Perspectives
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Blue ecology and climate change

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Abstract

Building on the concept of "Blue Ecology" introduced in previous *BC Journal of Ecosystems and Management* articles, the author proposes that we re-examine climate change from this "water first" angle: What is happening to the world's water in the context of climate change? As evidenced by higher temperatures resulting in melting Arctic ice, melting permafrost, freshwater (i.e., cold meltwater) influx into oceans, shifting water currents, drought, water stress, higher rainfall, and floods, the rhythm of water's transformations between solid, liquid, and gaseous states on our planet is undergoing a significant change, and at a significant rate. The author sees as essential the acknowledgement of water's central functional and spiritual roles in our world, and urges us to apply both respect and science-based understanding as we develop collaborative climate change mitigation strategies and instill this respect and understanding in younger generations.

KEYWORDS: *blue ecology, climate change mitigation, ecosystem function, First Nations, hydrological cycle, spiritual role of water, sustainable survival.*

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Introduction

Climate change, it's all about carbon emissions into our atmosphere, right? "Greenhouse gases," "carbon dioxide," "methane," "carbon credits," and "emission targets"—these familiar phrases encompass the language of the climate change movement. Eminent leaders advise: "There's too much carbon, go carbon neutral." But what about water? How does climate change relate to water?[1]

In earlier *BC Journal of Ecosystems and Management* articles (Blackstock 2001, 2002, and 2005), I introduced the concept of Blue Ecology. This concept emerged from interweaving two ways of knowing:

1. a First Nations spiritual and traditional ecological perspective; and
2. a Western science secular and ecological perspective.

Blue Ecology acknowledges water's life-enabling spirit, which has a central role in ecosystem function and encourages a collaborative water-first approach to teaching and practicing human interventions in our environment. In the complex, interconnected web of life, Blue Ecology is a means to focus, with new watery eyes, on the arrived crisis of climate change. Although world population growth is an equally important environmental change vector, it will not be discussed here.[2]

I propose we re-examine climate change from a new angle: What is happening to the world's water in the context of climate change? The amount of water in the world is constant, although its form, availability, and quality are not. Water is a transformer, a shape-shifter. I submit that the rhythm of water's transformation (phase changes between solid, liquid, and gaseous states) in our world is undergoing a significant change, at a significant rate. Milly *et al.* observed that "substantial anthropogenic change of Earth's climate is altering the means and extremes of precipitation, evapotranspiration, and rates of discharge of rivers" (2008:573).[3]

According to some First Nations oral history, significant shifts in climate have occurred at other times (see Cove and MacDonald [1987] and Robinson [1961] for examples from the Tsimshian peoples). For instance, when Raven stole the Sun from the Chief-of-the-skies to illuminate the dark Earth, and then, also through trickery, Raven brought freshwater in his spoon-shaped beak, this heralded a time of great change (see Figure 1). So change in and of itself is not worrisome. Perhaps, however, we incorrectly presuppose that we fully understand the triggers and dynamics of climate change, and most critically, may be too confident in the resilience of our ways of knowing Earth Mother (e.g., through Western science). If we do not fully understand, do we have time, given the increasing rate of change, to adapt our thinking?

> *"Clean cold groundwater will be an increasingly valuable resource under a warmer climate."—Thompson (2007:5)*

The Hydrologic Cycle and Climate Change

The hydrologic cycle is briefly taught in elementary school and now we should return to it for much deeper study and reflection. First Nations Elders, such as Albert Joseph or the late Mary Thomas, teach that water is our lifeblood, the forest a sponge, and springs a place of spiritual power and clean water. These types of teachings must be reinforced and highly emphasized with our children.[4] Now that we have shifted our gaze on climate change to water, let us focus on the language of recent news reports—"melting Arctic ice," "melting permafrost," "salt water influx into freshwater aquifers," "receding glaciers, "shifting ocean currents," "drought," "water stress," "higher rainfall," "floods"—and you begin to see the pattern. Climate change is about water and its transformation from one state to another.

The sun is the engine of the hydrologic cycle; the clouds are the arbiters of energy (Herring 2002). A warmer climate means, at the continental scale, a wetter

[1] The Intergovernmental Panel on Climate Change (IPCC) is currently working on a technical paper on climate change and water.
[2] As background, the United Nations medium population projection scenario estimates 9.7 billion people in the world by 2050 (United Nations 2005).
[3] As a result of their climate change studies, Milly *et al.* declared the demise of a core assumption in water resource management called stationarity: "the idea that natural systems fluctuate within an unchanging envelope of variability" (2008:573).
[4] Martin Chaplin (2007), of London South Bank University, has catalogued all the known unique physical and chemical properties of water.

FIGURE 1. Rain Raven by Michael D. Blackstock.

world (although for some localized bioregions, such as the Palouse in the northwestern United States, it may in fact be drier). Additionally, as the climate changes, the seasonal rhythms of water will shift: in British Columbia's snowy regions, the melt may occur earlier and quicker, and the summer low flows may be drier and earlier (Hamann and Wang 2006; Natural Resources Canada 2007). From a water-first perspective, we need to think about how and where the rhythms of water are changing and, most importantly, how we can mitigate the impacts from an interdisciplinary and ecosystems management approach.

As the ambient air temperature rises, so too does air's capacity to hold water. Water vapour absorbs much more infrared radiation than does carbon dioxide (Herring 2002). Carbon dioxide, however, absorbs heat from a slightly different wavelength than water, which results in a relatively small increase in heat from carbon dioxide. This, in turn, fuels a fast feedback loop for atmospheric heating of water vapour (Hansen 2003) and, as positive feedback loops do, it creates a hotter and hotter environment. From a Blue Ecology perspective, we ask what physical states will water now take: gaseous, liquid, or solid? At present, about 97% of the Earth's liquid water is salty and about 3% is fresh; about 1% of the freshwater is surface water and the rest is ice or groundwater (Environment Canada 2006). Will these proportions change, and if so, how and how fast? If the amount of polar and glacial ice decreases, then what state is it transforming into, given that the amount of water in the world remains constant?

How We Can Survive the Changes

What can we do? Water needs to be acknowledged by Western science for its central functional and spiritual roles in our world. Furthermore, we must teach children and ourselves about water's role in our world and, most importantly, how to respect water. The hydrologic cycle is an absolutely crucial concept—did you know there are numerous portrayals of the cycle in books and on the Web that do not illustrate the sun (e.g., Encyclopaedia Britannica's Web site has a sunless

[5] Hero of Alexandria was a second century BC Greek mathematician and water works engineer. He gave an interesting insight into an archaic view of the hydrologic cycle: "Water also, when consumed by the action of fire, is transformed into air; for the vapour arising from cauldrons placed upon flames is nothing but the evaporation from the liquid passing into air. That fire, then, dissolves and transforms all bodies grosser than itself is evident from the above facts. Again, in the exhalations that rise from the earth the grosser kinds of matter are changed into subtler substances; for dew is sent up from the evaporation of the water contained in the earth by exhalation; and this exhalation is produced by some igneous substance, when the sun is under the earth and warms the ground below, especially if the soil be sulphurous or bituminous, and the ground thus warmed increases the exhalation. The warm springs found in the earth are due to the same cause. The lighter portions of the dew, then, pass into air; the grosser, after being borne upwards for a certain space from the force of the exhalation, when this has cooled at the return of the sun, descend again to the surface." (quoted in Woodcroft 1851)

portrayal)?[5] In many parts of the world, groundwater is poorly understood by the public because we can't see it and it travels very slowly (on average about 1/9000th the rate of surface water). Because of the abundance of surface water in British Columbia and most parts of Canada, little attention has been paid to groundwater by resource management practitioners or the public; however, this is not generally the case globally. Our climate change mitigation strategies must acknowledge that the change is as much about water as it is about carbon. Water is a core human interest upon which we can build collaborative cross-cultural climate change strategies. In parts of the world, climate change will result in water being the most valued "commodity" produced from forested lands (Thompson 2007) necessitating a change in our management priorities and approaches.

Times have changed. No longer is our goal "sustainable development"—to plan for a high standard of living for our children. Our goal must now be "sustainable survival"—to plan and behave in a cross-culturally collaborative manner that ensures children, generations from now, can *survive with dignity* in a world where respect for water and our climate is ubiquitous.

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Test Your Knowledge . . .

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How well can you recall some of the main messages in the preceding Perspectives Paper? Test your knowledge by answering the following questions. Answers are at the bottom of the page.

1. What does water have to do with climate change?
   A) There may be increased flooding and drought throughout the world
   B) Climate change significantly affects the form and flow of water throughout the planet's hydrologic cycle
   C) There may be increased water scarcity in some bioregions
   D) Mitigation strategies involving water and watershed management is a minor focus for climate change mitigation
   E) Not much relationship between the two since the focus should be on the reducing the causal agents of climate change

2. What is a possible key impact to freshwater ecosystems if the sea level rises?
   A) None
   B) Habitat shifts in the ecotone
   C) Inflows of salt water into freshwater aquifers
   D) Reduction in estuarine ecosystems

3. What implications are there for Western science if it adopts the Blue Ecology tenet that water has a living spirit?
   A) None
   B) Destabilization of all forms of science-based management theories
   C) Elevated acknowledgment in current theory of the importance and role of water
   D) A schism in applied science between secular and profane practitioners
   E) Low-level debate and acceptance of the change
   F) A mild positive effect
   G) A mild negative effect

ANSWERS

1. B 2. C 3. C