreme weather projections

Significant climate changes are projected to occur over the next 50 years under all emissions scenarios, well within the normal lifespan of most new buildings. As we gain more information about climate change risks, it is becoming clear that investments in existing and new infrastructure will be required in order to ensure resilience to extreme weather events. Much of Canada's existing infrastructure is ageing, and increasingly unlikely to effectively function under the pressures that are projected to intensify as climate change advances. Current infrastructure may therefore need to be upgraded and improved, and any proposed new infrastructure carefully assessed for materials, location, and design in order to build in long-term resilience to impacts. This is particularly urgent given that most municipal infrastructure in Canada will require replacement within the next 15 years.³ Such planning offers the opportunity to update engineering approaches to include cyclic resource recovery, as per the comment in sub-section Cii above.

D. INSURANCE

i. Employ new mechanisms to shift risk from taxpayers to public-private partnerships

According to **Lapo Calamai, IBC Director of Catastrophic Risk**, the Insurance Bureau of Canada is currently proposing a new P3 (public private partnership) initiative⁴ that would see the insurance industry assuming the bulk of financial risk and offering coverage to the entire population, while government's role would be to ensure that coverage is affordable and available for everyone.

ii. Work with insurance industry to ensure people are aware of risks and incented out of at-risk areas

As the principal regulator, governments play a major role in the insurance industry's activities.

3 More information is provided in ACT's report "Low Carbon Resilience: Transformative Climate Change Planning for Canada." <http://act-adapt.org/lcr-report/>

4 For more information, go to <http://www.ibr.ca/nu/resources/studies/a-primer-in-financial-risk-from-natural-disasters-the-case-for-public-private-collaboration>

Decision makers could work with insurers to explore transformational risk reduction measures – such as expropriating homes after disasters, or implementing policies that require re-building to include resilience measures – so that homes will not be re-built in hazardous areas, or at least not in the same vulnerable way.

E. PLANNING

i. Implement legislated professional provisions similar to those in place for engineers

Professional planners could benefit from legislated professional provisions similar to those in place for engineers, whereby members of a professional association are held accountable to serve the best interests of the public. For planners, this change could be made through the introduction of unique legislation between government, professional planning institutes and municipalities. A more regulated planning practice would mean that planners who are knowledgeable about climate change risks could have an authoritative role in the decision-making processes of local councils. Planners employed by local governments would be held accountable by standards of practice that ensure planning and development decisions are made based on sound principles and in the best interests of people and the environment. This new framework could empower planners to make responsible, long-term decisions related to low carbon resilience irrespective of short term political tendencies.

ii. Work with planners on land use policies that acknowledge climate risk

Planners provide important expertise on land use, including climate change adaptation and mitigation principles. Promoting approaches such as increasing density, planning for district energy systems, the inclusion of green infrastructure, and the use of public transit are examples of ways in which planners can advocate for resilience. Planners can also assist by incorporating a focus on ecosystem-based approaches to the challenges of extreme heat, flooding and drought.

In their role as the interface between the client and implementation, planners are also uniquely well-positioned to model the development and use of effective shared language around climate change actions.



2. OPPORTUNITIES FOR GOVERNMENTS

A. LOCAL GOVERNMENTS

i. Assess climate change risk and vulnerability

Many local governments have begun undertaking assessments to better understand what climate change risks their communities face, how these risks are distributed, and what types of actions they could consider to address these risks. The ACTPAC advises that all local governments undertake such a process to ensure their planning and policies are informed by evidence-based, up-to-date, locally-specific climate information.

Additionally, a ranking system for community resilience to climate risks might aid communities in understanding existing vulnerabilities and the progress towards resilience they have already made, while planning for future risks. Risks to be ranked could include floods, wildfires, windstorms, and sea level rise. One challenge with ranking systems is considering how to coalesce complex issues into a straightforward, pragmatic tool that would be accessible enough to be useful for local governments. Such a system would need to be consistent and replicable, yet tailored to community-specific needs. In general, however, we need more data on the ranges of climate change impacts in order to decide what makes a community resilient or vulnerable.

ii. Implement annual assessments of progress toward climate goals

Local governments could also begin releasing annual reports on their progress toward climate goals, including both adaptation and mitigation activities. Metrics could include progress on greenhouse gas reductions, impacts of new clean energy projects, amount of ecosystems protected or restored, or actions taken to reduce vulnerability to extreme weather events. Such annual assessments would help local governments track their progress over time, and would also help to hold governments accountable for their actions.

iii. Explore options for funding and financing adaptation projects

ACT's June 2015 report on Paying for Urban Infrastructure Adaptation⁵ examines options available to local governments to finance adaptation projects, including levying new taxes and applying to federal funds. ACTPAC members agree that new forms of taxation – such as levies based on water metering – are useful. However, new taxes or levies are examples of a

5 To read the full paper, visit: <http://act-adapt.org/paying-for-urban-infrastructure-adaptation-in-canada-an-analysis-of-existing-and-potential-economic-instruments-for-local-gove/>

number of tools that have the potential to encourage proactive community-based adaptation and resilience building. ACT's report points to a variety of other measures, some of them innovative or experimental, and the federal government is likely to identify opportunities and priorities with the release of the new Pan-Canadian Climate Plan in December 2016.⁶

Given the additional social, economic and health vulnerabilities associated with climate change impacts outlined in Section 1, it is also clear that acting thoughtfully in advance, rather than responding in a reactive fashion after a disaster, might assist community members to prepare psychologically and target precious resources strategically, while minimizing financial losses.

B. PROVINCIAL AND FEDERAL GOVERNMENTS

i. Update and regulate floodplain mapping

Accurate, up-to-date floodplain maps are critical for identifying areas that are vulnerable and thus may require strategic deployment of resources, as well as areas in which future development should be avoided. The ACTPAC recognizes that there are a number of initiatives underway in Canada that acknowledge this need, such as the Insurance Bureau of Canada's work, and a national floodplain-mapping initiative being undertaken by Public Safety Canada, as well as the federal National Disaster Mitigation Program. At the time of writing, however, maps are unavailable for many locations; further, most existing maps are based on historical flooding and do not take projected sea level rise and other hydrological effects of climate change into account. Ideally, floodplain maps need to be updated every few years as we learn more about the hydrological impacts of climate change - a costly process.

Some cities may be reluctant to update floodplain mapping because they are unsure about liability issues. Provincial and federal governments could help rectify this issue by clarifying legal parameters.

All governments can be involved in floodplain mapping: local governments require maps that reflect specific regional challenges; provincial and territorial governments can assist in developing centralized resources; and the federal government is currently working on developing national guidelines for floodplain mapping.

ii. Provide funding, expertise, and centralized support

Provincial and federal governments could provide more funding for adaptation undertaken at the local level. ACT's June 2015 Paying for Urban Infrastructure Adaptation report recommends

6 For Pan-Canadian Working reports please visit: <http://climatechange.gc.ca/default.asp?lang=En&n=64778DD5-1>

that local governments receive a larger proportion of existing tax revenues in order to finance adaptation and resilience.

Provincial and federal governments could also provide centralized data, expertise, and other non-financial resources to support local governments as they work proactively on adaptation. These resources could be clearly outlined and consistent, which would enable local governments to apply scientific best practices to meet their unique needs. For example, provincial and federal governments could help local governments develop annual climate assessments by providing an assessment framework and standardized data resources.

It is also important to recognize that many local governments may already be undertaking various adaptation actions without identifying them as such. Examples include densifying residential areas, preserving green spaces, or building dikes and other flood protection measures. Provincial and federal governments might be able to help by contributing expertise that assists local governments in identifying which existing actions are increasing their resilience.

New federal funding for infrastructure will help to improve municipal capacity to adapt. However, much more investment is required in development of and training in effective decision-making, communication and design processes that can help facilitate transformative, effective climate change responses.

3. PROPOSED GUIDING PRINCIPLES FOR COLLABORATION AND AWARENESS-BUILDING

A. INTEGRATE LOW CARBON RESILIENCE PRINCIPLES AND INITIATIVES INTO PLANNING AND POLICIES

As outlined in ACT's June 2016 report on the topic,⁷ low-carbon resilience refers to actions that reduce emissions while increasing resilience to climate change impacts. Where possible, this can be achieved by focusing on ecosystem-based responses to planning and engineering challenges. These types of responses are likely to produce health, social, intrinsic, and economic co-benefits. Many ACTPAC members are already working to incorporate low carbon resilience ideas into their work. Examples include the implementation of green, ecosystem-based infrastructure to create carbon sinks and accommodate excess heat and water, and agricultural approaches that provide these same benefits, while at the same time improving the ecological health of the surrounding landscape.

7 Cf. <http://act-adapt.org/lcr-report/>

All governments, businesses, and non-profit organizations can incorporate low carbon resilience principles into their planning and policies. For instance, local governments can integrate low carbon resilience into their land use plans, their social policies, and their emergency response plans, to name a few. Provincial and federal governments can also use low carbon resilience as a standard against which to assess future policy proposals. However, more work needs to be done to develop coordinated planning tools, codes, and standards that drive implementation of resilience and emissions reduction in a coordinated fashion.

Some economic tools provide opportunities for implementing low carbon resilience. As **Dr. Nancy Olewiler of the SFU School of Public Policy** illustrated at the Climate Risk: Getting to Action workshop, carbon pricing is an essential tool for achieving emissions reductions, and the design of BC's carbon tax is an excellent example of how such pricing can be designed and how effective it can be. The BC model is revenue neutral; however, the Alberta model requires the funds collected to be spent on climate change measures including adaptation, demonstrating how carbon pricing could both raise awareness and assist in furthering low carbon resilience.

However, to be truly effective it is essential that the price of the carbon tax steadily escalates to counteract inflation and provide a continuous incentive to reduce emissions. The new Canadian federal carbon pricing plan has set a national floor price, designed to increase over five years, ushering in a new national approach to this measure that will be helpful as professions consider ways to move forward in the context of a changing climate.

Finally, professionals can explore ways to internalize climate risk and resiliency expertise within their organizations in addition to existing sustainability practices. Just as 'sustainability' has been integrated as a department, policy, or lens in the vast majority of companies, specific staff members in professional organizations could be dedicated to resiliency approaches and emissions reductions simultaneously. This would encourage mainstreaming of low carbon resilience as a filter to be applied to all projects and initiatives.

B. CONSIDER PILOT PROJECTS AND TRANSITIONAL STRATEGIES

Testing innovative approaches using pilot projects can be an effective way to explore alternative options while building support and awareness. Pilot projects are less expensive and less risky than widespread early investment, and positive results can be scaled up as benefits are proven. ACTPAC members are undertaking a number of pilot projects in their respective industries, and point to their successes as ways to garner further interest and funding for bigger future projects. Some examples from ACTPAC members include the BC Water & Wastewater Association's BC Water Use Reporting Centre (BC WURC), a pilot water reporting project; the Still Creek Watershed

Project, which revitalized an urban, salmon-bearing watershed in the City of Vancouver; and the provincial Agricultural Water Demand Model (AWDM), which is currently operational throughout the southern half of BC.

Transitional strategies that phase in innovative approaches gradually - for instance, federal initiatives to test innovations within the context of government infrastructure - can also help to encourage risk-averse industries to move out of their comfort zone where there may be nervousness over adopting new approaches.

C. EDUCATE AND ENGAGE THE PUBLIC

Public awareness of climate change impacts is growing due to visible increases in the severity, magnitude, and duration of extreme weather events. This in turn is driving opportunities for community outreach and education designed to ensure that people more fully understand the risks, actions they can take, and ways they can support professionals and governments moving forward. The future availability of water in a changing climate, and ways people can contribute to management of this challenge, is an example of one of the issues on which more public education would be helpful.

Guides to shifts in individual choices, such as calculating one's personal footprint for carbon and water consumption, offer promise as people gravitate towards more environmentally-conscious lifestyles. Tools providing homebuyers and investors with information on location-specific risks and investment decisions, or on ways to ensure dwellings are flood and heat-resilient, are also likely to increase in demand as awareness of climate risks rises.

Communicating with the public about climate change can be difficult given the need to balance the challenges of educating people and giving them hope without scaring or demoralizing

them. The tone, messaging, and methods of climate change communication would benefit by emphasizing the fact that climate change is a serious issue, yet there are concrete actions we can take to reduce emissions and build sustainable adaptive capacity. As new technology and approaches, such as electric vehicles or blue-green infrastructure, become more readily available and familiar, more people will adopt them due to improving cost and convenience levels. We can help to increase this uptake with smart communications.



Messaging that illustrates ways that climate change is projected to influence people's daily lives makes it more relevant for them. For instance, higher costs of certain aspects of living and new health risks are projected to become more prevalent, and these two impacts are highly relatable to the general public.

Finally, public communications could include recommendations on ways for people to adjust consumer choices in order to achieve benefits at the global level.

ACTPAC members suggested the following as potential examples for awareness-raising actions:

- Holding a “no water day” that encourages people to try using less water.
- Holding a “one tap challenge” that encourages people to get all their water needs from one tap for a day.
- Communicating important statistics in a way that speaks to individual scales; for example, explaining how much land and water is needed to grow enough food for one person for one year, or discussing flood risk and sea level rise in terms of one's mortgage timeline.
- Public engagement and communication present opportunities to partner with local non-profits, as these groups often specialize in education and outreach specifically related to climate change.

Financial incentives and penalties are also powerful behavioural change influencers. For example, water metering and pricing, as mentioned above, are recommended for municipal governments as ways to incentivize people to change their water consumption habits. However, new taxes tend to be unpopular and therefore new policies need to be framed appropriately to encourage public understanding and support.

D. INTEGRATE ACROSS ALL ORDERS OF GOVERNMENT

There are opportunities for the federal and provincial governments to work with local governments to help facilitate the responses and approaches discussed above where local governments lack the capacity to plan and implement action. Sharing of information and availability of centralized resources and support could assist local governments in tackling these challenges. It is also important to note that Indigenous governments have a key role to play in regional adaptation approaches through Traditional Knowledge and other forms of expertise, and that they also require resources to make this possible.

In addition, regulations and standards such as Flood Construction Levels (FCLs) currently vary across jurisdictions. Professionals are increasingly concerned about clarity and consistency in order to facilitate effective planning while driving coordinated adaptation approaches at the

regional level. For instance, as the creeping problem of sea level rise advances, it will be essential for neighbouring coastal jurisdictions to coordinate their responses in order to avoid exacerbating risks through differing approaches and standards. Professionals implementing these responses will rely on well thought out, consistent guidelines.

E. DEVELOP A SHARED LANGUAGE

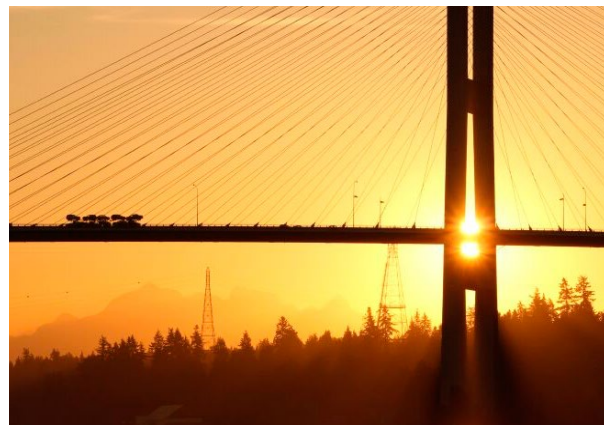
Gaps exist between definitions of adaptation in the scientific literature and the practices governments and organizations are undertaking, revealing a need for interdisciplinary, collaborative approaches that would allow policymakers and sectoral experts to work together on best practices and potential solutions. The risk of miscommunication across sectors could be addressed by development of a shared language focused on standardized terminology for climate-related issues.

There is a growing movement to develop effective valuation methods for ecosystem components represented as “critical infrastructure” and capital assets, that will help to improve public and practitioner understanding of the role of ecosystems in low carbon resilience.

Communicating with the public would benefit from a shared language that could re-frame climate topics in tangible ways that explain how these issues affect everyday life. For example, what does an 80% reduction in greenhouse gas emissions from 2007 levels mean in practice? How would a \$10/ton carbon tax affect people versus a \$50/ton carbon tax? What kinds of individual behavioural changes would these policies necessitate?

This shared language would likely prove most successful through efforts to show the positives around what a low carbon resilient city might look like in practice, with the message that this shift does not mean giving up or losing a way of life, but instead brings the promise of beautiful, vibrant, healthier communities. Too often in discussions about climate change, the conversation implies that if we don't sacrifice everything about our way of life now, we will suffer in the future. But there is another option: if we adequately respond to climate change now, we can set ourselves on a path toward a more sustainable future with only minor and sometimes temporary changes in our daily lives.

Communication tools such as conceptual renderings of low carbon resilient cities can help to



paint the picture of what desired policies and plans would look like in practice, helping to remove communication barriers.⁸

F. CONSIDER CARBON BUDGETING TOOLS

The United Kingdom uses a legislated carbon budgeting system to establish how much carbon the nation can emit over a given time period with the goal of striving to keep global warming at or under 2°C. Though focused on emissions reduction, this approach is related to adaptation in that the two processes and their solutions are inherently linked, as outlined in the concept of low carbon resilience. We must adapt to the changes we are now committed to, but we cannot adapt to runaway climate change, and it is therefore essential that we reduce global emissions as fast as possible while planning for resilience using low-emissions responses.

To aid in keeping within a carbon budget, ACTPAC members point to examples such as compact communities, electric vehicles, and carbon pricing. Additionally, utilizing Transit Municipal Agreements, or transit-oriented development (TOD) – a policy strategy that entails local governments agreeing to commit to certain levels of density along transit lines before investments are made – can promote dense development, rather than sprawl.

Carbon budgeting is now a worldwide concept thanks to the 2015 Paris Climate Change Agreement. Almost 200 nations pledged their own Intended Nationally Determined Contributions (INDCs), which outline the actions each nation plans to take to curb carbon emissions. However, the methodology and specific targets of carbon budgeting vary widely among nations. The upcoming Pan-Canadian Climate Plan may offer guidance on standardized ways Canadians can consider their engagement with this tool.

G. CONSIDER WATER BUDGETING TOOLS

Like carbon budgeting, water budgeting can help individuals and organizations determine how much water they use, calculate how much can sustainably be used each year, and incentivize jurisdictions to remain within this limit. This approach would help with raising awareness of the



8 For examples of renderings of resilient communities, see the work of the Collaborative for Advanced Landscape Planning (CALP) at UBC: <http://calp.forestry.ubc.ca/>

importance of water conservation. However, gathering the necessary data to implement such a plan is an important first step that is missing in many jurisdictions. In particular, more data is needed on aquifers, including their capacity, levels and quality of groundwater, and risks posed by development and climate change.

In an example of this approach, the BC Water & Wastewater Association advocates implementing a province-wide water reporting system. A pilot project, the BC Water Use Reporting Centre (BC WURC), has been developed in the Okanagan and is also being used by the Regional District of Nanaimo. In addition, the province is considering implementing mandatory water use reporting for all large water users (more than 250 m³ per day) within the next year.

4. CONCLUSION

This paper explores key climate change issues of concern to ACTPAC professionals and their sectors. The content of this paper comes from past meetings of the ACTPAC as well as the ACT Climate Risk: Getting to Action workshop held on September 9th 2016, and will also help to inform the content for ACT's next book on the Climate Nexus - *The Hard Work of Hope*, due out in Fall 2017 - which outlines transformative responses to the challenges emerging at the nexus of water, food, energy, and biodiversity in a changing climate.⁹

Professionals, including the members of ACTPAC, are key agents of change. How they engage with climate change issues, and the best practices they design and implement, will be crucial to rapid and effective transformational change as we begin actively planning for the risks and solutions. Many ACTPAC members and other professionals are already responding to climate change challenges; however, they have identified further support and actions outlined in this paper that would be useful in helping to advance and expand their work.

Discussing the projected impacts of climate change can be challenging, especially for a public audience. However, the ACTPAC believes it is important to begin planning proactively now in order to build the low carbon resilience and adaptive capacity of our economies, communities, and ecosystems. Climate change will increase the frequency and severity of extreme weather events, impact public perceptions regarding 'normal' life, and put current and future populations at risk of water, food, and health insecurity. We have the ability to manage these risks if we collaborate on transformational approaches to improving the systems we live and operate within, while investing in low carbon resilience.

9 For more information on ACT's first book on this topic, see: <http://act-adapt.org/join-us-to-launch-our-new-book-the-climate-nexus-water-food-energy-and-biodiversity-in-a-changing-world/>



APPENDICES



ACT

Adaptation to Climate Change Team

Appendix 1: Integrated Proposal to Tackle Canada's Climate Change Challenges

SUBMISSION TO ENVIRONMENT AND CLIMATE CHANGE CANADA'S PUBLIC CONSULTATION PORTAL: **ACT**

(THE ADAPTATION TO CLIMATE CHANGE TEAM), SCHOOL OF PUBLIC POLICY, SFU

KEY RECOMMENDATIONS

1. Recognize the urgency.

Changes to the composition of the atmosphere, loss of biodiversity and growing water demands are accelerating changes to the global water cycle. This is reducing water security for a wide range of uses in every region of Canada and resulting in increasing economic damage. As the atmosphere warms, it has greater capacity to hold water vapour, thus magnifying potential impacts. Addressing climate change requires urgent and persistent on-going policy attention.

2. Undertake multiple solutions to managing the nexus of water, food, energy and biodiversity.

The intersection of water, food and energy systems with loss of biodiversity has become an accepted platform for reconciling sectoral interests. But we face so many overlapping and intersecting interests we can no longer afford to fix them one at a time or in isolation to one another. Future development must be ecologically and socially restorative to increase benefits associated with proper functioning natural systems. More attention must also be applied to understanding how impacts of climate change affect our fragile political systems, vulnerable global economy and already tense international relations in a crowded and warming world.

3. Set a binding target for Canada to become carbon neutral by mid-century

This is the aspirational goal of the Paris Agreement and Canada should take a leading role in its achievement. This requires integrating the reduction of GHG emissions with adapting to the effects of climate change, a combination we have termed Low Carbon Resilience. Some of the resources associated with pricing carbon should be applied to undertaking the integrated solutions outlined above. These involve protecting and restoring ecosystems to increase carbon absorption; urban planning that combines emissions reduction and adaptation measures; policies for eco-agricultural practices that protect biodiversity; water conservation; maintaining carbon resilient soils and greatly reducing food waste. It also means shifting from centralized energy supply infrastructure to distributed business models based on renewable energy, reduced marginal costs due to rapidly changing technology, and demand management.

*ACT published **The Climate Nexus – Water, Food and Energy in a Changing World** in 2015, focusing on the crisis in the Nexus and its implications for the Canadian economy. The sequel will be published in Fall 2017 and will examine how we can manage the Nexus. The recommendations in this brief provide a preview of this book. Details of policies required to implement the recommendations are included in the following **Technical Briefing**.*

ACT TECHNICAL BRIEFING ON KEY RECOMMENDATIONS

1. Recognize the urgency.

The Government of Canada now has to address the urgent situation associated with permanent and progressive changes to the hydro-climatic regime across Canada. As Arctic sea ice melts, the slower and wavier the jet stream becomes; the more erratically it behaves, the more unpredictable the weather becomes. In combination with the atmosphere's capacity to hold more water vapour as global warming proceeds, both summer storms and winter snows are already persisting longer and causing greater and greater damage. It is now not unusual for what was once considered a month's rain to fall in a few hours, overwhelming outdated or inadequately maintained storm infrastructure. Government costs to restore services and repair and upgrade infrastructure are rising exponentially.

Changes to ocean conditions also reinforce the need for urgency. Not only do we face the prospect of increasing sea levels, but oceans are also acidifying, surface layers are warming, and algae blooms are growing. Our fisheries face the daunting prospect of depletions in marine production and warming, drying and eutrophication with potential threats to food webs in freshwater environments.

There are bound to be surprises as the trajectory of climate impacts unfolds. Many of these surprises will be non-linear resulting in rapid, unpredicted and potentially irreversible changes to both the physical climate and social systems. At present, much of the research on climate damage is focused on easier-to-characterize changes, such as those associated with the threat of sea level on coastal cities; potential impacts of extreme weather events on expensive infrastructure; or the effects of warming mean atmospheric temperatures on precipitation and water supply, but these are not the full picture. The more pressing questions relate to how climate disruptions of these kinds will more immediately impact our fragile social fabric, political institutions, vulnerable global economy and already tense international relations. If we are to get through the climate bottleneck, we must ask and answer these harder questions also.

Our data collection, storage, and sharing capacity must be significantly bolstered on all fronts to assist in effective and multi-dimensional planning to facilitate adaptation to these needs and future conditions.

2. Undertake multiple solutions to managing the nexus of water, food, energy and biodiversity.

The Climate Nexus – the intersection of water, food, energy and biodiversity – is the cornerstone of sustainable communities in Canada. In order to protect this nexus, we need to standardize both environmental accounting practices and environmental regulations globally, starting with water. To achieve this end, it is important to incentivize an acceleration of reform that is already advancing of both the engineering and planning professions. All future development must seek double, triple, if not quadruple benefits in terms of the restoration of fundamental Earth system functions as reflected in biodiversity stability, efficient water use, soil vitality, carbon storage, and human and planetary health.

Responses to changing hydro-climatic regimes will have to become multi-dimensional. It will not be sufficient just to redesign physical infrastructure: risk assessment must also deal with population health and migration; consider how foreign aid might alleviate issues in the international context; and cope with questions regarding ways vulnerable populations in Canada can be assisted. Canada's trade policy will also have to be revised; if there is to be a global response to climate change, Canada must consider reciprocal carbon reduction strategies when negotiating international trading arrangements.

All levels of government and industry will have to thoroughly revise their risk assessment approaches in order to map their exposure to extreme events using new forecasts of hydro-climatic variability. New poli-

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cies will be required to insure against catastrophic weather events and to integrate natural systems with engineered infrastructure. The federal and provincial governments should assist local governments in building their capacity to implement these new policies.

Multi-national corporations will be required to examine the resilience of their supply chains as well as the impacts they are having on global systems based on their operating practices.

3. Set a binding target for Canada to become carbon neutral by mid-century.

This target means that any carbon emissions must be offset by increased carbon absorption by natural or manmade systems. We must consider carbon reduction and adaptation policies simultaneously to create synergies. One example is to direct a portion of the funding generated by carbon pricing to pay for public investment in adaptive and resilient infrastructure.

THE FOLLOWING TRANSFORMATIVE POLICIES WILL BE REQUIRED TO MEET THESE GOALS:

Protect and maintain 50 percent of natural biodiversity in healthy condition.

Functioning ecosystems provide a wide range of ecosystem services such as flood control, drought management, carbon absorption, and benefits to public health as well as property values. Not only do we have to reverse a century of ecological mismanagement due to damaging development practices, but we must also restore degraded ecosystems as part of a new development ethic. We must encourage the private sector to pay for ecosystem services where it is part of a new business case for cost and damage avoidance. Green infrastructure is a natural asset and should be valued and included in asset valuation and management for all levels of government.

Shift to eco-agricultural practices by 2030.

Though current farming systems supply large volumes of food efficiently to global markets, they do so at an increasing price: widespread degradation of land, water and ecosystems; high emissions; biodiversity loss; and health impacts due to loss of micro nutrients, as well as increasing levels of obesity and diet-related diseases.

Another agricultural revolution is required; one that focuses on the integration of water, food and climate security and replaces uniformity with diversity; encourages holistic farm practices that retain carbon in the soil; rebuilds biodiversity; increases yields during droughts; and improves diets. A new national water ethic is also required; one that drives conservation; proper pricing of water use; protection of ecological flows; ensures that water is fit for purpose, and reuses treated wastewater.

Shift to distributed energy systems based on renewable sources by 2030.

Rapid cost reductions in renewable energy systems, development of battery storage capacity, practical and cost efficient electric vehicles, and smart monitoring facilities will reduce marginal costs of renewable energy and transport systems to near zero within 20 years, making distributed sources of electricity more efficient than large scale transmission systems.

The advent of zero marginal costs, rapid advances in electrical and transportation technology, and a shift to a sharing economy and universal smart digital technology providing almost universal real time information will transform the current capital-based energy systems to a new model where consumers drive the societal choices that governments formerly made through regulations and policy changes.

Universal education.

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The quickest way to advance the transformations outlined in this brief, and thereby meet the urgency for making the shift to a low carbon resilient economy, is through universal education for all consumers. Such education should be included in all school and post secondary curricula; should be universally provided to all students and should include experiential learning both in the home and in nature.

Mobile apps that track real time energy, water and food use by consumers are in development. Once these become universally available, every consumer will be able to track their nexus demands for water, food and energy and can therefore be encouraged to reduce their footprint. The federal government could stimulate development of such technology and showcase Canadian expertise in the process.

ACT (the Adaptation to Climate Change Team), at SFU's School of Public Policy in Vancouver, Canada, was created in response to the challenges and opportunities facing Canadians as a result of the commitment to climate change due to past, current and future emissions combined with other widespread environmental challenges. For the past ten years, ACT has led the field in Canadian adaptation research, bringing leading experts from around the world together with industry, community, NGO and government decision makers to explore the risks posed by climate change and identify opportunities for sustainable adaptation.

*ACT focuses on top-of-mind climate change impact areas including biodiversity, extreme weather, energy, water security, crops and food supply, sea level rise, health risks, population displacement, and new technologies, and a variety of related research initiatives. Our findings have stimulated new policy-making and much public interest. Our 2015 report, **Paying for Urban Infrastructure Adaptation in Canada**, received national acclaim. Other ACT reports providing federal policy analysis include: **Climate Change Adaptation and Extreme Weather (2009)**, **Climate Change Adaptation and Water Governance (2011)**, **Climate Change Adaptation and Canada's Crops & Food Supply (2012)** and **Low Carbon Resilience: Transformative Climate Change Planning for Canada (2016)**.*

*ACT gratefully acknowledges the support of the **Real Estate Foundation of BC** and the **Pacific Institute for Climate Solutions (PICS)**. ACT ED **Deborah Harford** is a *Climate Solutions Fellow* at the **SFU Centre for Dialogue**.*

Contact Information:

Deborah Harford, Executive Director, ACT, SFU

Email: adapt@sfu.ca

Tel: 604-671-2449

Website: <http://act-adapt.org>



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Appendix 2: Participant List for “Climate Risk: Getting to Action: Workshop with BC Thought Leaders, September 9th 2016

Amy Huva	Director, Canadian and International Networks, Climate Access
Angie Woo	Lead, Climate Resilience and Adaptation, Fraser Health Authority
Bob Sandford	EPCOR Chair, UN Institute for Water, Environment and Health/ACT
Carrie Brown	Director, Environmental Programs, Port Metro Vancouver
Christine Callihoo	Principal, Counterflow Community Planning
David Marshall	CEO, Fraser Basin Council
Deb Carlson	Staff Counsel, West Coast Environmental Law
Deborah Harford	Executive Director, ACT
Edward Nichol	Senior Researcher, ACT
Emily MacNair	Manager, Adaptation Planning, BC Agriculture and Food Climate Action Initiative
Glen Shkurhan	Principal, Urban Design Systems
Halena Seiferling	Senior Researcher, ACT
Jeff Fisher	VP and Senior Policy Adviser, Urban Development Institute
John Bell	Chief Advisor, Strategic Planning, Governance and Sustainability, BC Housing
John van der Eerden	VP, Water Resources, Associated Engineering Group Ltd
Jon O’Riordan	Former BC Deputy Minister of Sustainable Resource Management/ACT
Lapo Calamai	Director of Catastrophic Risk, Insurance Bureau of Canada
Leanne Sexsmith	Grants Manager, Real Estate Foundation of BC
Matt Horne	Associate Director, BC, Pembina Institute
Nancy Olewiler	Acting Director, School of Public Policy, SFU
Norma Miller	Manager, Government Relations, BC Real Estate Association
Samantha Gale	CEO, Mortgage Brokers Association of BC
Sean Markey	Professor, SFU School of Resource and Environmental Management
Steve Litke	Senior Program Manager, Fraser Basin Council
Suzanne Spence	Executive Director, Climate Action Secretariat, BC Ministry of Environment
Sybil Seitzinger	Director, Pacific Institute for Climate Solutions
Tamsin Lyle	Principal, Ebbwater Consulting
Ted van der Gulik	President, Partnership for Water Sustainability, BC
Zafar Adeel	Executive Director, Pacific Water Research Centre, SFU

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Appendix 3: Agenda for Climate Risk: Getting to Action Workshop with BC Thought Leaders, September 9th 2016

8:30 am	Meet and Greet/Networking
9:00 am	Deborah Harford, ACT: Welcome, agenda review, workshop goals
9:10 am	Leanne Sexsmith, Real Estate Foundation of BC: Funder welcome and research overview: Sustainable Built Environment
9:20 am	Introductory ACT Talks: The Hard Work of Hope - Managing the Global Crisis at the Nexus of Water, Food, Energy and Biodiversity in a Changing Climate Bob Sandford, UN Institute of Water, Environment and Health/ACT: Global Context Jon O' Riordan, former BC DM of Sustainable Resource Management/ACT: BC Context
9:50 am	Plenary Panel: Subject Matter Experts from Key Sectors
10:10 am	Jeff Fisher, Urban Development Institute: Emerging Risks for Development Lapo Calamai, Insurance Bureau of Canada: Insurance Risks and Solutions
10:30 am	Coffee Break
10:45 am	Plenary Panel: Subject Matter Experts from Key Sectors Emily MacNair, BC Agriculture and Food Climate Action Initiative: BC Agriculture Industry - Climate Impacts and Solutions
11:05 am	Sean Markey, SFU School of Resource and Environmental Management: Ecosystem Function and Restoration
11:25 am	Deborah Harford - Moderator: Roundtable Dialogue with Plenary Speakers on Perceptions of Risk, Solutions and Pathways Forward
12:30 pm	Lunch
1:30 pm	Afternoon ACT Talk: Low Carbon Resilience Nancy Olewiler, SFU School of Public Policy/ACT: Connecting Carbon Pricing and Resilience Actions
1:50 pm	Jon O' Riordan: Goals for Afternoon Discussion
2:00 pm	Group Discussion: Climate Risk and Responses Required: Recommendations for Policy and Edu-
3:00 pm	Bob Sandford: Summary
3:10 pm	Jon O' Riordan and Deborah Harford: Conclusions and Next Steps
3:30 pm	Adjourn

ACT (ADAPTATION TO CLIMATE CHANGE TEAM)

SFU Vancouver
3230-515 West Hastings Street
Vancouver, BC V6B 5K3
TEL: (604) 671-2449
E-MAIL: adapt@sfu.ca

WWW.SFU.CA/ACT