Why Natural Channel Design Projects are Incompatible With Natural Resource Protection and the Preservation of Native Biodiversity

Montgomery County Stormwater Partners Network

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Rod Simmons

Photo of Upper Watts Branch Forest Preserve Stream Restoration courtesy of Hazen.

"**Wrong Approach for Stream Restoration**“ [Letter to Editor]

The biggest problem with the so-called natural channel design approach to stream "restoration" for us in the greater Washington, D.C. region is that it is planned and implemented in completely the wrong places: small order, interior forested, upper headwater streams and wetlands. Natural channel design (Rosgen method) is mainly applicable to large order streams and rivers, especially the kinds one finds in the American west. Applying it to small order, upper headwater stream channels of the deeply dissected Fall Zone of our area is a misuse of the methodology, a misunderstanding of eastern Fall Zone hydrology and stream geomorphology, a sure recipe for failure, a mismanagement of public funds by inappropriately targeting sediment-control projects in places with low levels of the very nutrients for which funding is based, and an unacceptable loss of irreplaceable native forest, wildlife, and landscape memory…

Rod Simmons, Environmental Scientist
John Field, PhD, Stream Restoration Specialist and Fluvial Geomorphologist
Tony Fleming, Hydrogeologist
Barbara Southworth, Environmental Science and Policy Specialist
Greg Zell, Natural Resource Specialist
Edd Barrows, PhD, Georgetown University Biology Professor
Andrew Macdonald, PhD, Geologist and Environmental Council of Alexandria Chair
Laura Anderko, PhD, Georgetown University Professor, Health Studies and Climate Change
Jim Long, PhD, Physicist and past president of the Mattawoman Watershed Society
Ken Bawer, Watts Branch Watershed Alliance, Vice President

High-quality Coastal Plain / Outer Piedmont Acidic Seepage Swamp: *Acer rubrum – Nyssa sylvatica – Magnolia virginiana / Viburnum nudum / Osmundastrum cinnamomeum – Woodwardia areolata* Forest (USNVC: CEGL006238) along the south bank of Taylor Run at Chinquapin Park in the City of Alexandria, Virginia. Global/State Ranks: G3?/S3. Despite knowing otherwise, a City of Alexandria natural channel design project (and consultants) are treating this groundwater-controlled, non-alluvial wetland as an alluvial habitat dependent on overbank flooding regimes. This is a huge mistake that will destroy the Acidic Seepage Swamp.

High-quality, mature forest along upper Donaldson Run in Arlington County, Virginia that is imperiled by a misapplied natural channel design project. As seen in the photo, the natural sinuosity of the stream and deposits of wood and gravels perfectly protect the stream banks and forest from floodwaters. Fortunately for this privately owned section of the stream and forest, the landowner has refused any of the proposed project on their property.

When streams dry up (as the channels are widened and summertime flows are reduced in "natural channel design" restorations), the water temperature in the streams rises, which in turn cooks off the oxygen in the water. Dead fish/eels result.

Ecologists have pointed out that though restoration of hydrogeomorphology is a critical consideration in restoring many streams, it is typically not sufficient for degraded channels, and it can even lead to worsening the ecological condition of the stream; i.e., it may be viewed as a disturbance itself (Louhi et al. 2011, Tullos et al. 2009). For example, in restoring floodplain overflow potential, if riparian trees are removed from a previously closed-canopy stream, the underlying energy regime may change from allochthonous resources to one driven by primary production, which may shift the stream further away from the desired ecological state and often toward algae-dominated streambeds and higher temperatures (Sudduth et al. 2011). https://palmerlab.umd.edu/publications/Palmerpublications/Palmer2014a.pdf

Changes in vegetation near streams can have major impacts on stream temperature (Brown and Krygier 1970; Beschta and Taylor 1988; Johnson and Jones 2000).... The response of stream temperature to changes in near-stream vegetation has been shown to vary, with water temperature in some small streams dramatically increasing following disturbance and removal of riparian vegetation (Brown and Krygier 1970; Johnson and Jones 2000).
http://forestry.oregonstate.edu/cof/fe/watershd/fe538/StreamTemperature/johnson_factors_effecting_stream_temp_CJOF04.pdf

Maintain or enhance vegetation alongside streams, to shade the water and filter pollutants from the run-off. Shaded streams are cooler, allowing the water to hold more oxygen. Never remove the natural riparian vegetation that protects these waterbodies.
https://fortress.wa.gov/ecy/publications/documents/0210001.pdf

The denuded, post-construction footprint of a recently completed natural channel design (NCD) stream construction project along the north braid of the west branch of Turkeycock Run at Mason District Park in Fairfax County, Virginia. NCD projects are highly destructive to forest communities and wetlands because they require extensive clearing of canopy trees and forest along the stream banks as staging areas and to create artificial floodplains and stream channels.

"[Natural Channel Design projects targeting] stream bank erosion often do more harm than good. Credits should only be given if biological diversity is maintained." - renowned conservation biologist Marc Imlay, PhD

'And terms like this, which mean NOTHING: "increasing ecosystem resilience, increasing holistic forest function [among the usual inane selling points for these misapplied projects]' - renowned professor and Executive Director, Old-Growth Forest Network, Joan Maloof, PhD

'I helped lead the effort in developing the *Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects* with Tom Schueler of the Chesapeake Stormwater Network… I can no longer hide from the turmoil that I helped to create in the stream restoration industry… This action unleashed an unprecedented flurry of stream restoration projects identified in Watershed Implementation Plans and MS4 implementation plans across the Bay watershed which are now being implemented by a thriving billion-dollar stream restoration industry comprised of engineers, hydro-geomorphologists and a few biologists. I forgot to mention big-time financiers. Also, take notice of what I said about "few biologists"…

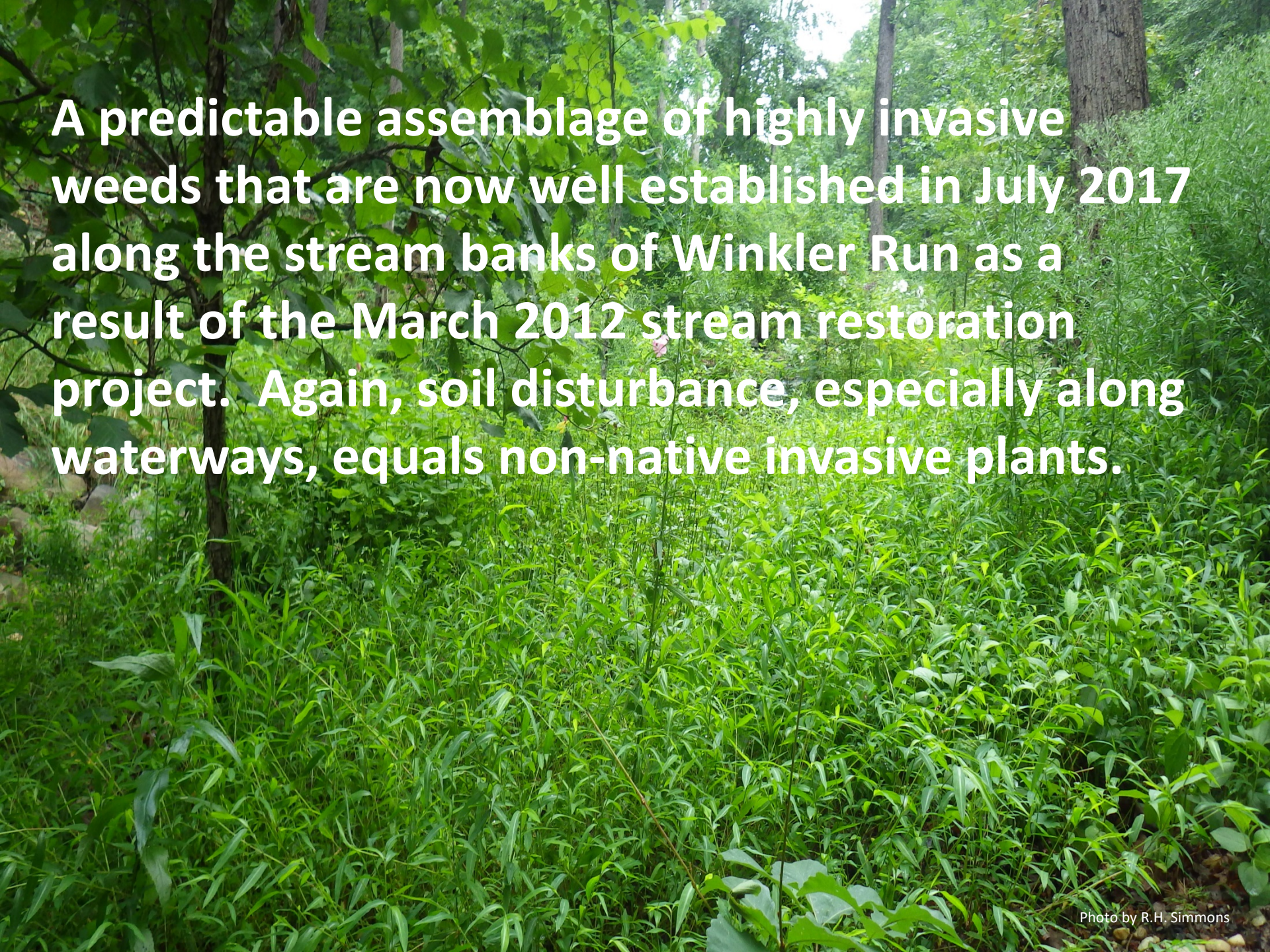
A severe training need exists among local and state governments, NGOs and practitioners in understanding their application and the appropriate siting of projects. Also, the Expert Panel felt strongly that as a qualifying condition to receive credit, projects have to be part of a comprehensive watershed plan that also addresses the root causes of stream bank erosion: impervious cover. Further, stream restoration projects are supposed to demonstrate "functional lift" or improvement to the ecosystem. Generally, this is not happening at least not to the extent that it should. Few biologists or ecologists are asked to participate in the design of stream restoration projects. As a result, municipalities are spending enormous amounts of money on projects that generate the necessary water quality credit but have no real impact on stream function… I am not sure what it will take to make these projects part of an integrated watershed plan to provide functional lift beyond the sediment and nutrient credits. Perhaps this will come after we spend billions of dollars on these projects and the taxpayers ask "why can't I catch fish in this stream?" '

- Bill Stack, PE and Chesapeake Stormwater Network Deputy Director of Programs

An unnecessary and poorly sited natural channel design stream project along the densely forested upper headwaters of Winkler Run at the Winkler Botanical Preserve in the City of Alexandria, Virginia in March 2012 that completely removed hundreds of linear feet of diverse forest, geologic features, and the stream itself, as well as the "landscape memory" of the stream valley.

Photo by R.H. Simmons


An example of the pristine, diverse, and irreplaceable forest community along the stream banks of Winkler Run that was destroyed during the March 2012 stream restoration project.
Photo by R.H. Simmons


A predictable assemblage of highly invasive weeds that are now well established in July 2017 along the stream banks of Winkler Run as a result of the March 2012 stream restoration project. Again, soil disturbance, especially along waterways, equals non-native invasive plants.
Photo by R.H. Simmons

There usually is no funding for non-native invasive plant management in the post-construction footprint of stream restoration projects, especially given the size and persistence of the infestations. Even if funds were available, the invasive species are already so well established and site conditions so degraded that control efforts are largely out of reach. This example is the post-construction footprint of a natural channel design project along Bear Branch – a small, spring-fed seepage stream west of Laurel in upper Prince George's County, Maryland.

Photo by R.H. Simmons

Sites where trees were removed had higher nutrient concentrations than sites where no trees were removed

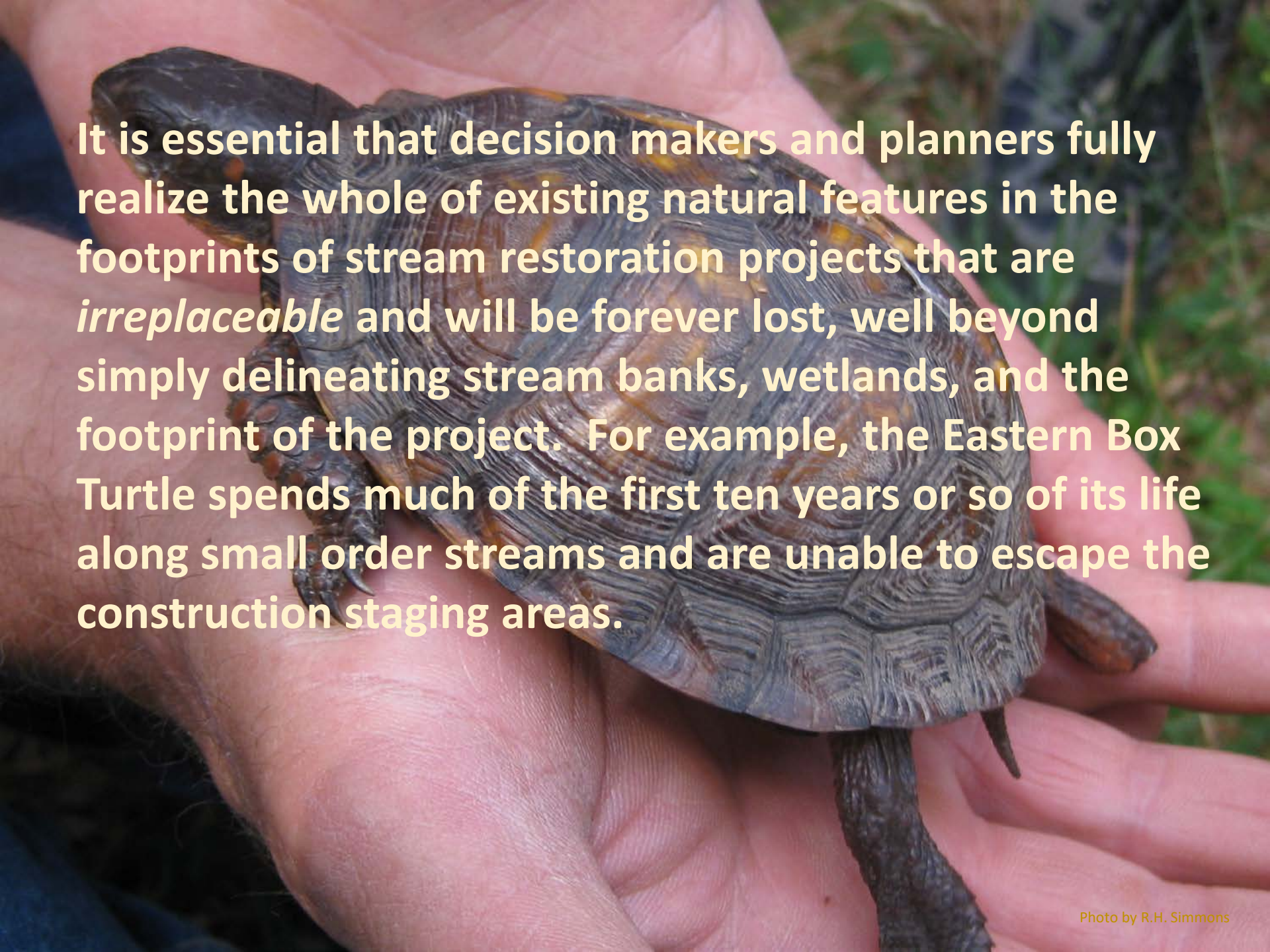
•Concentrations of nitrogen (N) and other nutrients were elevated in ground water in sites where trees were removed.

•Concentrations of nutrients in groundwater decrease downslope in riparian zones with trees, but increase downslope in riparian zones where trees were removed.

Other studies have shown increased nutrient concentrations after tree removal in watersheds:

- Löfgrenet al. (2009)
  - –Increased concentrations of Na, K, N, Cl, etc.
- Martin and Pierce (1980)
  - –Increased concentrations of Ca and N.
- Rusanenet. al. (2004)
  - –Increased concentrations of N.
- Likens et al. (1970)
  - –Increased concentrations of N, Ca, K, Na, Mg, etc.
- Hewlett et al. (1984)
  - –Increased concentrations of N, K, Na, Ca, Mg, etc.
- Feller and Kimmins(1984)
  - –Increased concentrations of N, K, Mg, Ca, etc.

Sujay S. Kaushal et al. 2018. Tree Trade-offs in Stream Restoration Projects: Impact on Riparian Groundwater Quality.



It is essential that decision makers and planners fully realize the whole of existing natural features in the footprints of stream restoration projects that are *irreplaceable* and will be forever lost, well beyond simply delineating stream banks, wetlands, and the footprint of the project. For example, the Eastern Box Turtle spends much of the first ten years or so of its life along small order streams and are unable to escape the construction staging areas.

Photo by R.H. Simmons

Ways to help ensure the future preservation and sustainability of forested stream valleys:

All jurisdictions share a public trust responsibility and commitment to properly steward and preserve their natural resources for present and future generations and the good of the environment.

Natural lands managers, ecologists, engineers, planners, and design and build companies likewise have a responsibility to thoroughly assess and present all irreplaceable natural resources potentially affected by a stream restoration or wetlands project as necessary environmental review prior to construction. The approach to date has traditionally been a very narrow scope solely through an engineering perspective, with little to no input from conservation biologists.


QUESTIONS?
Photo by R.H. Simmons


Thank you.
Photo by R.H. Simmons