Title: Systems Approach to Climate Change, Water, and Wellbeing in New Zealand

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Abstract:

New Zealand is facing significant threats from climate change, impacting both its natural environment and the wellbeing of its people. The increasing frequency and intensity of weather events such as droughts and floods pose serious risks to water security and public health, damaging infrastructure, disrupting services, and affecting agricultural productivity and other industry outputs, leading to broader socio-economic challenges. Effective risk assessment and decision-support tools that consider the interdependencies between climate, ecological, and human systems are crucially needed for addressing these challenges.

To tackle the issue, this study employed an integrated approach, leveraging the methodologies of System Dynamics (SD) and Bayesian Networks (BN) to create an interactive visual platform for stakeholders. The SD-BN framework examined cause-and-effect relationships, interdependencies, and feedback loops among factors influencing droughts and floods, and their consequential impacts on water supply and wellbeing in the Hawke's Bay region. Through collaborative workshops with experts and integration of previous project knowledge, the complex system was graphically mapped out using SD. This illustrated interconnections between environmental systems (atmospheric, hydrological), human systems (economic, social, built environment, governance), and wellbeing outcomes (income, health, etc.). Moreover, quantitative relationships between precipitation and groundwater modelling data were incorporated into BNs to demonstrate the connection between climate scenarios and the groundwater system. Additionally, precipitation and health modelling were integrated to analyse the relationship between Campylobacter infection risk and extreme rainfall.

The tool consolidates information from various sources, providing a systemic view of climate change impacts on the economy, environment, public health, and wellbeing. As an educational and communication tool, it fosters shared understanding within communities; stakeholders can use it for communication and engagement purposes. Moreover, the tool addresses a clear need for strategic planning, allowing stakeholders to trace the implications of various scenarios and adaptation options, for example the restoration of wetlands as an adaptation measure. It also serves as a foundational base for incorporating additional modules to address evolving challenges and serves to illustrate the scope and limitations of the various analytical models employed in the analysis of climate change and water issues for the region.

Overall, the case study highlights the importance of a systems approach to understanding and managing climate change impacts on water and wellbeing. The development of a visual platform exemplifies how complex system relationships can be effectively communicated to laypeople. The insights gained from this study can inspire wider and diverse projects in the water industry, helping to address the pressing climate challenges.