

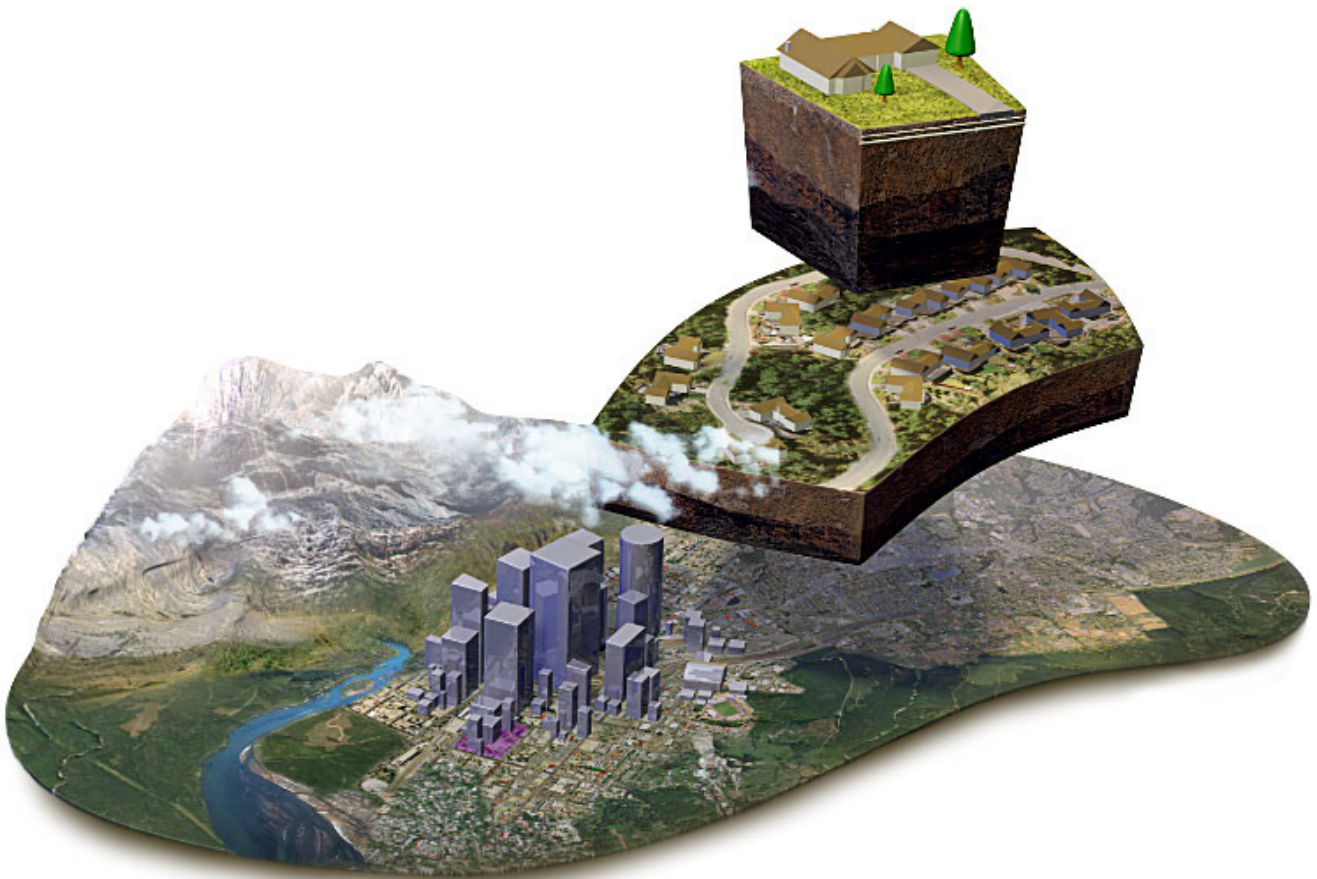


the partnership  
for water sustainability in bc

FORESTER UNIVERSITY WEBINAR:  
**Protecting Urban Watersheds and Stream  
Health in British Columbia**

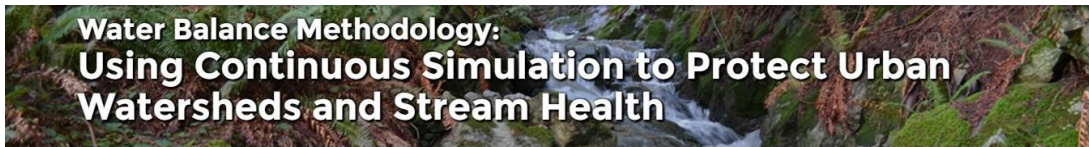
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Moving Towards "Sustainable Watershed Systems,  
through Asset Management"



FORESTER UNIVERSITY WEBINAR:<sup>1</sup>

**Look at the water cycle with fresh eyes to develop and implement new approaches, methodologies and tools that help communities achieve “Sustainable Watershed Systems, through Asset Management”**



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*Located in California, Forester University offers live, educational webinars and on-demand webcasts for professionals in Stormwater, Water Efficiency, Erosion Control, and the public utility sector to earn credits, or to simply learn something new.*

*The [Partnership for Water Sustainability in British Columbia](#)<sup>2</sup> is partnering with Forester University to share, via webinar on May 2<sup>nd</sup> 2017, the British Columbia innovation and experience that has resulted in the whole-system, water balance approach that is the hydrologic modelling foundation for [Sustainable Watershed Systems, through Asset Management](#)<sup>3</sup>.*

*This new way of thinking views watersheds as infrastructure assets. This is an important first step towards changing the engineering standard of practice. The desired outcome is a standard of practice that is state-of-the-art and reflects real-world hydrology.*

*The webinar will be available through May 2020 as a webcast.*

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<sup>1</sup> <https://www.foresteruniversity.com/ProductDetails.aspx?ProductID=2254>

<sup>2</sup> <http://waterbucket.ca/atp/>

<sup>3</sup> [http://waterbucket.ca/wp-content/uploads/2012/05/Primer-on-Application-of-Ecosystem-based-Understanding\\_Sept-2016.pdf](http://waterbucket.ca/wp-content/uploads/2012/05/Primer-on-Application-of-Ecosystem-based-Understanding_Sept-2016.pdf)



**Emily Shine**

Webinar Program  
Manager, Forester  
University



**Andy Reese**

Water Resources  
Engineer & Author

#### **VOODOO HYDROLOGY:**

*“Perhaps, if we make enough estimates of enough factors, the errors in estimation, high and low, will average out to the right answer. This is where voodoo really comes in handy.”*

## **Think Differently and ‘Design with Nature’**

“The Partnership for Water Sustainability in BC is excited to announce our collaboration with Forester University in California,” stated Richard Boase, Partnership Vice-President.

“The Partnership and Forester share a vision for effective management of land and water resources. This vision provides the backdrop for equipping land and water professionals with the tools and experience to think differently and design with nature.”

***A webinar that cannot be missed:*** “We are delighted to have Kim Stephens and Jim Dumont of the Partnership share British Columbia’s cutting-edge continuous simulation model, known as the **Water Balance Methodology**, in their upcoming, featured webinar,” continued Emily Shine, the manager of Forester’s webinar program.

“At Forester University, we aim to position ourselves at the forefront of innovation in rainwater management and green infrastructure, and that is why we are calling Water Balance Methodology a webinar that cannot be missed.”

***On coming to terms with Voodoo Hydrology:*** “Water Balance Methodology nicely complements Andy Reese’s annual Voodoo Hydrology webinar series, one of the most popular in the Forester curriculum,” adds Emily Shine.

“Voodoo Hydrology is a primer on the pitfalls of urban hydrology and the design storm methods drainage designers typically use.”

According to Jim Dumont, the Partnership’s Engineering Applications Authority, “So what is the nub of the issue? In standard practice, only surface runoff is considered with these methods, and this has led to degraded streams. The other pathways by which rainfall reaches streams are ignored.

“Yet we do need to mimic nature. If we are going to disrupt those other pathways when we develop land, we must fix or replace them.”



**Dr. Ray Linsley**  
(1917-1990)

Professor Emeritus,  
Stanford University

*“To be useful... the simulation model must be physically based and deterministic, and it must be designed to simulate the entire hydrological cycle.... hence, it must be a **water balance model**”*



**Jim Dumont**

Engineering Applications  
Authority, Partnership for  
Water Sustainability in  
British Columbia

## Mimicking Nature Saves Money

The Water Balance Methodology has its genesis in the whole-system approach that Dr. Ray Linsley championed more than 60 years ago. As a professor at Stanford University, he pioneered the development of continuous hydrologic simulation as the foundation for water balance management.

“Ray Linsley was a true giant of the profession. The citation upon his election to the National Academy of Engineering read, for ‘leadership in hydrology and water resources planning through distinguished teaching, research, professional practice and service to the government.’ It could not have been stated better,” wrote Robert L Smith in a memorial tribute that he wrote about Ray Linsley in 1992.

Ray Linsley was one of the most influential hydrologists of his time. He and his graduate students contributed greatly to the understanding of hydrologic processes

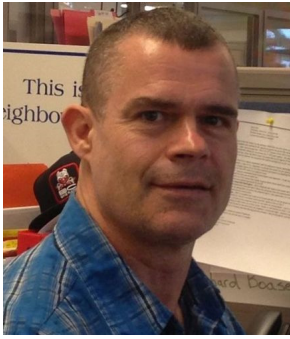
**Webinar Overview:** “In the webinar, we begin by examining how the protection of watershed and stream health in the urban environment ultimately depends on maintaining the natural proportion of rainwater entering streams via three pathways: overland runoff, shallow interflow and deep groundwater flow,” explained Jim Dumont, principal presenter for the webinar.

“We explore how the **Water Balance Methodology** provides an effective way to assess potential impacts resulting from urban development, by allowing a modeller to accurately mimic streamflow and duration in urban infrastructure design.

“We then jump into how optimizing the size and operation of mitigation facilities in the model can be used to demonstrate the effectiveness of the mitigation plan in protecting the receiving stream.

“Finally, we analyze how this approach provides a cost-effective methodology for creating watershed plans with optimized and effective mitigation facilities for a minimum total cost,” concluded Jim Dumont.





**Richard Boase**

Vice-President,  
Partnership for Water  
Sustainability in British  
Columbia

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### **The Partnership for Water Sustainability:**

*Develops tools and  
implements programs  
that are accessible and  
replicable.*

*Tackles “the disconnect”  
between information and  
implementation.*

*Facilitates alignment of  
regional and local  
actions with the Province  
of British Columbia's  
policy, program and  
regulatory framework.*

*Profiles, showcases and  
celebrates local  
government successes  
through professional  
development and  
outreach.*

## **Pathway to a Water-Resilient Future**

“Collaboration with Forester University means the Partnership will have created an online teaching resource that will keep on giving,” stated Richard Boase.

“Over the next 3 years, the May 2nd webinar will be readily accessible as a webcast. The net effect will be to expand the reach of the Partnership, and hence our ability to heighten awareness among land and water practitioners about the benefits of a **whole-system, water balance approach.**”

“The whole-system, water balance approach simplifies things down to an understanding of the consequences of changes in duration of flow. It is very much about the total numbers of hours per year that streams are subjected to particular streamflow rates,” added Jim Dumont.

***Apply Science-Based Understanding:*** “As a teaching tool, the webcast is intended to help these professionals ask the right questions,” continued Richard Boase.

“We would like them to focus on how they and others can apply science-based understanding, properly and effectively, to implement land use and infrastructure practices that incrementally turn the clock back.

**“Slow, spread, sink rainwater runoff.** Success would result from restoration of the pathways by which rainfall reaches streams, naturally. We define this outcome as hydrologic integrity.

“Once they are tuned in to the engineering and scientific principles guiding the Water Balance Methodology, our hope is that land and water professionals will be inspired to make a difference in applying this knowledge.

**“Restoring hydrologic integrity,** and thus the water balance, is key to achieving a water-resilient future in urban areas,” stated Richard Boase in summarizing a key takeaway message for the webinar.

## British Columbia's Whole-System, Water Balance Approach



**Kim A Stephens**

Executive Director,  
Partnership for Water  
Sustainability in British  
Columbia

### Whole-System, Water Balance Approach

1. Understand where the water goes naturally and reproduce those conditions.
2. Restore sub-surface **interflow** to maintain hydrologic integrity.
3. Maintain the proportion of rainwater entering a stream via each of 3 water balance pathways!
4. Replicate the streamflow-duration pattern to mimic the Water Balance

"The vision for implementation of a whole-system, water balance approach is to protect and/or restore stream and watershed health," stated Kim Stephens, webinar co-presenter.

"In 2002, and with publication of *Stormwater Planning: A Guidebook for British Columbia*, a breakthrough resulted from application of science-based understanding to develop the Water Balance Methodology."

**About the Water Balance Methodology:** "Watershed protection starts with an understanding of how water gets to a stream, and how long it takes," added Jim Dumont.

"The Water Balance Methodology allows water resource practitioners to examine how the watershed hydrology has been affected by development, and how this impacts on the condition and function of natural streams.

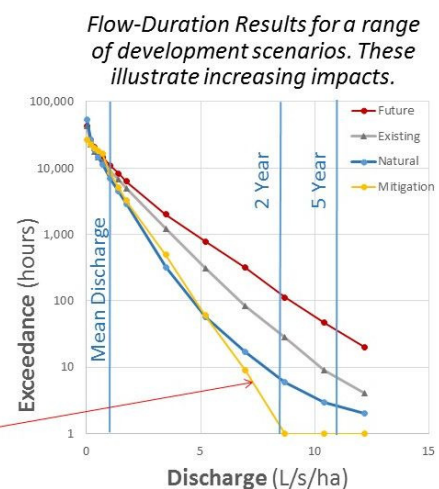
"The innovation of the Water Balance Methodology is in the way it integrates and applies standard scientific and engineering principles to address these components in ways which are not typically applied in planning and design of municipal infrastructure."

If the desired outcome is to limit stream erosion, prevent flooding and improve water quality by restoring watershed hydrology, then....

**APPLY THIS GUIDING PRINCIPLE:**  
Replicate the flow vs duration annual distribution that mimics the natural Water Balance flow paths

**TO ACHIEVE THIS MITIGATION OBJECTIVE:**  
Reduce flow-duration to natural conditions

**AND A DESIRED OUTCOME:**  
This represents a future scenario with mandated mitigation for all new development & redevelopment



FORESTER UNIVERSITY WEBINAR:

# **Protecting Urban Watersheds and Stream Health in British Columbia**

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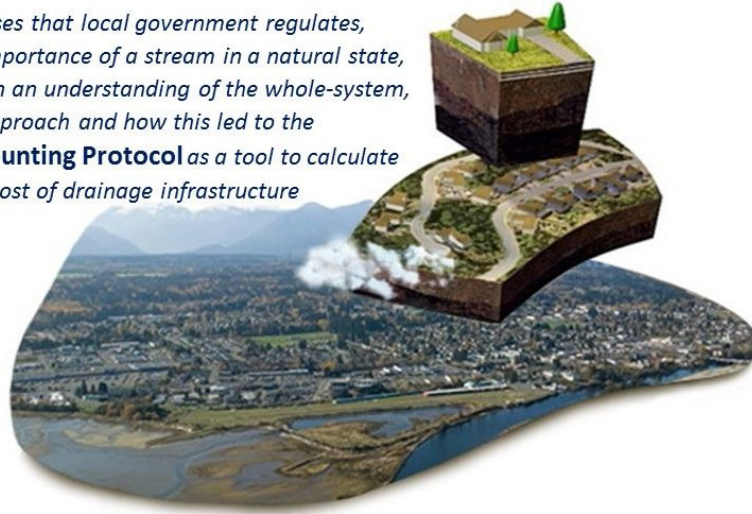
Moving Towards “Sustainable Watershed Systems,  
through Asset Management”

## Appendix

By 2017, an educational goal in British Columbia is that everyone involved in land use and drainage would understand the vision for.....

## “Sustainable Watershed Systems, through Asset Management”

Applies to land uses that local government regulates, recognizes the importance of a stream in a natural state, and is founded on an understanding of the whole-system, water balance approach and how this led to the **Ecological Accounting Protocol** as a tool to calculate the opportunity cost of drainage infrastructure



## Asset Management Continuum

Asset management for sustainable service delivery occurs alongside associated evolution in community thinking. It is a continuous quality-improvement process, and incremental.

A local government would experience the asset management process for sustainable service delivery as a continuum leading to a water-resilient future.

**Sustainable Watershed Systems** would be the outcome in Step Three



### Asset Management Continuum for Sustainable Service Delivery

**GROUND ZERO:** In the beginning, no Asset Management Plan exists. A consequence is 'unfunded infrastructure liability'.

**STEP ONE:** Local governments embrace the BC Framework, with an initial focus on core engineered assets (water supply, sewage, roads) and embark on an Asset Management Strategy / Plan / Program process.

**STEP TWO:** Local governments start thinking holistically and implement a life-cycle approach to infrastructure decision-making so that Sustainable Service Delivery for engineered assets becomes standard practice.

**STEP THREE:** For drainage function, local governments will integrate natural systems thinking and climate adaptation into asset management and account for the Water Balance Services provided by watershed systems.

As understanding grows, local governments will progress incrementally along the Continuum

THE OUTCOME:  
A Sustainable Watershed System



**ANNOUNCEMENT:****Partnership for Water Sustainability publishes Primer to support vision for “Sustainable Watershed Systems, through Asset Management”**

By Kim Stephens, M.Eng., P.Eng, Executive Director  
Partnership for Water Sustainability in BC

Released in September 2016, *Sustainable Watershed Systems: Primer on Application of Ecosystem-based Understanding in the Georgia Basin* is written in a magazine-style to appeal to technical and non-technical readers alike. TO DOWNLOAD A COPY, VISIT:

[http://waterbucket.ca/rm/files/2016/09/Primer-on-Application-of-Ecosystem-based-Understanding\\_Sept-2016.pdf](http://waterbucket.ca/rm/files/2016/09/Primer-on-Application-of-Ecosystem-based-Understanding_Sept-2016.pdf)

The Primer serves as a refresher on core science-based concepts that underpin the vision for *Sustainable Watershed Systems, through Asset Management*, a guidance document released by the Partnership for Water Sustainability in November 2015.



*A watershed is an integrated system. The need to protect headwater streams and groundwater resources in BC requires that communities expand their view from one that looks at a site in isolation to one that considers all sites, the watershed landscape, streams and foreshores, groundwater aquifers, and so on, as an integrated system.*

**Ask the Right Questions**

Everyone learns about the water balance (water cycle) in elementary school, but by high school most have forgotten what they learned. So what does this mean for communities, the reader might well ask? Consider that: A legacy of community and infrastructure design practices has failed to protect the natural water balance (hydrologic integrity). Failure has financial, level-of-service and life-cycle impacts and implications for local governments, and hence taxpayers. Consequences include expensive fixes.

Local governments are starting to recognize that natural assets have value, ecosystem services have a role in municipal service delivery, and so need to be integrated into their asset management programs. Hence, the sixth in the Beyond the Guidebook Primer Series is written to help multiple audiences – whether elected, technical or stewardship – ask the right questions and ensure that “science-based understanding” is applied properly and effectively to implement practices that restore the hydrologic integrity of watersheds.

**Vision: Re-Set the Ecological Baseline**

The vision for Sustainable Watershed Systems is the culmination of a building blocks process which cross-pollinated Washington State and BC experience. In the mid-1990s, Washington State research established the **primacy of hydrology** in either protecting or impacting stream health. In BC, this finding spurred development and evolution of the Water Balance Methodology. Twenty years later, a convergence of initiatives and ideas is the catalyst for taking stock of past and current research.

In 1995, Dr. Daniel Pauly coined the phrase “shifting baseline syndrome” (Figure 1) to describe why each new generation lacks direct knowledge of the historical condition of the natural environment, and how this lack of understanding plays out as a failure to notice change.

The flip side of an impact, however, is an opportunity. Over the past two decades, a series of teachable moments has set the stage to reverse the sliding baseline in the Georgia Basin. Communities could re-set the ecological baseline IF they would implement standards of practice that truly replicate and restore a desired watershed condition. This outcome requires a ‘whole systems’ approach to community planning and infrastructure servicing.

## Watersheds are Infrastructure Assets

BC has a provincial policy, program and regulatory framework that enables local governments to move from UNDERSTANDING to IMPLEMENTATION of a “whole systems” approach keyed to the primacy of hydrology.

The new Water Sustainability Act (“the Act”) plus **Asset Management for Sustainable Service Delivery: A Framework for BC** are lynch-pins for looking at water and watersheds differently. The Act connects land and water, and makes the link to desired water balance outcomes. The BC Framework is a powerful tool for local governments to focus their community planning and infrastructure decision processes on beneficial life-cycle outcomes.

Asset management has traditionally been about hard engineered assets such as waterlines, sanitary and storm sewers, and roads. Yet, watershed systems are also “infrastructure assets”. Trees, soil, green spaces and **Water Balance pathways** contribute to a municipal service function. These assets provide *hydrologic integrity* for a healthy watershed system. This desired outcome is a driver for protecting and managing nature’s services in the same way that engineered assets (and the services they provide) are managed.

## Whole Systems Approach

Restoring hydrologic integrity, and thus the water balance, is key to achieving a water-resilient future in urban areas. A key message in the Primer is the necessity of “staying true to the science” IF communities are to achieve a vision for *sustainable watershed systems*.

The Partnership hopes that readers will be inspired to learn more about the science behind the Water Balance Methodology. Four themes are introduced (in the box below).

Achieving sustainable watershed systems through asset management will require long-term commitment by communities, successive municipal councils and regional boards, and generations of land and water professionals.

**Harness nature to adapt to a changing climate:** Part 1 introduces new ecosystem-based adaptation (EbA) research in BC that may inspire a new generation to “think and act like a watershed”.

**Get the hydrology right and residential water quality typically follows along:** Part 2 celebrates the 20th anniversary of publication of the seminal Washington State research by Dr. Richard Horner and Dr. Chris May on the primacy of hydrology.

**A journey to a water-resilient future starts with the first rain garden:** Part 3 showcases breakthrough rain garden water quality research by Dr. Jenifer McIntyre at Washington State University that builds on the work of Horner and May.

**Water balance pathway to a water-resilient future:** Part 4 introduces the parallel journeys of Washington State, California and BC; and how the Water Balance Methodology is the foundation for an ecosystem-based approach to protection of hydrologic integrity.

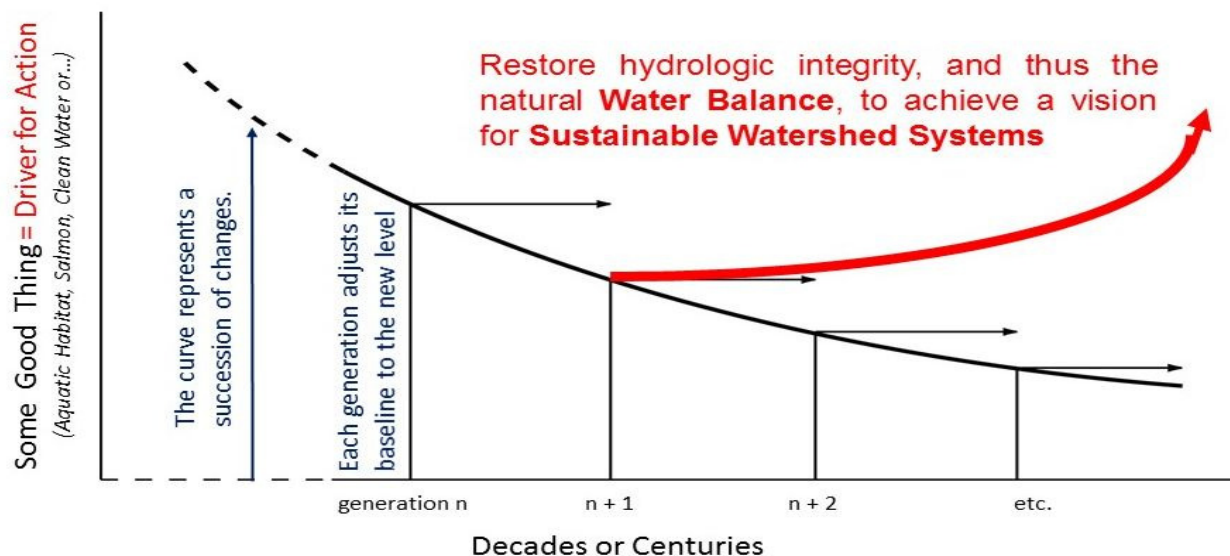


Figure 1 – Re-Set the Sliding Ecological Baseline