



**A REVIEW OF CONCEPTUAL FRAMEWORKS LINKING PUBLIC HEALTH AND
WELL-BEING TO ECOLOGICAL GOODS AND SERVICES
IN THE CREDIT VALLEY WATERSHED**

MARTIN BUNCH, YORK UNIVERSITY

Research conducted 2016-2018, Report published May 2020



WEPGN
Water Economics, Policy
and Governance Network



**Canadian
Water
Network**

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WHY DID WE DO THIS RESEARCH?

A well-functioning ecosystem provides a variety of ecological goods and services to the community, such as clean air and water, and is critical to public health and well-being. A poorly-functioning ecosystem may threaten public health and well-being in many ways, such as through flooding or disease transmission. These connections are well-supported by both the academic literature and professional experience, but remain poorly integrated in the realm of policy, programming and evaluation (Nerker et al., 2015).

Connecting environmental and public health concerns to natural resource management decisions requires conceptual frameworks that identify the key mechanisms that bring these elements together. Conceptual frameworks model natural resource systems to better predict their behaviour and can help organizations test and refine their ideas, and eventually their programs and policies. These frameworks can help explain connections and pathways of change that may otherwise be invisible. The process of creating and testing a robust conceptual framework that addresses complex real-world issues is as important as the product that is ultimately developed (Potschin-Young et al., 2018).

Credit Valley Conservation (CVC) is a community-based environmental organization, dedicated to protecting, restoring and managing the natural resources of the Credit River Watershed. Their vision is 'a thriving environment that protects, connects and sustains us'. This project was undertaken to help CVC realize their vision by connecting the watershed's ecological goods and services to public health and well-being, demonstrating the benefits of CVC's conservation work.

Conceptually linking the watershed's environmental goods and services with public health and well-being will enable CVC to explore innovative ways of valuing ecosystem goods and services at the watershed level. Non-monetary approaches to ecosystem service valuation examine the importance, preferences, needs and demands to the community, and put forward a range of values through qualitative and quantitative measures (Chan et al., 2012).

WHAT DID WE DO?

This project built on a wealth of expertise at CVC related to cost-benefit analysis and the valuation of ecological goods and services in a watershed context. Prior work has focused on the costs and benefits of ecological initiatives and infrastructure projects. The current project takes a broader approach by including costs and benefits related to public health and well-being. A variety of different modeling approaches were considered, including the work outlined by Bunch (2016), and an agent-based modeling approach was ultimately selected to explore the health and well-being impact of conservation actions (Bunch, 2020b).

To further inform model development, a wide range of conceptual frameworks linking human health and well-being with ecosystem goods and services were reviewed. These included the Millennium Ecosystem Assessment (MEA) Framework (MEA, 2005), Health and Environment Cause and Effect Framework (DPSEEA model) (WHO, 1997; Corvalan et al., 1999), Watershed Governance Prism (Parkes et al., 2010) and Community Health Map (Barton & Grant, 2006; Dahlgren & Whitehead, 1991). We also reviewed conceptual frameworks focused on ecosystem services, including the Ecological Cascade Model (Potschin & Haines-Young, 2011; Potschin-Young et al., 2018). The findings from this review are briefly summarized in Table 1.

CONCEPTUAL FRAMEWORK	BRIEF DESCRIPTION	ANALYSIS	KEY PAPERS
Millennium Ecosystem Assessment Framework	Global effort to link the ability of ecosystems to produce goods and services that enhance human health and well-being. Includes five domains of public health and well-being (basic material for a good life, health, good social relationships, security, and freedom of choice and action), direct and indirect drivers of change and ecosystem services (provisioning, regulating, cultural and supporting).	Oriented toward ecosystems as opposed to a specific driver such as climate change. Can be scaled to address local, regional and international concerns. Drawbacks include the difficulty of communicating complex interacting relationships clearly and concisely to the public.	MEA, 2005
Health and Environment Cause and Effect Framework	Developed by the World Health Organization. A widely applied hierarchical model designed to support decision-making to reduce the environmental burden of disease by linking health effects to their root causes. Builds on the classic pressure-state-response model.	Reflects conventional, linear thinking pertaining to environment and health. Weak at addressing non-climatic determinants of health. The limited theoretical basis for including or excluding elements of the framework makes it primarily descriptive.	WHO, 1997 Corvalan et al., 1999
Community Health Map	Designed as an update to the conventional social-ecological model in public health that explicitly includes global ecosystem drivers such as climate stability and biodiversity, as well as the natural, built and social determinants of health.	A nested, hierarchical representation of general categories of health determinants. The model needs to be further articulated to pull out and describe the potential health pathways of interest.	Barton & Grant, 2006 Dahlgren & Whitehead, 1991
Watershed Governance Prism	A governance model connecting ecosystems, social systems, health and watersheds. The watershed focus allows for the concepts to be grounded in a place, recognizing that watersheds can be defined at different nested spatial scales. The model is holistic, not directional, and needs to be interpreted for particular places and themes — for example, pathogens, social justice or health promotion.	The watershed is a useful focal point for regionally scaled place-based analyses of environment, society and health relationships. The “Prism” captures a wide spectrum of health relationships that could be further explored. While this provides a general structure, specific pathways need to be developed on a case-by-case basis. Watersheds can be replaced by other ideas (such as forests, wetlands, cities) as needed.	Parkes et al., 2010
Ecological Cascade Model	Provides a useful and adaptable framework for diverse place-based studies linking biophysical structures and processes to their functions, services, benefits and social value. Well-suited to watershed-based analysis.	Helps structure projects that analyze and/or value ecosystem services. Limited ability to graphically represent system-level interactions and outcomes (such as those related to health and well-being and/or governance).	Potschin & Haines-Young, 2011 Potschin-Young et al., 2018

WHAT DID WE FIND?

The review of the five conceptual frameworks highlighted the different ways that pathways linking health and the environment can be expressed. These frameworks provide distinct perspectives of which relationships between ecological goods and services and public health and well-being could or should be prioritized. The Millennium Ecosystem Assessment, Watershed Governance Prism and Ecological Cascade frameworks were deemed most appropriate for CVC because they could inform the development of an interactive online geographic information system (Bunch, 2016) and the agent-based model (Bunch, 2020b). This model creates a matrix for health components and ecological services that can be explored on a web-based map of the watershed and links specific actions that can be taken by CVC to protect, restore or manage land cover and demographic data, such as age and socio-demographic information. Key health outcomes are estimated, such as mortality associated with changing land cover. The model’s simulation outputs include monetary and health indicators, such as the total cost of tree planting, residential hazard ratios, mean change in these hazard ratios, total economic value and the number of avoided deaths, as well as canopy cover data. The model’s simulations are outlined in more detail in a summary report on the corresponding work (Bunch, 2020b).

Additional work in 2019 – 2020 will expand this model to include a larger suite of CVC activities and their potential health and well-being outcomes. Social justice and equity can also be explored using this model.

WHAT ARE THE IMPLICATIONS FOR DECISION MAKERS?

1. This work demonstrates that well-crafted conceptual frameworks can increase the likelihood that management actions and their associated economic, health and environmental indicators are closely connected to current knowledge about the interactions between ecological goods and services and public health and well-being. They also increase the opportunity for a clear, planned approach to the evaluation of management actions for achieving specific health outcomes.
2. Because public health and well-being is irreducibly linked to actions that protect and enhance ecological systems, the watershed is a logical and powerful public health boundary that can focus much of this work. This reframing of the role of public health in environmental protection and enhancement is supported by the development of a clear conceptual model that links the two domains.

Conceptual frameworks are continually evolving. They are not meant to represent the real world, only to simulate it. By necessity, such models are always simplifications of complex realities. Nonetheless, they allow us to learn about potential interactions and their consequences.

Conceptual models lead to assumption testing, model refinement and, over time, improved policies and programs. They are central to supporting innovative action and adaptation, particularly in interdisciplinary fields. They will become increasingly valuable as climate change undermines established ideas about how ecological systems and public health and well-being interact and intersect.



The Water Economics, Policy and Governance Network's (WEPGN) overarching goal is to build knowledge and facilitate exchange between social science researchers and partners, thereby increasing the application of research to decision-making and enhancing water's sustainable contribution to Canada's economy and society while protecting ecosystems. WEPGN was established with a SSHRC Partnership Grant. The Network's objectives are to:

- Create a vibrant and multidisciplinary network of **Partnerships** amongst researchers, government agencies and community groups;
- Provide **Insight** by mobilizing knowledge from social science perspectives to improve our understanding of water's role in Canadian society and economy;
- Strengthen **Connections** by facilitating a multidirectional flow of knowledge amongst researchers and partners to promote more efficient and sustainable water management;
- Provide high quality **Training** experiences for students and practitioners with interests in water policy decision-making and management.

This project by Bunch contributes to each of the above objectives, and is a notable example of a project that strengthens connections between researchers and partners to create and share knowledge that promotes efficient and sustainable water management.



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