State of Climate Adaptation Pilot Project

Final Report and Adaptation Measurement Resources

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BACKGROUND

Climate Adaptation in the Columbia Basin-Boundary Region

Columbia Basin-Boundary communities, like many communities in rural Canada, are highly vulnerable to climate change. Not only are rural residences inordinately exposed to environmental hazards like wildfires and flooding, but rural economies tend to be dependent on the ecosystems that may become stressed with a changing climate. Many rural communities also suffer from an infrastructure deficit and are challenged to implement the upgrades required to improve the resilience of their assets to more extreme weather or more severe flooding or droughts.

In addition to being vulnerable to climate change, rural areas face unique adaptation challenges, including a lack of locally-relevant data on which to base planning or program management decisions. In addition, due to their remote locations, rural communities may lack access to the supports or partnerships that can build their adaptive capacity.

Local governments are often the front-line response for community-level climate adaptation as they have jurisdiction over many services and programs delivered within their boundaries and they are the primary interface with the public in cases of emergency or natural disaster. Rural local governments, including those in the Basin-Boundary region, are typically small organizations operating with few staff and a small tax base. Because they are such a vital driver in adaptation, efforts to build the capacity of these organizations to adapt to climate change is essential to the future resilience of rural Canada.

A 'Made in the Basin' Approach to Adaptation Measurement

Out of recognition of the vulnerability of our region to climate change and the need to build capacity to embrace this complex challenge, climate change programs have been delivered in Basin-Boundary communities in the past. Among these was Columbia Basin Trust's Communities Adapting to Climate Change Initiative, which included an objective to support Columbia Basin communities to measure their progress in adapting to climate change. Purposeful measurement of progress is a valuable capacity support because it helps communities identify their vulnerabilities, understand the impact of past action, and prioritize allocation of resources to meet the most critical adaptation needs.

In 2014, Columbia Basin Trust and Selkirk College partnered to develop the State of Climate Adaptation and Resilience in the Basin (SoCARB) indicator suite, which measures community progress on climate adaptation across five climate impact pathways: extreme weather and emergency preparedness, wildfire, water supply, flooding, and agriculture. Each pathway links indicators of relevant climate changes to indicators of environmental and community impacts which are in turn linked to indicators of community response. In this way, the SoCARB approach allows for a comprehensive assessment of each community's vulnerability and resilience to climate change.

Though the SoCARB indicator suite was designed to reflect the environmental, economic and social context of Columbia Basin communities, the pathway approach can be adapted to reflect the adaptation

priorities of any community. See the section titled *Adaption Measurement Resources* for a description of documentation related to development of the SoCARB approach.

Project Goal, Objectives and Activities

With the overall goal of building the capacity of Columba Basin-Boundary local governments to build the resilience of their communities to climate change, the *State of Climate Adaptation Pilot Project,* which ran from fall 2016 to spring 2018, had two primary objectives:

1. Better understand community-level climate vulnerabilities in our region
2. Pilot and refine the SoCARB indicator suite with the intention of developing an approach to adaptation measurement that could be readily implemented by Basin-Boundary local governments.

In recognition of the capacity limitations of rural local governments, the project took a partnership approach to adaptation measurement in four pilot communities (City of Rossland, City of Kimberley, Regional District of Central Kootenay Area J and Regional District of East Kootenay Area F). Local government staff and elected officials worked with the project team to adapt the indicator suite to the community context and provided relevant data on local government operations. The project team collected and analysed data, completed the assessments, reported back to the community and mobilized project knowledge beyond the boundaries of the region. A steering committee helped guide the implementation process and link project activities to other initiatives. The project was completed in two phases, with two local governments participating in each phase. Following completion of Phase 1, an evaluation of the SoCARB approach was conducted with the goal of refining the indicator suite and recommending adjustments to the assessment process for Phase 2.

RESULTS

Overview of Community Assessments

Each community received its own detailed assessment based on the SoCARB indicator suite. This section discusses some of the findings common to multiple communities.

Based on a review of historic climate data, certain climate trends were being experienced in all four pilot communities. These included a trend toward increased annual average and winter temperatures. In addition, communities have witnessed an increase in annual precipitation. Various indicators of extreme weather are included in the SoCARB suite including maximum 1-day rainfall, annual days over 30 degrees and the frequency of extreme snowfall events. All pilot communities have seen an increasing trend in one of more indicators of extreme weather.

The four pilot communities generally performed well on the indicators that measured the existence of assessments or planning documents that set the stage for action. For example, as a result of their past participation in a regional water conservation initiative, most communities had a good understanding of their water use and had considered implementation of initiatives that would address high rates of water use or water loss. The pilot communities had also engaged in community wildfire protection planning and the regional districts had undertaken regional agricultural planning with the goal of enhancing local food production.

Despite current and well-researched plans or assessments having been completed, associated actions had yet to be implemented in some cases or, in others, action had been taken but vulnerabilities remained due to the pervasiveness of the issue at hand. For example, despite good water conservation planning, rates of water use generally remained high in the pilot communities. Similarly, while areas had been prioritized for interface fire fuel management, few treatments had actually taken place. Another clear area for action in the pilot communities related to personal emergency preparedness.

Assessment results generally confirmed some of the challenges that characterize adaptation in the rural context, including poor data availability, limited funding and capacity, and jurisdictional issues. For example, a lack of current or complete environmental data prevented most communities from truly understanding the state or vulnerability of their water supply. In addition, a hesitation to accept responsibility for interface fire management on crown land prevented local governments from undertaking wildfire risk reduction activities in the areas that border their communities. Though the SoCARB assessments do not offer solutions, they provide evidence of the importance of efforts to overcome these challenges.

Evaluation and Refinement of the SoCARB Approach

The evaluation completed following Phase 1 of the project identified opportunities to refine the indicator suite and assessment approach. These recommendations, some of which are detailed below, were implemented during Phase 2 and were found to improve the relevance of assessment results to communities.

Flexibility in the indicator suite is required to account for data availability or local priorities
Some indicators originally recommended for inclusion in the SoCARB suite could not be effectively measured due to a lack of available data. In these circumstances, alternative indicators that would serve the same pathway and category were chosen. In this way, the conceptual integrity of SoCARB's pathway approach was maintained. Where SoCARB did not sufficiently address a local adaptation priority, additional indicators were included in the assessment. While SoCARB was designed to be regionally-relevant, the project team found it was important to maintain some flexibility to ensure the assessment had maximum value for each community.

Local governments need full data collection and analysis support to undertake the assessment
The original plan for the State of Climate Adaptation Pilot Project was to develop an adaptation measurement toolkit following the Phase 1 assessments that the Phase 2 communities would use to undertake their own assessments relatively independently. Evaluation results indicated that local government staff did not anticipate being able to undertake the assessment without extensive support due to capacity constraints and insufficient expertise, especially for more complex indicators of climate change and streamflow, so the project team fully supported the assessments for Phase 2 communities.

Qualitative information and regional trends are necessary to supplement local data
The project team found that, for many SoCARB indicators, an analysis of local-level data did not tell the whole adaptation story. In some cases, a local dataset (e.g., streamflow data for a single watercourse) did not show trends that were apparent at the regional scale. It was important to present these regional trends alongside local findings to ensure readers had full information about potential climate vulnerabilities. Local government staff also provided important contextual information to help readers better understand their community's performance on certain indicators. This information was essential to generate a true assessment of adaptation progress and outstanding vulnerabilities.

IMPLICATIONS FOR RURAL CANADA

The *State of Climate Adaptation Pilot Project* produced community-specific adaptation knowledge, but it also generated lessons for other parts of rural Canada that are looking to advance their resilience to anticipated climate changes. First, project results confirmed that rural local governments, who are the front-line for community-level adaptation and responsible for delivering many climate-vulnerable services, need capacity support to understand their specific climate risks, make informed adaptation decisions, implement action, and monitor adaptation progress. Second, the project confirmed that cultivation of partnerships as an approach to capacity building applies in the context of rural climate adaptation. The project team and local government personnel collaborated to generate a comprehensive assessment that would not have been as rigorous without the former or as locally-relevant without the latter. Finally, the project demonstrated that efforts coordinated at the regional scale can help capacity-strapped communities access efficiencies in order to advance adaptation beyond the status quo. The SoCARB approach, by providing a regionally-relevant model for measuring climate adaptation progress, allow Basin-Boundary communities to undertake this work without having to research or develop their own assessment process. Regional organizations in other parts of Canada could adapt the SoCARB approach to provide their communities with similar benefits.

ADAPTATION MEASUREMENT RESOURCES

Several resources, described below, have been developed to facilitate measurement of climate adaptation in Columbia Basin-Boundary communities. Most of these resources include research or guidance relevant to other parts of rural Canada.

Rural Climate Adaptation Knowledge Briefs

The State of Climate Adaptation Project generated three short summaries of current knowledge related to rural climate adaptation. Part 1 asks 'what is adaptation' and 'how is adaptation done'? Part 2 looks at the specific adaptation challenges faced by rural communities and offers examples of successful community initiatives. Part 3 addresses the challenge of moving from adaptation planning to implementation and offers key resources to support this process.

Indicator Suite Development Resources

Extensive documentation related to the process of developing the SoCARB indicator suite is available. A literature review provides an overview of the types of indicators typically used to track climate change, impacts and adaptation. A summary report and technical report detail the rationale for selected and discarded indicators, and discuss the pathway approach along with the companion Community Resilience Index. The Community Resilience Index measures the socioeconomic resilience of the community as a determinant of its adaptive capacity. Due to resource limitations, assessments conducted as part of the *State of Climate Adaptation Pilot Project* did not include the Community Resilience Index.

Indicator Guidelines

For each indicator used in the *State of Climate Adaptation Pilot Project* community assessments, documentation is available on the data source, rationale for assessment, analysis methodology, resources required for data collection and analysis, and recommended assessment/reporting interval.

Samples for select indicators are included with this report as Appendix A. The full set of guidelines is available from the Columbia Basin Rural Development Institute.

Survey Questions

For some SoCARB indicators that assessed adaptation actions taken by the local government itself, the project team found that a survey administered to relevant operational staff (e.g., water operators or planners) was the most effective and efficient way to gather data. The questions included in these surveys were developed in partnership with local government personnel and based on research related to best practices. Questions for these surveys are included as Appendix B.

For some other indicators that assessed community preparedness at the household level (i.e., residents with 72-hour emergency preparedness kits and community food production), a survey was distributed to residents. The survey collects the basic information required to fulfill the indicators as well as supplemental information to provide an in-depth understanding of relevant conditions in the community. The survey is included as Appendix C.

Report Templates

Partner communities in the State of Climate Adaptation Pilot Project were provided with two reports on completion of their assessment: a full technical report with narrative descriptions of the results for each indicator and a two-page summary report showing only the trend for each indicator. The format of these reports was reviewed by project advisors and revised based on feedback received from the target audience. Templates are available from the Columbia Basin Rural Development Institute and samples can be found on the project's webpage.

APPENDIX A: SAMPLE INDICATOR GUIDELINES

Indicator	Description	Rationale	Data Source - Current Data	Data Source - Historical Data	Geographical Scale	Methodology	Proposed Reporting Interval	Person Hours (Estimate)	Challenges/ Comments
Weather-related highway closures	Measures the number (per year) and/or duration (hours) of highway closures caused by landslides, avalanche, snow, wind, or freezing rain.	Highway closures caused by extreme weather events can have significant impacts on local economies and quality of life.	https://catalogue.data.gov.bc.ca/dataset/historical-drivebc-events	https://catalogue.data.gov.bc.ca/dataset/historical-drivebc-events	All highways within the electoral area (for regional districts) or all highways within the municipality *and* major highways affecting travel to/from the municipality (for municipalities)	Highway incident start and end points were loaded into ArcMap and clipped to include only those in the area of interest. Excel spreadsheet was extracted and duplicate events were removed. Data was filtered to limit results to weather events and full or partial closures.	1 year	2	Does not account for vehicle accidents that may cause a closure but are the result of weather.
Water consumption	Measures the volume of total water supplied by the utility (including leakage), expressed per capita	Water supplies may be stressed by climate change. High rates of water use increase vulnerability to declining water supplies.	Local government and/or community-based water suppliers	Local government and/or community-based water suppliers	Local-government owned water systems (for regional districts) or municipal water system (for municipalities). Inclusion of data from community- or privately-owned water systems is optional but may provide useful insight for regional districts.	Total annual water supply was divided by the service population (where available) or by the number of connections x 2.5 (a standard estimate of users per connection)	1 year	2	Calculations based on pump hours (for well-sourced systems) or other readily-available information may be useful in the absence of data on metered water use.

APPENDIX B: LOCAL GOVERNMENT SURVEY QUESTIONS

Emergency Preparedness Plan Currency and Components

1. Does your local government have an emergency preparedness plan?
2. Has it been updated in the last five years?
3. Are the following components included in your plan?

	Yes	No	In Progress
Hazard risk assessment			
Emergency procedures			
Business continuity plan			
Community evacuation plan			
Public communication plan			
Designated emergency response centre			
Emergency program coordinator			
Designated emergency response team			
Identified emergency roles and responsibilities			
Action list for each type of hazard			
Designated emergency/reception shelter			
Plan for shelter stocking			
Training and emergency exercise plan for response personnel			
Contact list for all response personnel			
Fan-out call list or emergency alert system			
MOUs with any agencies helping in response (e.g. neighbouring municipalities, school board, local service groups)			

Implementation of Policies to Reduce Water Consumption

1. To what extent has your local government implemented the following policies or practices aimed at reducing water consumption?

	Level of Implementation			
	Full	Moderate	Minimal	None
Water metering				
Public education and outreach on water conservation				
Public education and outreach on water consumption trends				
Water meter data analysis				
Consumer billing by amount of water used (volumetric)				
Implementation of water utility rates sufficient to cover capital and operating costs of water system				
Water conservation outcome requirements for developers				
Water conservation targets				
Stage 1 through 4 watering restriction bylaw				
Enforcement of watering restriction bylaw				
Drought management plan				
Actions to address water system leaks:				
Targeted leak repair				
Water operator training				
Replacement of aging mains				
Addressing private service line leakage				
Pressure management solutions				
Solicitation of community input				

Implementation of Water Loss Detection Practices

1. To what extent has your local government implemented the following water loss detection practices?

	Level of Implementation			
	Full	**Moderate**	**Minimal**	**None**
District water meters				
Residential water meters				
Night flow analysis				
Water loss audits				
Acoustic leak detection				
Leak noise correlation testing				

Backup Power Sources

1. Does your local government have backup power in place for the following essential services?

	Yes	**Partial**	**No**	**N/A**
Drinking water system: water intake, control room, PRV stations, booster station				
Fire halls				
Sanitary sewer system: lift stations				
City hall				
Emergency operations centre				
Public works yard				
Evacuation centre				

APPENDIX C: RESIDENT SURVEY

Climate Change Adaptation Resident Survey

This short survey about backyard farming/food growing and emergency preparedness is being conducted by <local government> in partnership with the Rural Development Institute at Selkirk College.

The purpose of this survey is to help researchers understand how prepared <community name> residents are for the impacts of climate change. The survey is part of a larger project reporting on key indicators of climate change adaptation and preparedness in <community name>. Study results will be reported in <insert project end date>.

This survey takes 5 to 10 minutes to complete and your responses are anonymous. Your participation is voluntary and you may also skip a question if you do not want to answer it. There are no known risks if you decide to participate in this survey. You must be at least 18 years of age to participate.

<insert informed consent statement if applicable>

The closing date for this survey is <insert closing date>.

☐ Check this box to confirm that you understand this Informed Consent Statement and agree to participate.

1) Which <insert name of regional district electoral area> community do you live in?
    a. Community 1
    b. Community 2
    c. Other (please specify) _____

2) Do you grow or raise some of your own food? Yes ☐ No ☐

If you answered no to question 1, please skip to question 12.

3) Where do you grow or raise your food?
    In my own yard ☐
    In somebody else's yard ☐
    In the community garden ☐
    Other: (please specify) _____ ☐

4) What is the **approximate** size of the area you cultivate for food (excluding fruit trees and berry patches)? Keep in mind that a 10 by 10 foot garden bed would be 100 square feet.
Less than 5 square feet ☐
5 to 15 square feet ☐
15 to 30 square feet ☐
30 to 50 square feet ☐
50 to 100 square feet ☐
100 to 200 square feet ☐
200 to 300 square feet ☐
More than 300 square feet ☐
Other: (please specify) _____ ☐

5) How many fruit trees do you have?
0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Other: (please specify) _____ ☐

6) Do you have any of the following?

	Yes	No
A raspberry patch	☐	☐
A blueberry patch	☐	☐
A blackberry patch	☐	☐
A strawberry patch	☐	☐
Another type of berry patch (please specify):_____	☐	☐

7) What types of food (fruits, vegetables, herbs, nuts) did you grow this past summer?

_____
_____

8) Do you keep any livestock? Yes ☐ No ☐

9) If **yes** to question 7, approximately how many of the following animals do you keep?

	0	1-3	4-6	7-10	More than 10
Chickens	☐	☐	☐	☐	☐

Rabbits	☐	☐	☐	☐	☐
Goats	☐	☐	☐	☐	☐
Sheep	☐	☐	☐	☐	☐
Cows	☐	☐	☐	☐	☐
Pigs	☐	☐	☐	☐	☐
Geese	☐	☐	☐	☐	☐
Ducks	☐	☐	☐	☐	☐
Quail	☐	☐	☐	☐	☐
Other: _____	☐	☐	☐	☐	☐

10) Do you do any of the following?

	Yes	No
Keep bees	☐	☐
Compost your food and/or garden materials	☐	☐
Use compost in your food garden	☐	☐
Collect rainwater in barrels or cisterns to use in your garden	☐	☐
Sell any of your food	☐	☐
Have a greenhouse that you use to grow food on your property	☐	☐

11) What percentage of your own food (approx) would you estimate you grow or raise? _____

12) Do you have a 72-hour emergency preparedness kit in your home? Yes ☐ No ☐

If you answered no to question 12, you may skip to the end of the survey. Thank you for your time.

13) Do you have the following basic items in your 72-hour emergency preparedness kit?

	Yes	No	N/A
Drinking Water (2 - 4 litres of water per person and pets per day)	☐	☐	☐
Food that will not spoil (min. 3 day supply)	☐	☐	☐
Manual can-opener	☐	☐	☐
Flashlight and batteries	☐	☐	☐
Candles and matches/lighter	☐	☐	☐
Battery-powered or wind-up radio	☐	☐	☐
Cash in smaller bills and change	☐	☐	☐
First aid kit	☐	☐	☐

Special items such as prescription medications, infant formula or equipment for people with disabilities	☐	☐	☐
Extra keys that you might need (e.g. for your car, house, safe deposit box)	☐	☐	☐
A copy of your emergency plan including contact numbers (e.g. for out-of-town family)	☐	☐	☐
Copies of relevant identification papers (e.g. licenses, birth certificates, care cards)	☐	☐	☐
Insurance policy information	☐	☐	☐

14) Are all the items in your emergency preparedness kit in one location that is easy to access?
Yes ☐ No ☐

Thank you for completing the survey!