



the partnership
for water sustainability in bc

Creating the Future in British Columbia: *Recognize and Address the “Shifting Baseline”*

*By integrating the Site with
the Watershed, Stream
and Groundwater Aquifer*



October 2014

This publication is a backgrounder / op-ed for

**“Resilient Rainwater Management:
Across Canada Workshop Series on
Adapting to a Changing Climate”**

Integrate the Site with the Watershed, Stream and Groundwater Aquifer

Introduction

*Daniel Pauly, French-born marine biologist and professor at the University of British Columbia, is well-known for his work in studying impacts on global fisheries. In 1995, he coined the phrase **Shifting Baseline Syndrome** to describe his observation that:*

“Each generation of fisheries scientists accepts as a baseline that the stock size and species composition that occurred at the beginning of their careers, and uses this to evaluate changes...The result obviously is a gradual shift of the baseline...and inappropriate reference points.”

*The concept of “Shifting Baselines” has relevance in helping to understand why drivers for “Resilient Rainwater Management” differ across Canada’s diverse landscapes. The purpose of this backgrounder is to help inform knowledge-sharing via the **Across Canada Workshop Series** that the Partnership for Water Sustainability is delivering in Fall 2014.*

*The series is an opportunity for practitioners in other provinces to learn about solutions and tools that we are developing in British Columbia through a collaborative and adaptive approach to protecting and restoring watershed health. The series is made possible by funding provided by the Intact Financial Corporation through the **Climate Change Adaptation Project** at the University of Waterloo.*

In the op-ed that follows, Kim Stephens (Partnership Executive Director) connects the dots between Daniel Pauly’s work and the goals of Resilient Rainwater Management. Other members of the Partnership who contributed substantive review and input include Tim Pringle, John Finnie, Erik Karlsen and Peter Law.

*This is a good news story. We can “shift the baseline”. We can create a desired future watershed condition. BC’s new **Water Sustainability Act** provides a new opportunity and framework to collaborate and implement watershed-based solutions.*



*Ted van der Gulik, PEng,
President
Partnership for Water Sustainability in BC
October 2014*



Incorporated in 2010 as a not-for-profit society, the Partnership embraces shared responsibility and is the hub for a “convening for action” network in the local government setting. The Partnership plays a bridging role between Province, local government and community; is the steward for British Columbia’s Stormwater Guidebook; and is leading program delivery for the Water Sustainability Action Plan for British Columbia

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The Shifting Baseline Syndrome is....

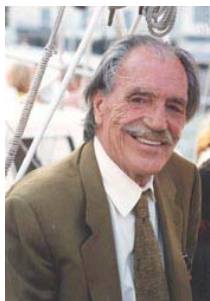
Shifting Baseline Syndrome refers to a gradual change in the accepted norm for ecological conditions.

The phrase describes an incremental eroding of standards that results with each new generation lacking knowledge of the historical, and presumably more natural, condition of the environment. Each generation then defines what is ‘natural’ or ‘normal’ according to current conditions and personal experiences.

With each new generation, the expectations of various ecological conditions shifts. Over time, and in the absence of a ‘teachable moment’ to raise awareness of a change, the result is that standards are lowered almost imperceptibly.

A Short History

The concept arose in Ian McHarg's seminal book **Design with Nature**, published in 1969. Renowned as a landscape architect, writer and educator, Ian McHarg (1920-2001) is best known for introducing environmental concerns in landscape architecture. McHarg



compared the landscape as we know it to that which ancient humans lived on.

“The innovation of which I am most proud was the discovery that the competing claims of the many environmental scientists

could be organized through the employment of chronology. Investigation began with the oldest evidence and proceeded towards the present,” wrote Ian McHarg in the Preface to the 1992 edition of **Design with Nature**.

Daniel Pauly developed the concept in reference to fisheries management in a one-page paper titled *Anecdotes and the shifting baseline syndrome of fisheries*.

“It’s one of my most cited papers, though it’s a very short piece. It’s like a thinking piece; it has no numbers, no equations. This piece became the topic of a blog that ran for several years by a Hollywood filmmaker. It became a stock phrase,” explains Daniel Pauly.

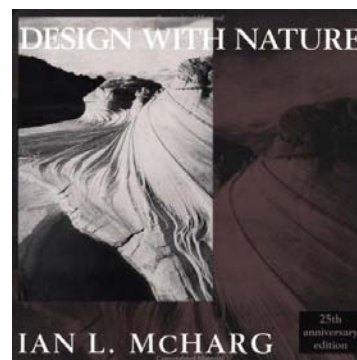


In 2002, film-maker and former marine biologist Randy Olson broadened the definition with an op-ed in the Los Angeles Times newspaper. He explained the relevance of the concept to all aspects of change and the



failure to notice change in the world today.

“If we know the baseline for a degraded ecosystem, we can work to restore it. But if the baseline shifted before we really had a chance to chart it, then we can end up accepting a degraded state as normal — or even as an improvement,” wrote Randy Olson.



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“And the question is, why do people accept this,” stated Daniel Pauly during his TED Talk in 2010

“We transform the world, but we don’t remember it. We adjust our baseline to the new level, and we don’t recall what was there. If you generalize this, something like this happens (refer to graphic below),” explains Daniel Pauly.

“You have on the y axis some good thing: biodiversity, numbers of orca, the greenness of your country, the water supply. And over time it changes – it changes because people do things, or naturally.”

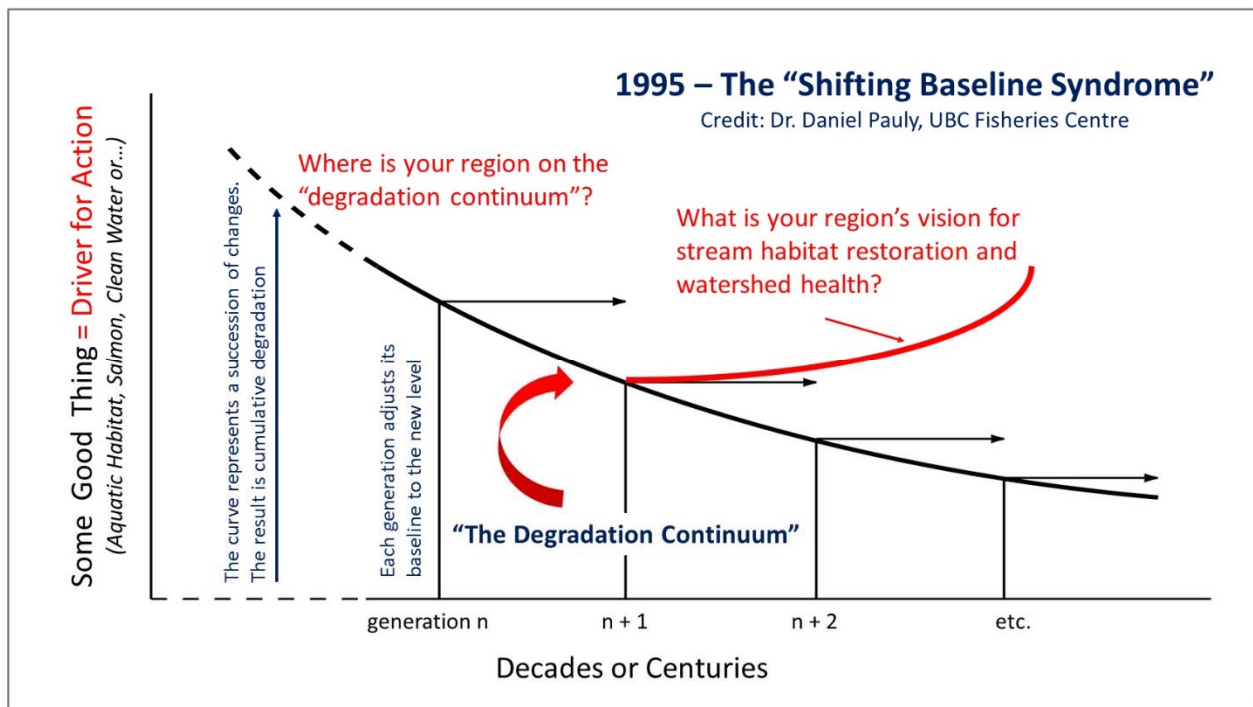
“Every generation will use the images that they got at the beginning of their conscious lives as a standard and will extrapolate forward. And the difference then, they perceive as a loss. But they don’t perceive what happened before as a loss.”

“You can have a succession of changes. At the end you want to sustain miserable leftovers. And that, to a large extent, is what we want to do now. We want to sustain things that are gone or things that are not the way they were.”

“And the question is, why do people accept this? Well because they don’t know that it was different. And in fact, lots of people, scientists, will contest that it was really different. And they will contest this because the evidence presented in an earlier mode is not in the way they would like the evidence presented.”



“So you have a situation where people don’t know the past, even though we live in literate societies, because they don’t trust the sources of the past,” concludes Daniel Pauly.



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Resilient Rainwater Management: Comparing BC to Other Provinces

“The notion of Shifting Baselines helps me explain why the drivers for Resilient Rainwater Management in British Columbia differ from those in the other regions of North America,”



states Kim Stephens, Executive Director with the Partnership for Water Sustainability in BC.

“The BC culture can be described as ‘fish-centric’. This helps to explain why

the protection and/or restoration of aquatic habitat in tributary streams rates as a high priority outcome for rainwater management. In the rest of North America, elimination of water pollution in the main stems of rivers is typically an over-arching regulatory driver.”

“From a BC vantage point, the water quality emphasis in the rest of Canada may reflect the influence of the United States *Clean Water Act* on Canadian practitioner thinking. In the mid-1990s, BC almost went down that water quality pathway as well. But BC stepped back, reassessed and changed direction once we had the benefit of research findings by Richard Horner and Chris May in Washington State. Their work was transformational.”



We Can Re-Set the Baseline

“In 1996, Horner and May demonstrated that ‘changes in hydrology’ is the #1 factor determining stream health where fish spawn. Deterioration of water quality is 4th-ranked. When the watershed goal is protection of aquatic resources, Horner and May proved that a water-quality driven program would not achieve the goal,” adds Kim Stephens.

Table 1. Factors Limiting Stream Health

Ranking	Limiting Factor
1	Changes in hydrology
2	Disturbance and/or loss of integrity of the riparian corridor
2	Degradation and/or loss of aquatic habitat within the stream
4	Deterioration of water quality

“With hindsight, one can appreciate just how profound that change in direction has proven to be. In BC, the pioneer work of Horner and May crystallized a science-based road map for managing rainwater effectively. Their findings also provided a springboard to ‘reinvent’ urban hydrology. The Partnership describes this as ‘mimic the natural water balance’. The resulting Water Balance Methodology is founded on standard scientific and engineering principles. The innovation is in the integration and application of these principles.”

“As a result, this focussed attention on the rainfall interception role of trees as well as how water moves through soil. In turn, this is now leading to development of standards of practice that are affordable and effective.”

“In BC, a learn-by-doing process is opening minds and building confidence that we can re-set the baseline. As Daniel Pauly has noted, we can recreate the past. Seeing examples of what the past looked like enables people to re-set their baseline, he stated.”

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Why Do We Think Differently in British Columbia?

“People say that we think differently in BC. In August 2013, my son and I drove from east to west across the continent. That experience really brought home to me several reasons why it is that we have a different way of looking at rainwater management in BC,” continues Kim Stephens in reflecting on the insights that he gained from the experience.

Headwater Streams: “First and foremost, BC is primarily a mountainous region. The landscape is defined by a multitude of headwater streams with small tributary areas. This shapes our thinking. When compared to BC, the rest of North America is relatively flat.”

Physical Limits: “Because almost 85% of BC comprises mountain ranges, this physically constrains our ability to re-shape the landscape. The rest of the continent, on the other hand, has been fundamentally transformed by settlement and development over several centuries.”

Connection to Nature: “A third factor is the environmental stewardship ethic which is deeply rooted in BC. Memories are strong because our history is more recent – for example, there are people who remember when streams in the Metro Vancouver region were flush with spawning salmon as recently as the 1950s.”

Landmark Public Processes: “Awareness of shifting baselines in BC has been reflected in several landmark public processes, particularly the Agricultural Land Reserve Act (1972) and Fish Protection Act (1997). Embedded in these shifts of direction are appreciation of the ecosystem value of small, headwater streams and their connection through watersheds to lowlands and food production. Baseline impacts of rapid population growth and land development were denied overall prominence in watersheds.”

And Now Our Climate is Changing

“The ‘salmon crisis’ in the late 1990s galvanized awareness in BC that our baseline was shifting, suddenly and dramatically. The ecosystem value of small, headwater streams had not been fully appreciated. The result: streams were being lost as a consequence of rapid population growth and land development. In response, governments recognized the need to restore and protect watershed and stream health,” explains Kim Stephens.

Restore Hydrologic Function: “The historical significance of passage of BC’s Fish Protection Act in 1997 is often overlooked. Yet, in combination with the findings of Horner and May at about the same time, the process around the Act set in motion a chain of transformational events which continue to reverberate to this day.”

“A foundation piece for watershed and stream health is restoration of hydrologic function – that is, the three pathways by which rainwater reaches streams: surface runoff, interflow in shallow soils, and deep groundwater. The goal is to *mimic the natural water balance*. If we get the water part right, the rest will follow.”

“By 2002, looking at rainfall differently led the Province to embrace the Water Balance Methodology, initiate a performance target approach to capturing rain where it falls, and initiate changes in the ways rainwater runoff is returned to streams. Even so, those who were part of the process must continually remind land and water practitioners as to why BC is on this pathway.”

The Water Balance Methodology examines the flow paths of water in the watershed, and the flow in streams.

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“Design with Nature” at the Site Scale: “To know where you are going, you need to know where you have come from. Otherwise, as Daniel Pauly observed in 1995, baselines shift when successive generations of practitioners do not have an image in their minds of the recent past. This happens because they were not there to experience it. Ongoing transfer of knowledge, from those who were key players in past processes to successor generations, is therefore essential if there is to be continuity and consistency of understanding. This also includes teaching the basic principles of applied hydrology.”

“Now that BC’s climate is changing, we can see that the ‘**changes in hydrology**’ driver for aquatic habitat protection in tributary streams will ultimately benefit people too. Designing with nature at the site scale – so that benefits accumulate and we mimic the natural water balance at a watershed scale – ultimately means communities will be more resilient during periods when there is either too much or too little rain.”

At the heart of the Water Balance Methodology is recognition of the integrated significance of the three flow paths, the period of time required for rainwater to reach the stream via each flow path, and the need to protect and maintain the natural distribution of rainwater via each flow path.

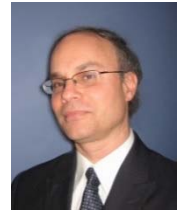
Hydrology is Still Hydrology

“Organizing the Across Canada Workshop Series has afforded me the opportunity to better understand and compare how practitioners in other provinces think about the goals and objectives of Resilient Rainwater Management. The Shifting Baselines concept has become a helpful metaphor,” states Kim Stephens.

Maintain the Three Pathways to Streams:

“During the planning of the series I met with Gilles Rivard, generally considered to be the leading rainwater management practitioner in Quebec, to discuss how we would tailor our content for the Montreal Workshop. Our conversation illustrates the relevance of the Shifting Baselines metaphor.”

“Fish-centric passion is not the driver for action in Quebec the way it is in BC, said Gilles Rivard. When Quebecers think about fish, he explained, it is usually in the context of the St. Lawrence River which is typically close to most settled areas. They do not think about protection of fish habitat the way we do in BC.”



“This significant difference in perspectives is understandable when viewed in the context of Shifting Baselines. Quebec’s landscape has been transformed over the past five centuries. Tributary streams were channelized or eliminated generations ago. So there is no living memory or contemporary awareness of their original fisheries function. As a result, the drivers for Resilient Rainwater Management in Quebec are water quality, flooding and erosion – not fish habitat, said Gilles Rivard. This is representative of much of North America.”

“BC and other provinces may be at different points along a continuum, yet our perspectives are complementary and compatible. While our drivers for action differ, hydrology is still hydrology. Whether the goal is to protect aquatic habitat in headwater streams or reduce total sediment loading in major rivers, water balance thinking still applies. Stream erosion is an example of a commonality. It is caused by changes in hydrology. So, maintain the three pathways [see image on p 7] to streams to mimic the natural water balance when designing communities - and thereby prevent erosion.”

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What Do We Want This Place to Look Like in 50 Years?

“In BC, the Partnership challenges our audiences by posing this question: what do you want this place to look like in 50 years? The decisions we make today will ripple through time. We do have a choice – will it be cumulative impacts or cumulative benefits?”

Accept the Call to Action: “Looking back, 2008 was a defining year for ‘designing with nature’ on Canada’s west coast. The government of British Columbia put in place a policy framework that is a ‘call to action’ on the part of local governments,” says Kim Stephens

“The call to action is to build greener communities, live water smart and adapt to a changing climate. A guiding premise is that water sustainability will be achieved by ‘designing with nature’ and implementing green infrastructure policies and practices that ‘mimic the natural water balance’. We are getting there because we have changed our mindset.”

Embrace Shared Responsibility: “This call to action is underpinned by the notion of *shared responsibility* – that is, everyone needs to understand and care about THE GOAL. If all the players know their role in relation to the goal, then together we can create the desired future.”

“John Finnie, retired General Manager of Regional and Community Utilities with the Regional District of Nanaimo has described the impact of shared responsibility as follows:

Part of the reason for the success in BC of our way of thinking is a result of the efforts of various organizations who have managed to successfully engage governments, developers, the community, academia, etc., in water-centric thinking, planning and development activities. In many jurisdictions, water-centric has become a focus and part of our daily conversations.”

Learn by Doing: “Local government leaders in BC are applying science-based understanding to develop tools, establish precedents and gain the experience necessary to successfully implement an environmentally adaptive approach to community design. It happens when we apply a water balance way-of-thinking to effectively integrate what we do at the site so that we do protect the watershed, stream and aquifer.” (Refer to image opposite)



Create the Desired Watershed Condition:

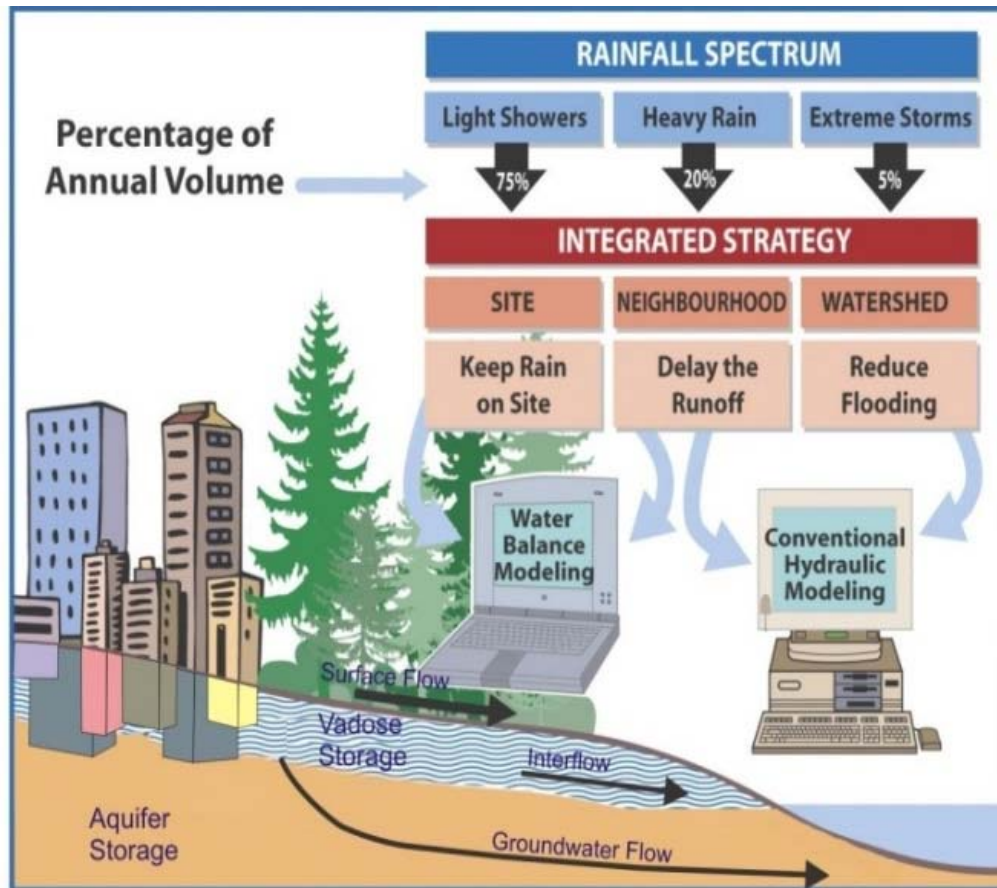
“We can shift the baseline by replicating a desired watershed condition. It will take time, commitment and perseverance. To assess the cumulative benefits of water balance practices on watershed health, some BC communities are embracing an adaptive management framework.”

“A collaborative process is underway in BC. Through sharing and learning from each other, we can ensure that where we are going is indeed the right way,” concludes Kim Stephens.



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Source: Stormwater Planning: A Guidebook for British Columbia, 2002

“Design with Nature” to Maintain the Natural Proportion of Rainwater Entering a Stream via Each Flow Path

Explanatory Notes – Key Messages:

Definitions: ‘Aquifer Storage’ refers to the saturated zone below the groundwater table where all pore spaces in the soil are filled with groundwater. ‘Vadose Storage’ refers to the unsaturated zone above the groundwater table where pore spaces are filled with air AND water.

Urban development reduces the ‘vadose storage’ and interflow. Therefore, to mimic the natural water balance of the site, development projects should strive to retain or restore these processes by means of green infrastructure solutions.

Basements and underground structures will lower groundwater levels to the footing level. The ground above this then becomes part of the vadose zone and can be used for vadose storage. When designed properly, this zone can form part of the green infrastructure solution.

How Does Water Reach a Stream?

Surface Runoff -
from minutes to hours

Interflow (Shallow Groundwater) -
from days to years

Deep Groundwater -
from years to decades or more