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RESEARCH ARTICLE

Mitigating the Economic and Social Effects of Drought in Kamloops

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Abstract: Drought, defined as a prolonged period of below-normal precipitation, that may result in water shortages, poses significant environmental and socio-economic challenges. Located in the interior of British Columbia, the city of Kamloops is particularly susceptible to drought due to its semi-arid climate and increasing exposure to climate-induced temperature variability. These conditions place considerable strain on the region's water resources, ecosystems, and economic stability. By integrating primary data collected through a community survey, this study aims to evaluate the perceived effects of drought and corresponding water restrictions, identify key areas of vulnerability, and assess the viability of local adaptation strategies. Initial observations suggest that while 84% of respondents follow water restriction alerts closely, over 57% are unaware of their annual water consumption. As droughts become an increasingly persistent feature of the regional climate, evidence-based, community-oriented approaches will be essential for supporting long-term resilience and sustainable water management in Kamloops.

Keywords: *adaptation, drought, semi-arid climate, vulnerability, water restrictions*



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Introduction

Drought, increasingly recognized as a complex environmental hazard, poses escalating risks to communities across British Columbia. For the City of Kamloops, this threat is intensified by the region's semi-arid climate, historical precipitation patterns, and projected climate variability. Relevant literature reflects a growing consensus that integrated, evidence-based, and community-centered strategies are essential to mitigate both the economic and social consequences of drought. This study aims to address these components by evaluating the socio-economic and environmental impacts of drought in Kamloops, assessing community awareness and responses to water restrictions, and identifying actionable strategies to enhance local resilience. Altogether, by integrating survey data and comparative analysis, the study is focussed on highlighting potential gaps between awareness, behaviour, and policy to support long-term drought mitigation efforts.

Kamloops is situated within a landscape that has long been characterized by moisture sensitivity. Paleoenvironmental research in nearby Roche Lake reveals that fluctuations in effective moisture have shaped ecosystem productivity for over 1,800 years, reinforcing the region's ecological vulnerability to long-term climatic variability (Mushet et al., 2022). Additionally, Merritt et al. (2006) modelled future climate scenarios for sub-watersheds in the Okanagan Basin, of which the Thompson-Nicola region is a part, and projected reduced snowpack, earlier spring melt, and declining summer streamflows by the 2050s and 2080s. These changes are expected to increase water demand and stress hydrological systems during the warmest months, directly affecting communities like Kamloops.

Historical drought events provide tangible insight into what future conditions may resemble. The 2015 extreme drought in Western Canada, as analyzed by Szeto et al. (2016), was one of the most severe on record, resulting in record-low soil moisture, widespread agricultural stress, and intense wildfires across British Columbia and Alberta. This event, which emerged from an anomalously warm and dry winter–spring transition, serves as a powerful case study of how climate extremes can disrupt socio-economic systems and emphasizes the importance of preparedness and adaptive governance in regions like Kamloops.

Effective drought mitigation requires robust modelling and data-driven decision-making. Daneshmand et al. (2014) advocate for a multi-period optimization of water allocation based on socio-economic and environmental indices. Their integrated water management model offers a tool for balancing competing demands under constrained supply, a necessity in water-stressed regions. Freire-Gonzalez et al. (2017) similarly call for a refined analytical perspective that distinguishes between green water (soil moisture) and blue water (surface and groundwater), therefore improving our understanding of drought's sector-specific impacts.

On a practical level, drought planning must be adaptive and community-specific. Lloyd (2017), in a study of rural British Columbia, emphasized the importance of localized disaster planning and flexible governance models. He iterates, "drought adaptation planning must be reflective of community realities and capacities" (p. 42), noting that top-down approaches may fall short without meaningful local engagement. This aligns with the perspective of Azadi et al. (2018), who urge the need for multi-scalar strategies that encompass micro (local), meso (national), and macro (international) efforts. They describe drought as a "gradual consequence of climate change" that necessitates "the development of an integrated approach" to address its full socio-environmental scope (p. 184).

Social vulnerability is a recurring concern. Droughts disproportionately impact marginalized communities, yet their economic ripple effects are felt broadly (King-Okumu et al., 2020). Hagenlocher et al. (2019) argue for "people-centered drought vulnerability and risk conceptualization and assessments" (p. 1), highlighting the gaps in traditional institutional responses. Empirical examples from Sub-Saharan Africa further illustrate that drought is one of "the most important natural factors contributing to malnutrition and famine in many parts of the region" (Shiferaw et al., 2014, p. 67), emphasizing the global significance of local resilience planning.

Environmental interactions also complicate drought impacts. Shang et al. (2024) demonstrate that summer droughts are associated with higher levels of tropospheric ozone (O_3),

which adversely affects plant growth and subsequent agricultural productivity. While some species may display short-term resilience, cumulative ecological degradation remains a concern.

Lastly, the literature consistently highlights the importance of shifting from reactive to proactive frameworks. Wilhite (2002) claims that priority should be placed on "preparedness, mitigation, and improved early warning systems (EWS) over emergency response and assistance measures" (p. 275). This is further advanced by Wilhite et al. (2007), who advocate for "improved documentation of the consequences of extended periods of water shortage" (p. 763) to better inform institutional responses.

Altogether, the literature presents a compelling case for localized, integrated, and forward-thinking strategies to address the multifaceted challenges posed by drought. For Kamloops, these findings reinforce the urgency of combining municipal planning, scientific modelling, and community engagement to support sustainable adaptation. As climate trends evolve, resilience will depend on infrastructure and on the capacity of local institutions and residents to anticipate, adapt, and respond.

This paper is structured to provide a comprehensive analysis of drought impacts and mitigation strategies in Kamloops. It begins by outlining the study's methodology, followed by an examination of public awareness, water use behaviours, and conservation practices. A comparative review of approaches used in other municipalities is then introduced to contextualize local efforts. The paper concludes by discussing key implications, offering policy recommendations, and emphasizing the need for proactive, evidence-based approaches.

Methodology

In line with many notable recommendations of a "localized approach," this study utilizes a survey to capture Kamloops residents' perceptions of drought and water use policies. The survey was written in SurveyMonkey (SurveyMonkey Inc., n.d.) and distributed through various online platforms. It was available from February to March 2024, and a non-probability, voluntary response sampling method was utilized. Participants self-selected into the study after encountering the survey through these local online platforms. During survey construction and data

analysis, particular emphasis was placed on gauging respondents' awareness of drought, their attitudes towards water conservation, and their responses to water use policies.

The survey contained four broad sections. The first section provides background information about the purpose of the study, facts about drought and water usage in Kamloops, and explains the topic's relevance to residents. The second section, Drought and Water Usage Awareness, evaluates how familiar respondents are with local drought conditions, their exposure to public signage and information sources, and their opinions on current and future water policies. The third section, Conservation Behaviour, investigates the degree to which households have been affected by drought and what water-saving measures, if any, respondents have implemented or considered. It also examines the perceived barriers to conservation and the impact of pricing on usage habits. The fourth section, Sociodemographic Questions, collects data on household composition, housing type, irrigation practices, property characteristics, awareness of and estimates of annual water consumption, household income, and geographic identifiers such as postal codes. An open-ended prompt at the end of the survey allows participants to contribute additional feedback or suggestions.

The collected data were examined using descriptive statistics to produce meaningful observations. These observations succinctly capture a wide range of responses, indicating the various stakeholders involved in this complex topic. The insights derived from the survey provide a balanced overview of Kamloops' strengths and shortcomings in responding to water shortages. Contextual data from analogous municipalities in British Columbia, such as Kelowna and Vernon, are added to highlight effective policy interventions. Together, the literature review, survey data, and comparative framework support a commitment to "data-driven decision-making."

Results

The results section is organized into several subsections to present key findings from the community survey conducted in Kamloops. The first subsection provides an overview of water-related household characteristics, including property size, irrigation practices, and water usage awareness. This is followed by an analysis of regional variations in water usage practices and

drought awareness across Kamloops neighbourhoods. The next subsection explores drought and water usage awareness, highlighting residents' perceptions of drought impacts and water restrictions. Water pricing preferences and their influence on conservation behaviours are examined and the final subsection discusses conservation behaviours, barriers to implementation, and preferences for water-saving incentives.

Engagement was satisfactory ($n = 133$), and a crucial theme of residents' passion about the topic of drought was maintained, which is encouraging. Of the 133 responses, nine were discarded due to insufficient input (no answers past initial consent). Of the remaining 124, two provided a postal code with "VOE," representing rural outlying areas (e.g., Barriere, Chase), and another two provided "V2H" representing the Tk'emlúps te Secwepemc/Sun Rivers area. Due to the small sample size, these four observations were removed, leaving 120 observations for analysis. In addition, "VIS" representing Aberdeen/Dufferin and "V2E" representing Sahali/Juniper were combined, resulting in four main areas, including "V2C" Downtown/Valleyview/East Kamloops, and "V2B" North Shore/Westsyde. There were 27 observations that did not provide a postal code.

Summary of Water-Related Household Characteristics

The section on socioeconomic questions asks respondents for house characteristics such as house type, size of property, occupancy, and number of bathrooms. It also asks water-related questions, such as having a garden or lawn requiring irrigation, having an irrigation system, awareness of water usage, and a rough idea of usage per year (annual consumption).

Most respondents (72.5%) reside in single-family detached homes, with most properties classified as medium-sized lots between 3,000 and 7,000 square feet (49.2%). The average household consists of 2.7 people and contains 2.3 bathrooms. A significant proportion of households (51.7%) actively maintain a garden or lawn that requires irrigation, while an additional 33.3% report infrequent water usage. Regarding irrigation infrastructure, nearly half of respondents (49.2%) reported having an automatically controlled system, while 15.8% rely on manual systems. Awareness of water consumption is limited, with 57.5% of households unsure of how much water they use annually. Among those who track or estimate usage, most report

consuming between 151–250 cubic meters per year. These findings suggest a high prevalence of outdoor watering systems and a need for improved water literacy and monitoring among residents. Table 1 summarizes the information.

Table 1: *Type of House and Water Usage*

Question	Type	Responses	Total	Percentage %
What type of home do you live in?	Single-family detached home	120	87	72.5
	Townhouse	120	15	12.5
	Apartment/condo	120	6	5.0
	Mobile home	120	1	0.8
	Other (please specify)	120	3	2.5
What is the approximate size of your property	Small lot (< 3,000 square feet)	120	23	19.2
	Medium lot (3,000-7,000 square feet)	120	61	50.8
	Large lot (> 7,000 square feet).	120	21	17.5
	Not applicable (e.g., apartment or condo resident)	120	7	5.8
Does your home have a garden or a lawn that requires irrigation?	Yes, and I actively maintain it.	120	62	51.7
	Yes, but I do not water it frequently.	120	40	33.3
	No, I do not require irrigation (e.g., xeriscape, garden or lawn)	120	11	9.2
Do you have an irrigation system?	Yes, it is manually controlled	120	19	15.8
	Yes, it is automatically controlled	120	59	49.2
	Yes, it is a smart irrigation system (automated based on weather conditions)	120	7	5.8
	No	120	31	25.8

Question	Type	Responses	Total	Percentage %
Is your household aware of how much water it uses annually?	Yes, we track our water usage	120	12	10.0
	We have a rough idea, but don't check regularly	120	31	25.8
	No, we don't know	120	69	57.5
If you answered "yes" or "we have a rough idea"	Less than 100 cubic meters	32	3	9.4
	100–150 cubic meters	32	2	6.3
	151–250 cubic meters	32	15	46.9
	251–350 cubic meters	32	7	21.9
	351–450	32	4	12.5
	More than 450 cubic meters (please specify)	32	1	3.1
	Did not answer annual water usage	106	75	70.8

Note. Among the 118 participants who reported gender, 54.2% identified as female, 37.3% as male, and 6.8% preferred not to answer; no respondents identified as non-binary. With respect to household income, approximately 65.5% of respondents reported annual gross income above \$100,000, 29.9% were in the \$50,000–\$100,000 range, and 7.5% reported earning less than \$50,000. This distribution suggests that the sample skews toward higher-income households, which may be relevant for understanding water infrastructure investments or the affordability of advanced irrigation systems.

Water Usage by Area in Kamloops

Water usage awareness and practices show notable variation across Kamloops' neighbourhoods (Table 2). In the Aberdeen, Dufferin, and Sahali areas (postal codes VIS and V2E), 74.3% of respondents were aware of drought conditions, with 77% living in single-family homes and 71% using automatic irrigation systems. However, only 6.5% reported using smart irrigation systems. A smart irrigation system is an automated watering system that adjusts irrigation based on soil moisture, weather, and plant needs to conserve water efficiently. A large majority (71%) were unaware of their annual water usage, and just 12.9% actively tracked it. Most households (58.6%) reported high annual incomes over \$100,000.

Downtown, Valleyview, and East End (V2C) showed similar drought awareness (74.4%) and a high prevalence of single-family homes (82.1%). Automatic irrigation was reported by 59.0% of households, but smart irrigation adoption was lowest at just 2.6%. Only 10.3% tracked their annual water use, while 65.8% reported household incomes over \$100,000.

In North Shore and Westsyde (V2B), drought awareness was even higher at 85.7%. However, fewer households used automatic irrigation (43.5%), and only 8.7% had smart systems. Half of the respondents were unaware of their water use, with 17.4% tracking it. High-income households made up 56.5% of the area's sample.

Across Kamloops neighbourhoods, while drought awareness is relatively high, this does not consistently translate into proactive water conservation behaviours. Smart irrigation systems and annual water tracking remain uncommon, even in higher-income areas (Table 2). This highlights a gap between awareness and action, suggesting that targeted interventions are needed to encourage more widespread adoption of water-saving practices. Given the sample size, care should be taken in making broad generalizations.

Table 2: *Water Use Summary by Area*

Area	FSA	N	Awareness of Drought	Single-Family Homes (%)	Automatic Irrigation (%)	Smart Irrigation (%)	Unaware of Water Use (%)	Track Water Use (%)	High-Income Households (%)
Aberdeen/ Dufferin/ Sahali	VIS+ V2E	31	74.3	77.4	71.0	6.5	71.0	12.9	58.6
Downtown/ Valleyview/ East End	V2C	39	74.4	82.1	59.0	2.6	53.8	10.3	65.8
North Shore/ West Side	V2B	23	85.7	78.3	43.5	8.7	52.2	17.4	56.5

Drought and Water Usage Awareness

This section of the survey starts with awareness of drought conditions, restrictions, and sources of water usage information. Respondents were asked to measure their own cognizance of

drought conditions in Kamloops over the past years (Table 3). On a scale of 0 (no awareness) to 100 (extremely aware), an average of 78.3 was recorded, with a median of 90. This figure is notable, indicating a high awareness of drought among Kamloops residents. Initial awareness is reassuring, but actionable awareness must also be gauged.

Turning to attitudes, respondents indicated conflicting views on a variety of topics. Initial questions, such as "Do you think droughts will increase or decrease in frequency/severity for Kamloops in the future?" reflected a large majority believing that they will "increase"; while no respondents indicated that they believe it will "decrease." In terms of being aware of water restrictions or drought alerts issued by the City of Kamloops in the past year, awareness was high, with over 84% of respondents indicating that they follow drought alerts closely. This suggests that the community-institution relationship is strong in Kamloops (Table 3).

Table 3: *Awareness of Restrictions and Alerts by Area*

Area	Yes, and I follow them closely (%)	Yes, but I don't pay too much attention (%)	No, I was unaware (%)	Yes, and I follow them closely (#)	Total responses (#)
Aberdeen/ Dufferin/ Sahali	80.6	16.1	3.2	25	31
Downtown/ Valleyview/ East End	84.6	10.3	5.1	33	39
North Shore/ West Side	91.3	8.7	0.0	21	23
Total Responses	84.2	13.3	2.5	101	120

Respondents are aware that the city measures precipitation levels using a six-point drought scale. This high level of knowledge comes from a variety of sources ([Figure 1](#)). A wide range of engagement with these various sources appears to correlate with the high overall drought awareness among residents. The City of Kamloops, in collaboration with other organizations, is facilitating easy access to drought information.

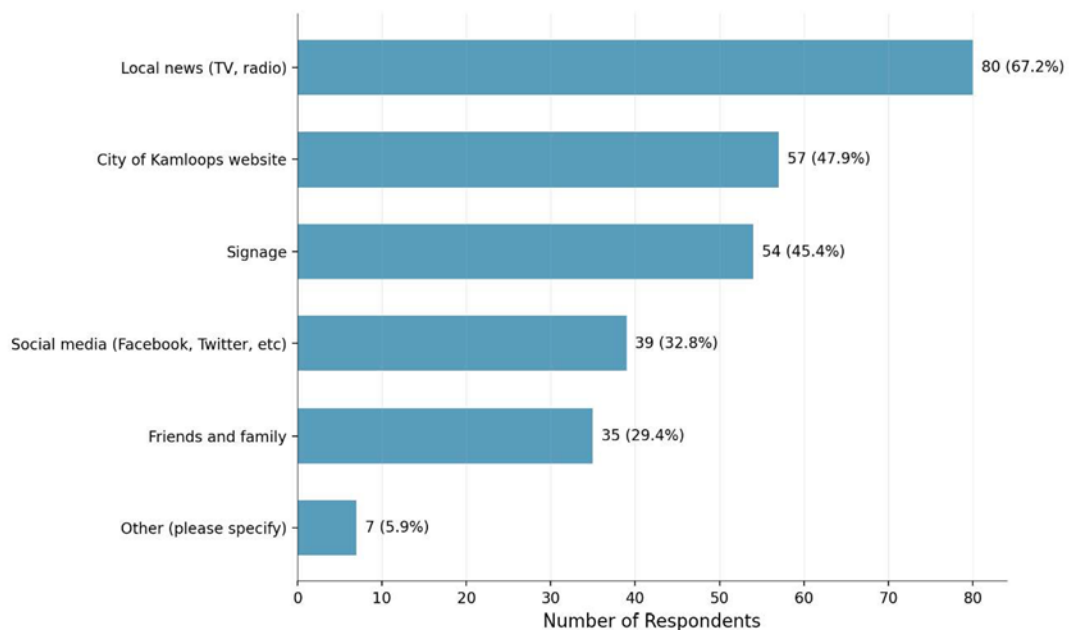


Figure 1. Where do you usually receive information about water restrictions and drought conditions? (Select all that apply) [Image description](#)

Table 4 shows that 89% of respondents report being affected by drought or water restrictions. Nearly half report minimal effects, indicating community resilience, but over 40% face moderate to severe impacts. A key limitation is that the survey does not distinguish between impacts from drought conditions and impacts from water restrictions, making it unclear whether reported effects stem from environmental factors, policy measures, or both. This distinction matters for policy, as natural drought impacts call for long-term adaptation, while restriction-related burdens may require policy refinement or targeted support. Despite this limitation, the data suggest a need for differentiated responses, support for the 4.2% severely affected, and broader conservation outreach to the 47.5% reporting minimal impact. Future surveys should separate impact sources for clearer policy direction.

Table 4: *How Have Droughts and Water Restrictions Affected You?*

Answer	Response Counts (#)	Percentage (%)
Negligible - Water shortages or restrictions have not affected me. [I] Never consider water insecurity	13	11.0
Minimally - Water shortages or restrictions have had minimal effects on me. [I] Rarely consider water insecurity	56	47.5
Moderately - Water shortages or restrictions have moderately affected me. [I] Sometimes consider water insecurity.	44	37.3
Severely - Water shortages or restrictions have severely affected me. [I] frequently consider water insecurity	5	4.2

The comparison between drought awareness levels (Table 3) and reported impacts (Table 4) shows a critical finding: high awareness correlates with greater recognition of drought effects rather than protection from them. Despite 84.2% of residents actively following drought alerts, only 11% report experiencing a negligible impact from water restrictions. This apparent paradox suggests that informed residents are more familiar with how drought conditions affect their daily water use and security concerns. The data indicate that awareness functions as an amplifier of impact perception, and those who pay attention to official drought communications are better equipped to identify and articulate the ways water scarcity touches their lives.

Geographic differences in engagement levels, from 80.6% in Aberdeen/Dufferin/Sahali to 91.3% in North Shore/Westsyde, likely contribute to varying community responses and adaptive capacity. Ultimately, the near-universal experience of some drought impact (89% of respondents) demonstrates that water restrictions create tangible effects across the community, while high awareness levels ensure these effects are recognized and potentially addressed through informed decision-making.

Water Pricing

This section of the survey included perceptions and opinions about water pricing. Some differences emerge in water billing preferences across the areas. The Downtown/Valleyview/East End residents show the strongest preference for hybrid billing systems that combine both fixed

charges and usage-based pricing (56.4%), while North Shore/Westside residents favour purely usage-based billing with no fixed charges (56.5%). Aberdeen/Dufferin/Sahali residents are nearly evenly split between usage-based only (45.2%) and hybrid systems (48.4%). Across all regions, fixed-charge-only billing remains consistently unpopular, garnering support from fewer than 8% of respondents in any area. These regional variations suggest that water utility pricing policies may need to consider neighbourhood-specific preferences, with downtown areas favouring predictable hybrid models and northern communities preferring consumption-based pricing that directly reflects usage patterns. Table 5 provides a summary.

Table 5: *Water Pricing Preferences*

Area	Fixed Charge Only (%)	Usage-Based Only (%)	Both Fixed + Usage (%)	Total Responses (#)
Negligible - Water shortages or restrictions have not affected me. Never	2 (6.5%)	14 (45.2%)	15 (48.4%)	31
Minimally - Water shortages or restrictions have had minimal effects on me. [I] Rarely consider water insecurity	3 (7.7%)	14 (35.9%)	22 (56.4%)	39
Moderately - Water shortages or restrictions have moderately affected me. [I] Sometimes consider water insecurity.	1 (4.3%)	13 (56.5%)	9 (39.1%)	23
Severely - Water shortages or restrictions have severely affected me. [I] frequently consider water insecurity.	6 (6.5%)	41 (44.1%)	46 (49.5%)	93

Conservation Behaviour

Water conservation is a critical strategy for improving drought resilience in semi-arid regions like Kamloops. To better understand how residents are responding to ongoing water scarcity and related policies, this section analyzes survey responses on conservation behaviour. The results reveal how economic incentives, visible neighbourhood practices, and structural barriers shape the adoption of drought mitigation measures. By exploring what actions residents

have taken—or not taken—and why, this analysis identifies key leverage points for improving conservation outcomes through targeted outreach, incentives, and supportive infrastructure.

The analysis of water conservation practices in response to the question "Have you changed your water conservation practices due to recent water pricing changes?" shows that respondents were evenly split between those who made small changes and those who maintained their existing habits (51 responses each, 42.5%), while only 13 (10.8%) reported significantly reduced water usage. This suggests that while pricing changes prompted some behavioural adjustments, they were generally modest, with most respondents either making minor modifications or no changes to their water consumption patterns.

Table 6 reveals significant regional variations in response patterns. North Shore/Westsyde residents demonstrated the strongest conservation response, with 69.6% making changes to their water usage (52.2% small changes, 17.4% significant reductions), compared to only 30.4% reporting no behavioural change. In contrast, Aberdeen/Dufferin/Sahali and Downtown/Valleyview/East End residents showed more modest responses, with roughly equal splits between those making small changes and those maintaining existing habits (around 43–48% each). The higher conservation response rate in North Shore/Westsyde suggests greater price sensitivity in this region.

Overall, the response rate indicates that pricing mechanisms can be effective tools for promoting water conservation across the community (See Table 6).

Table 6: *Change in Conservation Practices Due to Recent Water Pricing Changes*

Area	No Change	Significantly Reduced	Some Small Changes	Total Responses
Aberdeen/ Dufferin/ Sahali	14 (45.2%)	1 (3.2%)	15 (48.4%)	31
Downtown/ Valleyview/ East End	17 (43.6%)	5 (12.8%)	17 (43.6%)	39

Area	No Change	Significantly Reduced	Some Small Changes	Total Responses
North Shore/ West Side	7 (30.4%)	4 (17.4%)	12 (52.2%)	23
TOTAL	38 (40.9%)	10 (10.8%)	44 (47.3%)	93

In terms of being influenced by their neighbour's behaviour, most respondents observed limited visible water-saving efforts in their neighbourhoods (Table 7). Specifically, over one-third (34.9%) reported that *very few or none* of their neighbours had implemented measures such as xeriscaping or rainwater collection, and another 28.6% observed such actions among *less than half* of their neighbours. Only a small portion of the community, 11.2% in total, noted that *more than half* or *most* of their neighbours had taken visible conservation steps. These findings suggest that while awareness of drought and water restrictions may be high, the adoption of neighbourhood-level conservation practices remains modest. This highlights an opportunity for targeted outreach and community engagement strategies to promote broader participation in visible, sustainable water-use behaviours.

Table 7: *Perceived Neighbour Water Conservation Behaviour*

Response Category	Frequency	Percentage (%)
Most of my neighbours have taken visible measures	7	5.6
More than half of my neighbours have taken visible measures	7	5.6
Around half of my neighbours have taken visible measures	20	15.9
Less than half of my neighbours have taken visible measures	36	28.6
Very few or none of my neighbours have taken visible measures	44	34.9
No response	11	8.7

The analysis of visible water-reducing measures reveals interesting patterns in observing neighbourhood conservation adoption within areas in Kamloops. Described in Table 8, Downtown/Valleyview/East End shows the highest perception of neighbour adoption, with

41.0% reporting that most neighbours have implemented visible measures and 69.2% reporting that more than half have done so. Aberdeen/Dufferin/Sahali follows closely with 38.7% each reporting "most" and "more than half" neighbour adoption (77.4% combined). North Shore/Westsyde shows more moderate perceptions, with 34.8% each for "most" and "more than half" categories (69.6% combined). Overall, 72% of residents across all regions perceive that most or more than half of their neighbours have implemented visible water conservation measures, suggesting strong community-wide adoption of observable conservation practices such as xeriscaping and rainwater collection.

Table 8: *Change in Conservation Practices Due to Neighbour's Behaviour*

Area	Most of my neighbours have taken visible measures	More than half of my neighbours have taken visible measures	Around half of my neighbours have taken visible measures	Less than half of my neighbours have taken visible measures	Very few or none of my neighbours have taken visible measures	Total Valid Responses
Aberdeen/ Dufferin/ Sahali	12 (38.7%)	12 (38.7%)	4 (12.9%)	0 (0.0%)	3 (9.7%)	31
Downtown/ Valleyview/ East End	16 (41.0%)	11 (28.2%)	10 (25.6%)	1 (2.6%)	1 (2.6%)	39
North Shore/ Westsyde	8 (34.8%)	8 (34.8%)	3 (13.0%)	30 (13.0%)	1 (4.3%)	23
TOTAL	36 (38.7%)	31 (33.3%)	17 (18.3%)	4 (4.3%)	5 (5.4%)	93

When asked to indicate which measures sample members have considered or implemented to reduce the impact of drought, the results are shown in [Figure 2](#). Based on survey data from 117 respondents, water-efficient appliances are the most frequently selected drought-reduction measure, with 53.0% of participants indicating they have either considered or implemented this approach, followed closely by xeriscaping at 51.3%. Smart irrigation systems and

water harvesting (rain barrels) show selection rates at 49.6% and 46.2% respectively, while other unspecified measures account for 23.9% of responses. The relatively high and consistent selection rates across the four main categories (46–53%) suggest that residents are actively engaging with multiple drought mitigation strategies, though the data cannot distinguish between those who have merely considered these measures versus those who have implemented them.

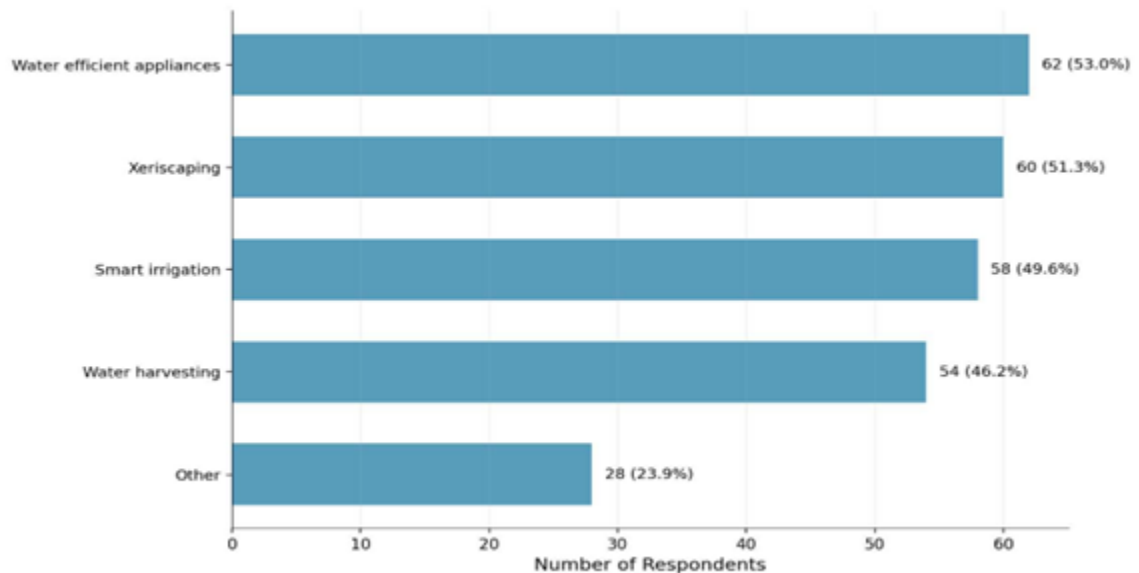


Figure 2. Indicate which of the following measures you have considered or implemented to reduce the impact of drought. (Select all that apply) [Image description](#)

The next question asks for those who have not taken measures to provide reasons for not implementing them. The analysis reveals that 55 respondents out of the 118 responses (46.6%) have not implemented any drought reduction measures ([Figure 3](#)). The main barrier for non-implementers is the cost of measures, most likely related to household income, cited by 41.8% of this group, followed by other unspecified reasons accounting for 32.7%, and time and effort requirements affecting 20.0%. While many respondents recorded considerations or implementations of water conservation methods ([Figure 2](#)), many also cited several reasons for non-implementation, with the “other” category predominantly referring to housing situations, such as apartments, which do not enable conservation efforts. Limitations of available measures

present a barrier for 14.5%, and lack of awareness affects 7.3%, while aesthetic concerns and perceived reductions in quality of life each represent minimal barriers at only 3.6%. This analysis provides a more accurate picture of the barriers faced by those who have not taken action (non-implementers), showing that economic constraints and housing limitations are the primary impediments. The fact that 53.4% of respondents have already taken at least one measure indicates substantial engagement with drought reduction efforts in the surveyed population.

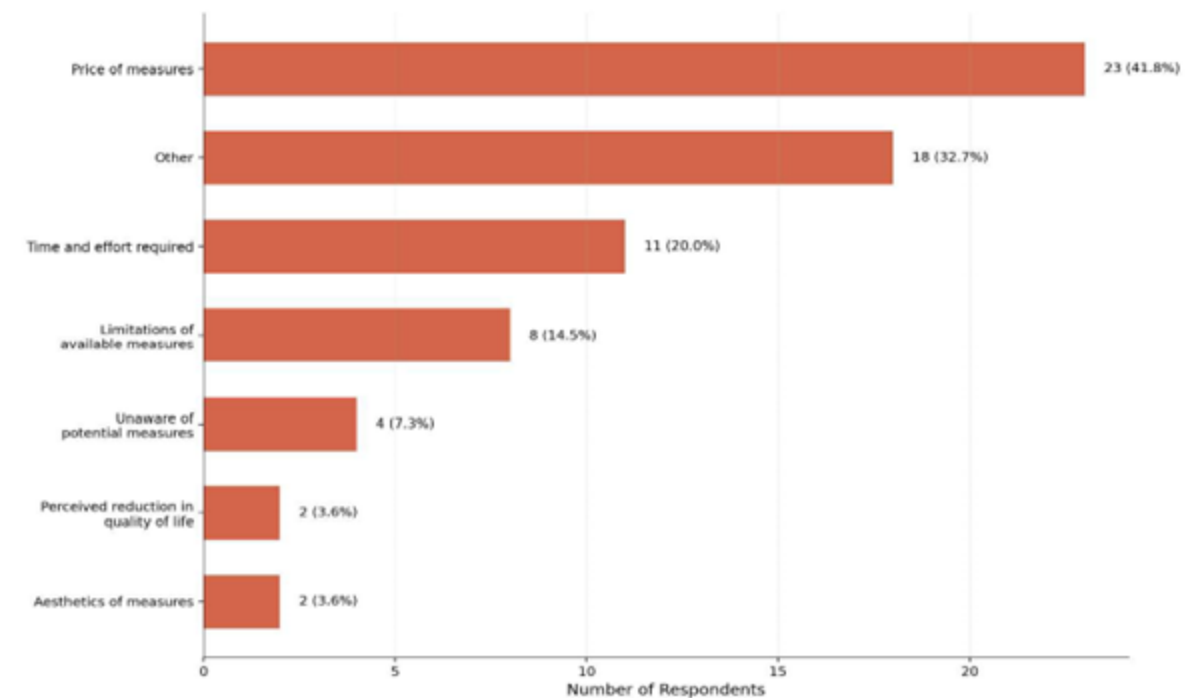


Figure 3. *If you have not taken any water-saving measures, provide reasons for not implementing them.* [Image description](#)

Finally, respondents were given an opportunity to express their own thoughts about what could be done to influence water use behaviour. Table 9 reveals important preferences for water conservation incentives. Rebates for water-efficient appliances lead at 45%, followed by higher prices for excessive use at 39.2%. The relatively narrow 10-point range across all options suggests residents see value in multiple approaches rather than favouring a single strategy. Notably, positive incentives (rebates) outperform punitive measures (restrictions), and the high "Other"

response rate (35.8%) indicates additional unexplored incentive options that warrant further investigation.

Table 9. *What Would Encourage You to Use Less Water?*

Answer	Responses	Percentage (%)
Higher water prices for excessive use	47	39.2
Rebates for water-efficient appliances	54	45.0
More education on drought conditions	44	36.7
Increased water uses restrictions	42	35.0
Other	43	35.8

Together, Kamloops residents are responding to trends by recognizing drought trajectories and potentially considering their own role in sustainability by implementing measures to offset the negative effects of drought. Regardless, many respondents also indicate several barriers to their own contributions. These highlighted barriers must be addressed to foster individual efforts and, therefore, more general “localized” or “community-based” initiatives. Besides recording individuals' attitudes towards conservation, the survey also attempts to gauge more aggregate responses to policies. The reactions to these policies, which aim to create more widespread water-use behaviour changes, are summarized below.

Comparative Water Management Practices

Kelowna: Integrated Supply Management and Demand-Side Incentivization

Kelowna employs a highly integrated and incentive-based water conservation framework that combines infrastructure optimization with behavioural change programs. The city's [Integrated Water Supply Plan](#) separates potable and non-potable systems, enabling the delivery of untreated

water for agricultural purposes and preserving treated water for domestic use. This separation reduces treatment costs and enhances drought resilience (City of Kelowna, 2017).

The [Water Smart Program](#) serves as Kelowna's primary demand management initiative. It includes:

- Free irrigation assessments for residential properties.
- Rebates for xeriscaping, high-efficiency irrigation systems, and water-saving appliances.
- Assigned-day watering restrictions with automated versus manual time specifications to manage peak demand.

In addition, Kelowna employs a seasonal pricing structure that increases per-unit water costs during the summer, therefore providing economic signals aligned with conservation objectives. The city's approach represents a model of integrated infrastructure planning combined with behavioural guidance and price-based demand control.

Vernon: Agricultural Quotas and Metered Water Allocation Model

Vernon's water management system, operated by the [Greater Vernon Water Utility \(GVW\)](#), emphasizes sector-specific regulation and real-time monitoring through a dual water distribution system. Potable water is reserved for urban users, while non-potable irrigation water is supplied to agricultural customers by gravity-fed systems. A major aspect of Vernon's strategy is its agricultural water quota system, where each farm receives an annual water allocation based on crop type, acreage, and historical evapotranspiration rates. These quotas are enforced through mandatory metering, enabling precise tracking of usage and causing surcharges or restrictions if limits are exceeded. For residential and commercial users, Vernon uses a tiered pricing model and drought stage-based restrictions to moderate high-volume consumption during peak seasons. Public outreach initiatives, including educational campaigns, demonstration gardens, and school programs, support conservation awareness.

While Vernon currently lacks large-scale rebate programs, it has introduced smart metering in select neighbourhoods to enhance data-driven planning and promote transparency

(Clarke, 2011). Vernon's approach demonstrates the efficacy of real-time monitoring and zoning-responsive policy enforcement in managing drought-sensitive, multi-user systems.

Kamloops: Fixed Restrictions and Compliance-Centered Governance

In April 2024, the City of Kamloops implemented a revised Water Use Restriction Bylaw, transitioning from the former seasonal odd/even irrigation system to a permanent, address-based watering schedule. Under default (Stage 1) conditions, residents are permitted to irrigate up to three times per week, with specific days assigned according to civic address. To limit water loss during peak heat hours, irrigation is prohibited between 11:00 a.m. and 7:00 p.m. Water Use Exemption Permits are available for properties with newly established landscaping (City of Kamloops, 2024).

The bylaw is designed to escalate in response to provincial drought level alerts, which are determined by hydrologic and environmental conditions across the Thompson-Okanagan region. Higher drought stages cause corresponding restrictions automatically, with residents notified of changes within 24 hours through the City's website and outreach channels.

Enforcement plays a key role in ensuring compliance, with fines starting at \$100 for first-time infractions and rising to \$200 for repeat violations.

The City's water pricing model is structured to support conservation through three primary components. The Fixed Capital Charge, based on service size, covers long-term infrastructure needs such as treatment facilities, pump stations, and transmission networks. For a typical residential property with a ¾-inch connection, this charge is \$242.30 annually, billed quarterly. The Fixed Consumption Charge provides residents with a seasonal water allotment of 45 cubic metres in fall and winter, and 90 cubic metres in spring and summer, for an annual cost of \$136.67. Any consumption exceeding these limits is subject to a Variable Consumption Charge, calculated based on actual excess use.

Complementing these regulatory and financial mechanisms, Kamloops has placed growing emphasis on public education and engagement. Conservation awareness efforts include the

installation of neighbourhood signage, demonstration xeriscape gardens, media advertisements, electronic meter boards, and the publication of local water use statistics.

Additionally, compliance-related door hangers are deployed to reinforce residential irrigation guidelines (Wightman, 2024). These actions reflect the City's broader commitment to cultivating long-term behavioural change and empowering residents as active participants in sustainable water management.



Figure 4. Xeriscape garden in Kamloops, BC. (Courtesy of Sheila Webster, 2010)

Altogether, as explained by the City's Utility & Environmental Services Manager, Greg Wightman, "This plan illustrates the City's commitment to environmental responsibility by enhancing our resiliency and capacity for mitigating climate change while providing a solution that we are confident will help the City achieve provincial water use reduction targets associated with drought."

Discussion

As droughts increase in frequency and severity across British Columbia, the City of Kamloops faces a critical juncture in developing policies that mitigate both the economic and

social impacts of water scarcity. While existing frameworks, such as the revised [Water Use Restriction Plan](#), demonstrate a foundational commitment to water governance, comparative evidence and community-based feedback indicate several opportunities for improvement. The recommendations outlined below are designed to address observed policy gaps using empirically grounded, community-responsive strategies that align with best practices adopted in comparable municipalities.

Implement Financial Incentives to Support Household-Level Conservation

Survey data indicate that 45% of respondents would be motivated to use less water if rebates for water-efficient appliances were introduced. This reflects a clear desire for support mechanisms that empower individual action. Both Kelowna and Vernon provide relevant examples: Kelowna's Water Smart Program offers rebates for xeriscaping and irrigation upgrades, while Vernon's quota-based enforcement model could be adapted to provide a usage-based incentive structure. Without similar financial tools, Kamloops limits residents' participation in long-term water conservation (City of Kelowna, 2017; Clarke, 2011).

Recommendation: Introduce targeted rebate or subsidy programs for water-saving appliances, retrofits, and landscaping alternatives. These should be paired with outreach to residents of multi-unit housing who face barriers to implementation.

Improve Equity and Accessibility in Policy Design

While survey participants generally reported high levels of drought awareness, several respondents cited housing constraints, such as apartment living, as a barrier to conservation action. This points to a lack of inclusive options for renters and non-landscaping residents. Lloyd (2017) stresses that effective drought policy must be "reflective of community realities and capacities" (p. 42). Without tools that account for structural constraints, conservation efforts may exclude significant segments of the population.

Recommendation: Develop equity-focused programming (e.g., water efficiency kits for renters, greywater workshops, and indoor water-use campaigns) to ensure all residents have access to actionable conservation strategies, regardless of housing type.

Strengthening Education and Community Engagement

Although 84% of survey participants reported awareness of local water restrictions, 36.7% still requested more education on drought conditions. This highlights a gap between awareness and deep understanding—a gap that may limit behavioural change.

Kelowna and Vernon both integrate public education into their broader water strategies, using school programs, signage, and interactive platforms to promote conservation. Kamloops could build on its already strong communications efforts and ensure that all residents have the same level of understanding, with deeper, multi-platform engagement.

Recommendation: Expand drought education through interactive online tools, school partnerships, and neighbourhood ambassador programs that personalize conservation for various demographics and water use profiles.

In summary, the City of Kamloops has laid foundational policy infrastructure to address water scarcity but remains heavily reliant on enforcement-based models. A more holistic approach that combines community incentives, data-driven tools, and inclusive engagement will capture best practices from regional peers and reflect the expressed needs and capabilities of Kamloops residents themselves. As climate pressures grow, the City's resilience will increasingly depend on its willingness to evolve from reactive regulation to proactive preparedness.

Conclusion

The intensification of drought conditions in Kamloops presents not just an environmental challenge, but a socio-economic imperative. As shown by the City's 2023 response, triggered by provincial Drought Level 4 and 5 designations for over 100 days that year, the urgency of mitigation is clear. The implementation of elevated restrictions yielded a significant 58% reduction in water consumption, saving over 1.4 million cubic metres of potable water. However, this conservation came at a financial cost, including approximately \$550,000 in reduced revenues (Wightman, 2024). These figures illustrate the delicate balance between sustainability and fiscal stability, reinforcing the need for proactive, well-integrated water policy reform.

Survey results indicate that Kamloops residents are highly aware of drought issues, with over 84% reporting that they closely follow water restriction alerts. Yet, many also express frustrations with the limitations of current conservation efforts. As one survey respondent noted, "many of the people I talk to are aware of lawn watering practices and restrictions but think little of water conservation past that" (Anonymous, 2025). Another respondent shared a detailed articulation of the real-life complexity of water use, explaining that despite wanting to conserve more, "extra supports to conserve water, such as subsidies... would be appreciated" (Anonymous, 2025). These insights confirm that awareness alone is not enough, and that successful drought mitigation must be supported by accessible tools and financial incentives.

Comparative analysis reveals that peer municipalities like Kelowna and Vernon have adopted tiered pricing, rebate programs, and advanced metering systems, all of which have measurably improved conservation outcomes. Kamloops, while commendable in its structured restrictions and rapid response protocols, remains reliant on enforcement rather than empowerment. Its current policy lacks the behavioural incentives necessary to align resident motivation with municipal goals.

To move forward, Kamloops must continue building on its strong foundations by expanding its drought response strategy into a multi-dimensional, participatory model. Recommendations such as introducing water-use reduction subsidies, inclusive policy implementation, and enhancing public education and data transparency are not merely aspirational; they are aligned with community demand and regional precedent.

Kamloops' future resilience is contingent not only on its bylaws but on its ability to activate community-level engagement, address socio-economic barriers, and pursue continuous policy innovation. In the face of a shifting climate, a robust and inclusive drought response framework will ensure that environmental sustainability and community well-being are protected for years to come.

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Brennen Lockwood is an undergraduate student studying Economics and Political Science at Thompson Rivers University. During his time at TRU, he has shown particular interest in the role local communities play in fostering international relations. Brennen has studied abroad in China and New Zealand and is committed to using these experiences to guide future decision-making. As he approaches graduation, he has ambitions of pursuing a career in law, where he believes many tangible differences can be made and the relations between community and international law can be realised.

Image Descriptions

Figure 1 image description:

A horizontal bar chart showing the sources from which people learned information. The bars are ranked from most to least selected:

- Local news (TV, radio): 80 respondents (67.2%)
- City of Kamloops website: 57 respondents (47.9%)
- Signage: 54 respondents (45.4%)
- Social media (Facebook, Twitter, etc.): 39 respondents (32.8%)
- Friends and family: 35 respondents (29.4%)
- Other (please specify): 7 respondents (5.9%)

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Figure 2 image description:

A horizontal bar chart presenting the number and percentage of survey participants selecting different water-saving practices:

- Water-efficient appliances: 62 respondents (53.0%)
- Xeriscaping: 60 respondents (51.3%)
- Smart irrigation: 58 respondents (49.6%)
- Water harvesting: 54 respondents (46.2%)
- Other: 28 respondents (23.9%)

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Figure 3 image description:

A horizontal bar chart displaying reasons survey participants gave for not implementing water-saving measures:

- Price of measures: 23 respondents (41.8%)

- Other: 18 respondents (32.7%)
- Time and effort required: 11 respondents (20.0%)
- Limitations of available measures: 8 respondents (14.5%)
- Unaware of potential measures: 4 respondents (7.3%)
- Perceived reduction in quality of life: 2 respondents (3.6%)
- Aesthetics of measures: 2 respondents (3.6%)

[\[Back to Figure 3\]](#)



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