



WATER RESOURCES

IMPACT

NOVEMBER 2019
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CONSERVATION FINANCE



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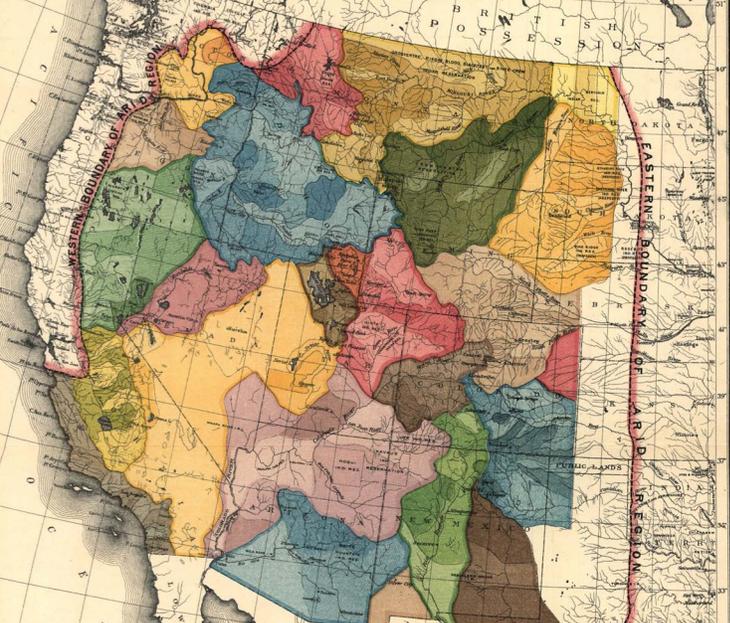
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Patrick Coady, Lisa Beutler, and Justin Sauble.

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PRESIDENT'S MESSAGE

The Season of Thanks

Lisa Beutler, President

THANKSGIVING IS UPON US. There is plenty to express thanks for. First, and foremost, thank you to all of our American Water Resources Association (AWRA) members. Members are the foundation of AWRA's mission to build community, conversation and connection. Beyond paying dues (thank you for that too), members advance the water profession's body of knowledge by contributing to *IMPACT*, *JAWRA* (our journal) and presenting at conferences. A significant number of volunteers serve on technical committees, as conference hosts, as judges and reviewers, as associate editors, on our Board of Directors, and in other leadership roles.

The hosts of this November's Annual Conference in Salt Lake City, Utah, deserve special thanks. Our congratulations go to the General Chair, **Candice Hasenyager**, Utah Division of Water Resources, Technical Program Co-Chairs, **Jeremy Williams**, Brown and Caldwell, **Gus Williams**, Brigham Young University, and **David Rosenberg**, Utah State University, Finance Chair, **Matt Jensen**, Parr Brown Gee & Loveless, Exhibits Chair, **David Hartvigsen**, Smith Hartvigsen PLLC, Student Activity Co-Chairs, **Steve Burian**, University of Utah and **David Tarboton**, Utah State University, and Field Trip Co-Chairs, **Karen Nichols**, HDR, **Marisa Egbert**, Utah Division of Water Resources, and **Delmas Johnson**, J-U-B Engineers.

The Planning Committee and conference attendees are a prime example of the intellectual firepower, personal generosity, and collaborative spirit that make AWRA the vital, multidisciplinary organization it is. For more on the power of an AWRA annual conference, see the article from **Jillian Young** on page 38.

I am personally honored and thankful for the opportunity to serve as President. This experience has allowed me to interact with water professionals on a national and global scale. Earlier President's messages featured some of my adventures (our Spring Conference on Integrated Water Resources Management in Omaha, Nebraska, the Georgia Water Resources General Conference in Savannah, and the AWRA Summer Conference on Resilient Adaptation in Sparks, Nevada). A few additional 2019 highlights include participating in a conversation hosted by the Spanish Embassy in Washington DC, on Latin America's water infrastructure, invitations to speak at universities and seminars, providing guest columns to various water and infrastructure publications, and, spending an extraordinary week in Beijing at AWRA's joint conference on Water Security with the Center for Water Resources Research of the Chinese Academy of Sciences.

As we experienced during our time in Utah, our conference hosts treated us to exceptional hospitality and top-notch interdisciplinary thinking.

Another great privilege of the Presidency is the opportunity to present AWRA's annual Awards. This is the 55th year AWRA has recognized individuals, organizations, projects, state sections, and student chapters for outstanding leadership and service in the water resources profession. Both members and non-members can make nominations by completion of an application. An awards committee, chaired by a Past AWRA President, screens applications (sometimes requesting additional information) and then makes a final awards recommendation. As in years past, the 2019 nominees and awardees exemplified the best of our profession. Please see more about the 2019 Awards on page 39.

In addition to the formal awards process the President is able to personally recognize individuals for outstanding contributions and support to the organization. The 2019 President's Award went to AWRA's Technical Director and *IMPACT* Technical Editor **Michael E. Campana**. Listing Dr. Campana's contributions to our organization through the years would fill an entire page. A past President, this year he has been instrumental in helping with many organizational transitions, and as Technical Director, served as our resident sage on all matters water.

Years are often marked by themes and for AWRA it was a time of great transitions. In the Chinese Zodiac 2019, is the Year of the Pig. Interestingly, the Pig is associated with the hours 9–11 in the night, and good fortune. Both seem fitting given how a lot of late night work is really paying off. We are particularly thankful for the efforts of our Chief Executive Officer **Dresden Farrand**, and staffers **Megan Balkovic** and **Judie Talbot**. Kudos also go to the Board of Directors and particularly Immediate Past-President **Brenda Bateman**, and Board Members **Lisa Engelman**, **Claire Bleser**, and **Scott Kudlas** for going above and beyond regular board duties as we moved AWRA into the next decade.

Looking forward to 2020, we will continue to modernize the organization and engage in strategic planning to ensure AWRA remains relevant to our members and the water resources profession. President-Elect **Betsy Cody** has already jumped in with both feet and we are sharing a variety of duties. We are also welcoming **Jason Doll** as our newest Board Member.

A wise person once offered that no duty is more urgent than that of returning thanks. A special thanks goes to all of

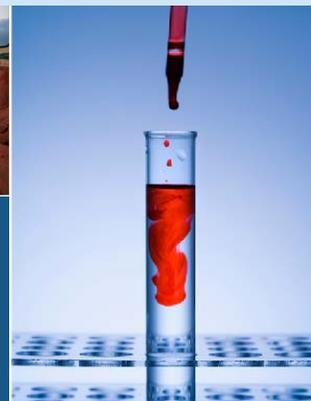
(continued)

you that have sent notes and emails with suggestions and encouragement. We read your comments carefully and aim for continuous improvement of AWRA's performance. Thanks also to my family and my employer **Stantec** for allowing me the time to serve as AWRA President and spend a year focused on promoting the water resources profession. It has been an honor.

We always appreciate hearing from you. Please feel free to correspond with me directly at president@awra.org. ■



Michael Campana receives the 2019 President's Award for Service from Lisa Beutler.



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HIGHLIGHTS - JAWRA OCTOBER 2019

[access full table of contents here: <https://onlinelibrary.wiley.com/toc/17521688/2019/55/5>]

CELEBRATING 55 YEARS OF JAWRA – SUSTAINED CONTRIBUTIONS TO IMPROVE WATER RESOURCES

ANOTHER INSTALLMENT of Celebrating 55 Years of JAWRA is presented in the October 2019 issue. The editorial highlights some contributions of JAWRA in the fifth decade (2005 – 2015) focus on a set of trendsetting papers that defined the social dimensions of water especially understanding public perceptions and how they are integrated into water resources decision making process. The virtual issue can be found at - [https://onlinelibrary.wiley.com/doi/toc/10.1111/\(ISSN\)17521688.JAWRA55](https://onlinelibrary.wiley.com/doi/toc/10.1111/(ISSN)17521688.JAWRA55)

Featured Series – Optimizing Ogallala Aquifer Water Use to Sustain Food Systems

The October 2019 issue also contains two papers from the Optimizing Ogallala Aquifer Water Use to Sustain Food Systems featured collection. This installment of this featured series is coordinated by Dr. Prasanna Gowda and edited by Drs. Ryan Bailey, Isaya Kisseka and Xiaomao Lin

Being the largest aquifer in the US, sustaining Ogallala Aquifer is critical to maintaining food security of our nation. The papers highlighted in this issue address how two critical aspects – climate change and land use change impacts on water management in this aquifer.

Silva et al. investigate the aggregate county-level effect on the High Plains Aquifer (HPA) of groundwater withdrawal for irrigation, of climate variables, and of energy price changes. Their results show the average net effect of irrigation in the HPA is a reduction in groundwater level of 0.47 feet per year. Climate change could significantly increase the rate of change.

Moriasi et al. present the soil and water assessment tool (SWAT)–land use update tool (LUT). SWAT-LUT is a standalone, user-friendly desktop-based tool for updating land use in the SWAT model. It allows users to process multi-year land use data.

Other Technical Papers

The October issue also contains 15 other technical papers that span a wide range of topics and issues in water resources. Topics addressed in this issue range from development of novel decision making methods, non-point source loadings and best management practices (BMPs) to mitigate these loadings, improving irrigation practices and social dimensions of water management including an analysis of the media coverage of water issues. Some highlights from this issue include:

Ator et al. present their findings of how point-source reductions account for more than 80 percent of the decline in nitrogen flux to Chesapeake Bay between 1992 and 2012 but were offset by rising phosphorus inputs from the Susquehanna River.

Dangle et al. quantify the implementation and effectiveness of best management practices (BMPs) at 75

randomly selected forest road stream crossings in Virginia. They found erosion rates decreased as the implementation of water quality best management practices increased.

Phung et al. present how seasonal changes in climate are expected to increase irrigation requirements and reduce the number of field-work days.

Land use changes may mitigate or amplify these impacts on streamflow and baseflow.

Mika et al. review 124 urban Watershed Management Plans (WMPs) across the U.S. to characterize historic approaches and identify emerging trends in watershed planning. They find that methodologies for the development of WMPs in urban areas are being responsive to changes in policy and technology.

Doyle and Patterson analyze a database of reservoir reallocations implemented and proposed by the U.S. Army Corps of Engineers, which reallocates reservoir storage to adaptively manage water infrastructure. They find different districts of the Corps of Engineers reallocate differently, illustrating federal decentralization.

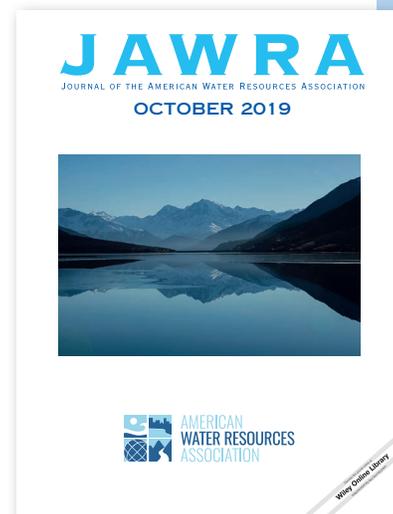
Flint et al. investigate coverage of water issues across seven newspapers in the core of the U.S. Intermountain West region to determine whether or not local daily newspaper coverage of water issues provides a more local or regional sensitivity.

McLaren et al. quantify increase in outflow water temperature as a mid-sized irrigation reservoir is drawn down, helping resource managers quantify costs and benefits of reservoir management strategies.

Eisworth and van Kooten analyze how a planner should allocate payments for water-based ecosystem services (PWES) optimally. They show how consideration the externalities (spillovers) induced by payments for water-based ecosystem services can substantially affect the optimal allocations of payments made to land managers.

Liu et al. introduce the Gini coefficient and location quotient to analyze the spatial pattern of regional water use profile and optimize regional water use.

A full table of contents for the October issue can be found at Wiley Online. There are several other articles tackling various water resources issues on the Early View section of JAWRA's website.



FEATURE

Introduction to the Conservation Finance Issue

Patrick Coady

Dedication to John Wesley Powell

Seeing Things Whole (the title of a forthcoming book by William duBoys) - This Conservation Finance issue of *Water Resources IMPACT* is dedicated to John Wesley Powell, scientist, explorer, reformer and institution builder. Powell's *Report on the Lands of the Arid Region* called for watershed commonwealths where governance was to be by hydrographic basins.

In 1889, Powell was asked to address the framers of the Montana Constitution. The main thrust was a land use plan that started with forests providing the water that is ultimately needed for agriculture. He gave an example:

"Every man who settles in the valley of the Gallatin Valley comes ultimately to be interested in every other part of that valley, because it is the entire Gallatin Valley, the whole drainage basin, (that) gathers the water for his farm. Only a portion can be redeemed for agriculture, another portion will be used ultimately for pasturage. High up in the valleys we have the timberlands, and higher up in the valleys we have mountains where the waters are condensed. The people below must necessarily be interested in the whole drainage system around about where these waters are gathered".

Powell then argued that counties needed to be organized by drainage basin along with other specific suggestions. The Montana framers thanked Powell and took no action along the lines Powell recommended.

Conservation Follows the Science, Finance Follows the Plan - Finding Convergen

THE ARTICLES IN THIS ISSUE OF *Water Resources IMPACT* are organized around the idea that a watershed must be the organizing principle for conservation action and the related finance has to support the watershed conservation plan. Within a watershed are many sources of funding and many ecological benefits to be extracted. There is a great opportunity and need to craft financial convergence and having the watershed inhabitants play together.

Organizing the Vision

Both vision and consensus building are critical and very hard to achieve (translate into frustrating, time consuming and requiring special patience). But nothing happens unless you have a "champion" on the case for as long as it takes.

Tracy Stanton, of the Emerald Alliance, describes the efforts to pull together a broadly accepted strategic plan for the Puget Sound. This has entailed time and dogged leadership. The strategic plan is then turned into implementation effort and a finance plan.

Laurie Wayburn, President of the Pacific Forest Trust, calls attention to the importance of the enabling framework of policies and regulations that are not only clearly supportive but do not undermine financial solutions.

Getting a Conservation Idea into a Finance Plan

One of the challenges of conservation finance is taking an idea and making it financeable. Conservation finance lives in a world of government, private property and, often, complicated transactions. An important finance initiative has

been the Healthy Watersheds Grant program that supports the pioneering pilot project watershed development work. Jeff Lerner points out that the Healthy Watersheds Grant program received 367 grant requests seeking \$80 million from a program that only had \$10 million to be awarded to 56 grantees. Two of the articles in this issue are beneficiaries of the HWC grants.

New Approaches and Perseverance

Conservation finance is abuzz with great new ideas. This issue highlights three topics: the state of nutrient trading, a new forest resiliency bond, a joint benefit finance approach to urban resiliency. Genevieve Bennett asks - "Is the day of nutrient trading finally upon us?" Nathalie Woodward of the Forest Service brings us up to date on the forest resiliency bond which is now in its pilot phase. Will such a forest bond become a significant finance mechanism? Lisa Beyer and Todd Gardner of WRI tackle the idea of capturing all the ecological benefits of a functioning natural urban watershed and proposing a consolidating finance approach called a "Joint Benefits Authority".

Perseverance and Champions

My observation is that progress in the field has been achieved because talented people are dedicated to a project, region or aspect of conservation. And conservation finance has depended on similar dedication. The articles in this issue continue to trek onward.

The last article is an interview with a watershed champion, Jessica Fox, who has lead the Ohio River nutrient trading program with EPRI for decades. Many of the articles in this issue are represented by champions committed to playing the

“long game” and hopefully making the game a bit shorter for the rest of us.

Conservation Finance – Looking Ahead

The science of conservation is on the verge of achieving a reduction in transaction costs by being able to quantify environmental benefits. Marrying watershed conservation with public bond structures has arrived, and can be mainstreamed. The focus on outcomes, not just costs, has opened up an important area of conservation finance. Some breakthrough in watershed finance seems promising.

Still, most watershed ecological needs assessments are measured in billions of dollars and the financing mechanism are tens of million of dollars.

The next time *Water Resources IMPACT* decides to do an issue on Conservation Finance, there will be plenty of new finance ideas to showcase along with their champions. ■

Patrick Coady is chief mechanic at Pat’s Garage – “Putting Conservation Projects Back on the Road”. Pat has a lifetime career in investment banking and concentrates on moving the field of conservation finance to scale. He has raised private capital for wetlands and species mitigation projects, is Senior Fellow at Conservation International and a co-founder of the Northern Virginia Conservation Trust. And loves conservation finance conference.

Contact: coadyco@earthlink.net

Some Sources of Conservation Finance Information

Conservation Finance Network
www.conservationfinancenetwork.org

Ecosystem Marketplace
www.ecosystemmarketplace.com

U.S. Endowment for Forestry and Communities
www.usendowment.org

World Resources Institute
www.wri.org



AWRA-University of Washington (UW) Student Chapter and AWRA-Washington Section (WA) Participate in Earth Day Celebrations at UW Bothell and Cascadia College Campus – April 24, 2019



*By Rabia Ahmed,
Greene Economics – President, AWRA-WA*

THE AWRA-WASHINGTON SECTION In response to an invitation from UW Bothell Campus, the AWRA-UW Student Chapter and AWRA-WA participated in the UW Bothell/Cascadia College Sustainability Festival to celebrate Earth Day on April 24, 2019. Tyler Oshiro – AWRA-UW Student Chapter President, Rabia Ahmed – AWRA-WA President, and Patrick Vandenberg – AWRA-WA Board Member, set up a booth at the festival. The objective of this initiative was to promote the many opportunities offered by AWRA-WA for students, inform the students there about the AWRA-UW Student Chapter, and guide them on how they could get involved with the organization. The event was well-attended with many students stopping by the booth to talk about the organization. ■



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FEATURE

A Regional Approach to Funding Conservation in Central Puget Sound

Tracy L. Stanton

THE PACIFIC NORTHWEST REGION of the United States is known for its spectacular natural features and treasured landscapes, offering unparalleled recreation opportunities and other exceptional aspects of livability including thriving communities supported by robust economic growth (Figure 1). The central Puget Sound, region, defined by the four counties of King, Kitsap, Pierce and Snohomish, are among the fastest growing areas in the country. This growth, fueled by a strong labor market, is projected to continue through 2050, adding some 1.8 million more people; creating increasing demand for new housing, commercial and retail areas, transportation and access to recreation and parks both urban and rural.

been working to advance a regional approach to landscape conservation predicated on the ecological connectivity of the landscape across jurisdictions, the strong return-on-investment from investing in natural resource protection and the high value placed on the natural environment by residents of the region. The initial work was encapsulated in the Regional Open Space Strategy (ROSS), a multi-year collaborative effort aimed at: 1) creating a preliminary vision for a regional, multi-objective open space plan; 2) improving regional coordination and decision-making on open space issues, including the inadequate and fragmented conservation funding structure; 3) scaling conservation investments commensurate with the needs; 4) building a regional collaborative to improve collective

impact; and 5) developing a framework to help advance prioritized projects and actions. At the core of the ROSS theory of change was addressing the fact that the true value of natural infrastructure is not accounted for in planning processes and resource allocation decisions.

Much of the technical work of the ROSS involved framing the many ways that landscape protection is fundamental to addressing other key regional challenges such as the impacts related to climate change and building climate resiliency; the loss of critical biodiversity due to land conversion and loss of habitat, the human health impacts due to the loss or absence of natural infrastructure, the desire to sustain the region's robust growth and addressing the issues of equal

access and opportunity for all residents across the region. The ROSS demonstrated that an investment in the region's rich landscapes and natural resources serves as a catalyst for achieving multi-benefits such as those described above. The ROSS effort culminated in a final report that called for five key actions: 1) create a dynamic regional vision; 2) establish an integrating regional planning structure; 3) expand and streamline funding; 4) advance supportive messaging and decision-support tools; and 5) create a regional collaborative alliance.

Picking up where the ROSS left off, the Puget Sound Regional Council (PSRC), the region's transportation planning authority, secured grant funding from the US Endowment for Forestry and Communities and spearheaded the creation of the Regional Open Space Conservation Plan (ROSCP), a

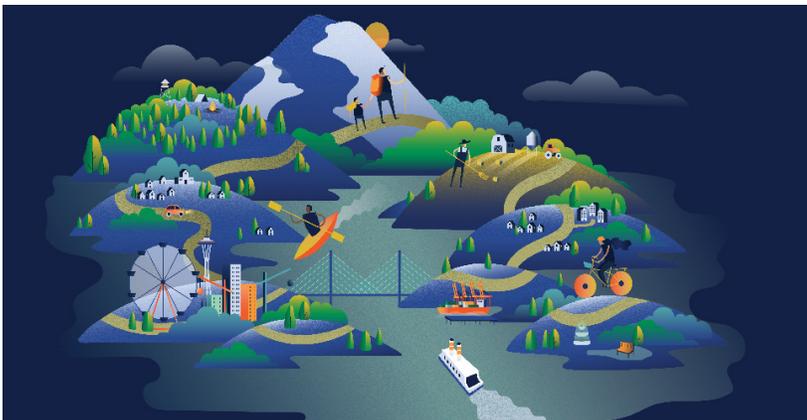
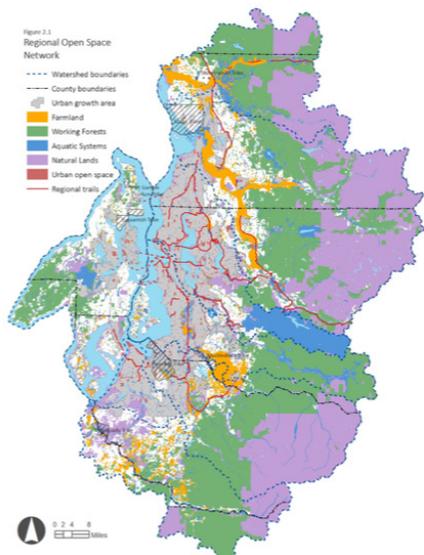


Figure 1. Diversity of Activities and Landscapes in the Puget Sound Region.

With ever-increasing people comes ever-increasing development pressure on those same landscapes that serve as the foundation for what makes this region unique and attractive to its residents. Fundamental to protecting the region's treasured open spaces is to ensure that a key factor in planning efforts be that the regional growth plan - currently in the process of being updated - is a county's comprehensive plan or a watershed plan. Otherwise, future growth will exacerbate the current data showing loss of working forests, farmland and urban trees along with increased degradation of aquatic systems, parks and opportunities to complete vital trail connections across the region.

Motivated by the love of, and loss of open spaces, the overall declining health of Puget Sound as well as the regional growth projections, key stakeholders from across the region have

blueprint that for the first time visualizes a regional open space network across all land ownership categories, geography and ecological functions. The network (Figure 2), which covers just over 3 million acres and 339 miles of trails, categorizes six types of open spaces including aquatic systems, farmlands, natural lands, regional trails, working forests and urban green spaces. The network also highlights the areas with existing protection (roughly 70 percent of the total acres) and the priority areas in need of protection, which combined across all six categories totals some 463,000 acres and 300 miles of trails.



Regional Open Space Network

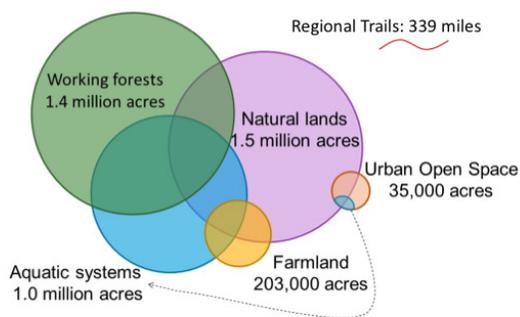


Figure 2. Regional Open Space Network.

The key conservation strategies called for in the ROSCP include:

- Incorporate open space conservation into all levels of planning.
- Support growth in the right places.
- Keep working lands working.
- Protect remaining key habitat areas and restore habitat in high-value areas.
- Support urban open space and increase access to nearby nature for urban residents.
- Build a regional trail network.
- Enhance stewardship on open space lands, both public and private.
- Coordinate planning among and within agencies, jurisdictions, tribes and organizations.
- Build multi-benefit green infrastructure.

The overall ROSCP, completed in June 2018, and its articulation of the regional open space network serve as a collective, regional vision and action plan for conservation and local planning that, when implemented, will better sustain the region's open spaces and the vital ecological functions they provide for generations to come.

While the ROSCP is a vital step toward the long-term protection of at-risk open spaces, the plan needed to be followed by an implementation and funding strategy. With

a Phase 2 grant from the U.S. Endowment for Forestry and Communities, secured by the Emerald Alliance for People, Nature and Community (<http://bit.ly/2LvebG1>; a regional alliance formed in the wake of the ROSS), work is underway to develop the implementation and funding strategy for putting this plan into action (due in July 2020).

The methodology for developing the ROSCP implementation strategy builds from the recent example of King County's Land Conservation Initiative (<http://bit.ly/2AP0a6o>), an effort that first identified the last remaining high-value conservation land to prioritize for protection over the coming 30 years. The work begins with estimating the cost of protecting the 463,000 acres of at-risk land identified in the ROSCP. The second step involves an inventory of funding mechanisms currently used to invest in conservation actions and at what level of funding. The result of these first two steps will illuminate the funding gap that is needed to fully protect the priority acres. The last step will be to highlight some of the approaches that could serve to fill the funding gap. Below (Figure 3.) is the funding analysis from King County's effort to identify both existing and needed revenue for land conservation actions over 30 years.

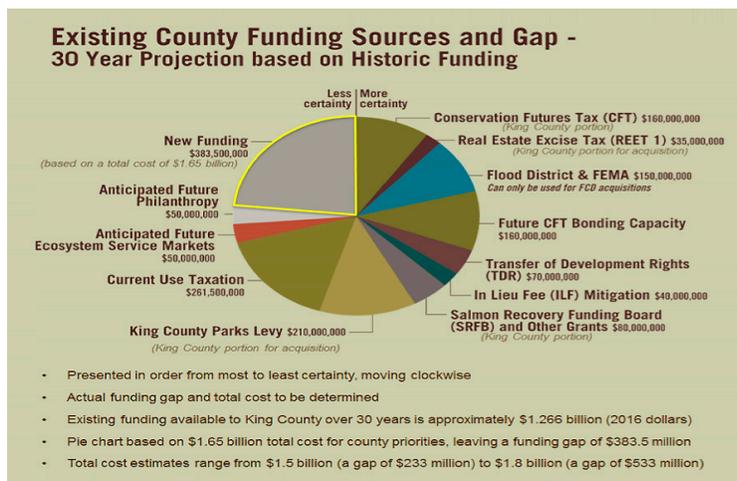


Figure 3. Existing and Needed Funding for Land Conservation Actions (from King County, Land Conservation Initiative, Advisory Committee Materials)

The Emerald Alliance, working in collaboration with PSRC, is adapting the methodology used by King County for application to the other three central Puget Sound counties to determine the overall cost of protecting the 463,000 areas of at-risk land. Beyond the cost estimates and determining the overall funding need, the ROSCP identified key actions that will be reflected in the final implementation strategy. These include

Dinner Meeting

American Water Resources Association-Washington Section Organizes 2019 Legislative Update on June 12, 2019 in Seattle



Carrie Sessions

It has become a tradition at AWRA-WA to provide its membership with an annual legislative update related to water resources during summer. The section's June 2019 Dinner Meeting at Pyramid Alehouse in Downtown Seattle was organized around this topic and was a collaborative event with the Washington Hydrologic Society. Carrie Sessions from the Washington State Department of Ecology provided the update and her insights. During her presentation, Ms. Sessions explained that the 2019 legislative session brought significant gains on environmental issues. While legislators mostly focused their attention on environmental topics such as climate change, oil transportation, and recycling, they did not forget about water resources. She presented the bills related to water resources that the State Legislature debated (and the one that they passed!), as well as the enacted budget appropriates for this area. She also talked about Ecology's request legislation on drought preparedness and response, explained why it did not pass, and surmised about the bill's future. Lastly, she gave a brief overview of some of the momentous environmental bills that passed in 2019. As always, Ms. Sessions provided her audience with an informative presentation and provoked an engaging discussion. ■



advancing the use of key conservation tools such as Transfer of Development Rights, Ecosystem Service Markets such as credit trading, the newer Innovative Conservation Finance tools such as Environmental Impact Bonds and Pay for Performance approaches, return on investment analysis and multi-benefit green infrastructure projects; all tools that will be examined as part of this regional funding approach.

The long-term success of this effort to protect open space and natural infrastructure at the regional scale hinges, in large part, on how successfully the ROSCP is integrated into Vision 2050, the region's growth plan which is in the process of an update to be completed in October 2019. Specifically, the protection of those 463,000 at-risk acres identified as part of the region's open space network will depend on a few critical actions that will be further defined in the updated growth plan and specific multi-county planning policies including: 1) focusing growth in already established regional growth centers and avoiding the impacts of development on the regional open space network; 2) prioritizing the funding to protect at-risk land; 3) ensuring equitable access to parks and open space for all residents both urban and rural; and 4) treating all open spaces as vital interconnected natural resources that are too valuable to lose.

Equally important to success is the role of the new regional collaborative, the Emerald Alliance, and its efforts to grow a stronger, more cohesive conservation movement by focusing on connecting the many efforts to protect open space across central Puget Sound and intentionally engaging more diverse stakeholders across sectors, disciplines and geographies from community-based organizations to the private sector. The Emerald Alliance is centered on the vision that healthy, intact landscapes = healthy people, a healthy economy and livable, equitable and resilient communities. ■

Key Resources: Regional Open Space Conservation Plan, June 2018, Puget Sound Regional Council, Seattle, WA. (<http://www.psrc.org/open-space>)

Tracy Stanton is the founding Executive Director of the Emerald Alliance for People, Nature and Community, a new regional collaborative alliance, funded, incubated and fiscally sponsored by the Bullitt Foundation. Tracy brings 20+ years of experience in environmental policy and conservation finance strategies which included work in Executive Education at the University of Maryland, her alma matter, and with the Ecosystem Marketplace. **Contact:** Tracy@emeraldalliancenw.org

FEATURE

The Healthy Watersheds Consortium Grant Program

Jeff Lerner

The Healthy Watersheds Consortium Grant Program is designed to accelerate strategic protection of healthy, freshwater ecosystems and their watersheds. A straightforward and cost-effective strategy to retain watershed health has been to permanently protect intact watershed lands using land protection tools like conservation easements or maintain them through stewardship. With protection as the essence of the Healthy Watersheds Consortium Grant Program, a watershed approach and bringing new and collaborative financing tools into the preservation equation moves the effort to a meaningful scale.

Watershed Protection on the Rise

The Healthy Watersheds Consortium (HWC) was conceived by the Environmental Protection Agency (EPA) and is funded and managed by the U.S. Endowment for Forestry and Communities in partnership with the EPA and the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS). The HWC premise is that it is cheaper to proactively protect healthy watershed lands than to restore them after degradation. HWC focuses on accelerating the protection of watershed lands that are still in relatively good condition to conserve working lands and prevent nonpoint source pollution.

Work by the World Resources Institute (WRI) and Bonneville Environmental

Foundation (BEF) helped shape the HWC and the activities it supports. Research on watershed protection by WRI outlines several success factors, which together can lead to effective programs. Factors include clear threats and opportunities; effective partnerships; a shared vision of success; champions and advocates; outreach and education; science-based plan(s); capacity and social infrastructure; business case for investment; and financing mechanisms at scale. BEF has supported watershed-based initiatives in the Pacific Northwest. Their experience reveals that improving and maintaining watershed health is a long-term endeavor. Long-term capacity support to partners across a watershed can be an essential and cost-effective ingredient.

Most successful HWC proposals have large visions for watershed protection, which cover thousands of acres of watershed lands to be conserved over time horizons of 25–50 years. Recipients have also identified key hurdles to achieving success factors that they will work on as part of their grants.

HWC supports activities which lead to permanent land protection through acquisition and easements or stewardship of land that is already protected and in good condition. Grants can: 1) develop funding mechanisms, plans, policies, or strategies to implement large-scale watershed or source water protection or green infrastructure objectives; 2) build the sustainable organizational infrastructure, social support, and long-term funding commitments necessary to implement large-scale protection of healthy watersheds; and 3) support innovative or catalytic projects that may accelerate funding for or implementation of watershed protection efforts, or broadly

advance this field of practice.

Demand for the program is high. Since the first grant cycle in 2016, the HWC has received 367 proposals requesting \$80 million. The program has awarded \$10 million to 56 projects in watersheds across the U.S. including Alaska and Hawaii. Grantee projects receiving HWC funding have conserved over 240,000 acres of land to date and expect to conserve 500,000 acres and over 700 miles of stream by the end of 2021. The potential exists to impact millions of acres through these initiatives. An important feature of many projects are local staff who can engage with landowners and serve as a conduit to accessing conservation programs and funds.

CWSRF Sponsorship Program:

Ohio EPA reduces interest rates on infrastructure loans as an incentive and to include and fund smaller nonpoint source projects. Ohio has used this approach since 2000 and commits \$15 million each year split between protection and restoration projects.

HWC grantees such groups like the Chagrin River Watershed Partners (CRWP) and their partners regularly compete for these funds to help pay for projects as they work toward their protection goal of 320,000 acres and 2,800 miles of streams in their Cleveland area watershed.

Finding Conservation Finance Solutions

Adequate and consistent conservation finance is one of the largest obstacles these watershed efforts face. Several HWC projects are making progress toward solutions which may be replicable, scalable, and ultimately sustainable. Some

examples of HWC funded projects:

Complex Finance: In the Blue Creek watershed of the Klamath Basin in California, the Western Rivers Conservancy protected 47,000 acres of forest. The project used a variety of finance tools including New Market Tax Credits, a Clean Water State Revolving Fund (CWSRF) loan, carbon credits, state grants and other sources. The land is being transferred to the Yurok tribe who will manage part as a community forest and part as a salmon sanctuary. Long-term forest management in the area will create jobs while conserving important habitat, demonstrating multiple benefits of watershed protection. An HWC grant helped with the finance mechanisms for the project including training tribal staff on their use.

State Revolving Funds: Each state manages a CWSRF to fund loans for wastewater infrastructure. The program can also be used for nonpoint source pollution protection or restoration projects. CWSRF has many creative finance tools like sponsorship (see box) or principal forgiveness. It also requires 10% of funds to go to Green Projects. Each state also manages a Drinking Water SRF, which funds water supply infrastructure but can also protect source water areas.

Pennsylvania's Department of Conservation and Natural Resources is building a statewide forest conservation easement program with a short-term goal of 100,000 acres and a voluntary forest certification program. They worked with their SRF program (PennVest) and the Lyme Timber Company to secure two \$25 million SRF loans to protect 60,000 acres of working forests in the Chesapeake Bay watershed.

Private investors: WRI and Encourage Capital are working with Central Arkansas Water to unlock private capital for source water protection. By leveraging watershed fees and carbon finance to access Program Related Investments and green bonds, the partners plan to conserve 20,000 acres of privately-owned forest, which are source water areas adjacent to reservoir lands. The project is modeled on the newly-created Forest

Resilience Bond (FRB) for watershed stewardship on 15,000 acres of the Tahoe National Forest in California discussed in this issue.

Catawba-Wateree Watershed:

The Foothills Conservancy works with 18 water utilities to investigate the potential to build a local water fund for the expanding Charlotte, NC Metro area. A source water protection tool evaluates costs and benefits of watershed lands, their benefits and builds the case for utility investment. The Catawba-Wateree Clean Water Initiative's long-term protection goal is 50,000 acres with 10,000 acres protected since 2017.

Water utilities and local watershed funds: HWC has made grants to three local water utilities and HWC grantees are in active partnerships with over 30 utilities. In Maine, the Sebago Clean Waters Initiative is a partnership with the Portland Water District that seeks to protect 70,000 acres in the Sebago Lake watershed. The District contributes up to 25% of the cost of conservation easements.

In Florida, the Conservation Foundation of the Gulf Coast is working to finish protecting 7,000 acres in the Myakka River Conservation Corridor largely supported by local sources such as the Peace River Manasota Regional Water Supply Authority, Southwest Florida Water Management District, and Sarasota and Manatee Counties. In Michigan, The Huron River Watershed Council completed a millages toolkit to teach communities how they can generate revenue for local watershed protection and implementation of local green infrastructure plans.

Military installations: Development threatens not only watersheds but potentially also military training. Military installations, water utilities and other conservationists may ultimately want the same thing: a protected watershed sustainably managed in mostly natural or semi-natural condition. HWC supports watershed protection projects, which intersect with buffering military installations around Camp Ripley, MN; Ft.

Huachuca, AZ; Naval Air Station Patuxent River, MD and Camp Blanding, FL. These efforts make use of a variety of federal programs such as U.S. Forest Service Forest Legacy, U.S. Fish and Wildlife Service North Americans Wetlands Conservation Act (NAWCA), and/or NRCS Farm Bill Programs. The latter will include new source water protection funds discussed in this issue.

This AWRA *Water Resources IMPACT* issue also profiles additional HWC funded projects with strong conservation finance elements. Grants in Washington State support the Puget Sound Regional Council and Emerald Alliance to explore whether a regional government can plan for and execute large-scale watershed protection. In California, the Pacific Forest Trust is exploring how to fund seven million acres of watershed protection, stewardship and restoration in five key source water watersheds of Northern California using public and private capital investment.

Conclusion

The health of our nation's watersheds only seems to generate news and interest when there's a big problem, like the poor health of the Chesapeake Bay or the Great Lakes. By contrast, there are hundreds of watersheds around the country which are in very good condition but largely unprotected. Over time they will continue to be degraded piece by piece through our land use decisions unless concerted efforts are made to keep watersheds intact.

Watersheds themselves are part of our nation's water infrastructure. We should consider financing options for large scale watershed protection in the same way we

Camp Blanding:

The North Florida Land Trust protects lands in the Ocala to Osceola Wildlife (O2O) Corridor. These lands buffer Camp Blanding, conserve working forests, protect wildlife habitat and aquifer groundwater supply. The goal is to protect 140,000 acres by 2040 with 7,500 acres protected since 2017.

decide to invest significantly in traditional water infrastructure like treatment facilities, pipes, and dams. Both provide services to millions of Americans. When considered together, a blended approach of investing in both green and gray infrastructure would help prevent future problems and save on infrastructure costs. Large watershed visions, which will take time and require resources for many years to achieve, and resources for many years, lend themselves to large-scale financing solutions. The Healthy Watershed Consortium has helped connect financing tools with local capacity for watershed scale protection efforts to produce tangible results. ■

Jeff Lerner is a private consultant, with 25 years of experience in conservation program leadership, covering wildlife, forests, watersheds and urban areas, and who helps manage the Healthy Watersheds Consortium Grant Program on behalf of the U.S. Endowment for Forestry and Communities in conjunction with the EPA and USDA NRCS. **Contact:** jalanlerner@gmail.com

NOTICE OF BY-LAWS CHANGES

On November 2, 2019, the Board of Directors made the following substantive amendments to the Bylaws of the American Water Resources Association. This summary does not include formatting changes, spelling fixes, capitalization changes, or grammatical corrections.

1. Global change of position title from Executive Vice President (EVP) to Chief Executive Officer (CEO); no changes to duties or responsibilities are included in the title change.
2. Global changes to allow for electronic notification to members ("mail" has been updated to "mail/email", as well as posting some things to the Website).
3. Objectives updated to include water resources policy and management in areas of interest listed. [Article I, Section 2]
4. Definition of composition of the Executive Committee. [Article III, Section 3]
5. Better definition of the timeline for nominations and election to the Board of Directors. [Article III, Section 6]
6. Removal of the "Nomination by Petition" option; this has been replaced by a "Write-in option" on the ballot instead of being a separate weeks-long process. [Article III, Section 3.C (Ballots)]
7. Establish timeline for notification to Membership regarding proposed Bylaws changes. [Article VII, Section 2]

The following substantive amendment to the Bylaws of the American Water Resources Association will be considered at the January 2020 meeting of the Board of Directors.

1. Addition of a non-voting, Ex-Officio Board Position of Parliamentarian to the Board.
 - a. To be appointed and serve at the pleasure of the Association President after confirmation by the Board.
 - b. To advise on conformance of Board Actions as they relate to the By-Laws and Articles of Incorporation
 - c. To provide guidance on parliamentary procedures.

Dinner Meeting

American Water Resources Association-Washington Section Holds Dinner Meeting on August 15, 2019 in Seattle



Dr. Gretchen Greene

The American Water Resources Association-Washington Section hosted its August Dinner Meeting on August 15, 2019 at the Pyramid Alehouse Restaurant in Seattle. The speaker was Dr. Gretchen Greene from Greene Economics, who presented her research on "Stormwater Funding Challenges in Washington State." After working on a State legislature-sponsored statewide effort to estimate funding needs for stormwater infrastructure over 20 years (from 2017 to 2036) a couple of years ago, Dr. Greene and the economists from Greene Economics learned that though the funding need was vast, stormwater management held the promise of providing benefits to address a host of other critical water issues facing Washington State. The presentation included a review of the regulatory environment, innovative stormwater funding strategies in Washington State and elsewhere, and a discussion of current challenges and recommendations going forward. The event was attended by engineers, scientists, and representatives from different government agencies. ■



FEATURE

Critical Importance of Proper Policies and Regulations for Watershed Infrastructure Financing

Laurie Wayburn

Forests, Watersheds and Finance

A MAJOR CHALLENGE IN FOREST CONSERVATION

FINANCE the vast body of water that stretches north and west ois the availability of significant, consistent, monetizable values to pay for that conservation. Despite knowing forests provide essential, life sustaining services from climate mitigation to water supplies---we just have not paid for them. They have been the “free lunch”. Now, however, when forest water and climate services are desperately needed, that is changing. New “markets” are emerging to foster a new forest conservation financing future. The first step in this is developing policies that sustain consistent, scalable markets for the myriad essential services forests provide.

Water is perhaps the most tangible and compelling of these. While there is broad acknowledgement that forests provide essential water services, they are rarely monetizable in a way that would underpin the financing of a conservation transaction in a timely way. As such, funding and financing for forest watershed services has typically been insufficient, episodic, and uncoordinated. In contrast, built water infrastructure often receives large-scale and sustained funding in recognition of the public and private services it provides. A new approach is called for – one that goes beyond the traditional general obligation bond funding of “random acts of watershed conservation kindness”, one that manages and funds watersheds as the essential infrastructure they are.

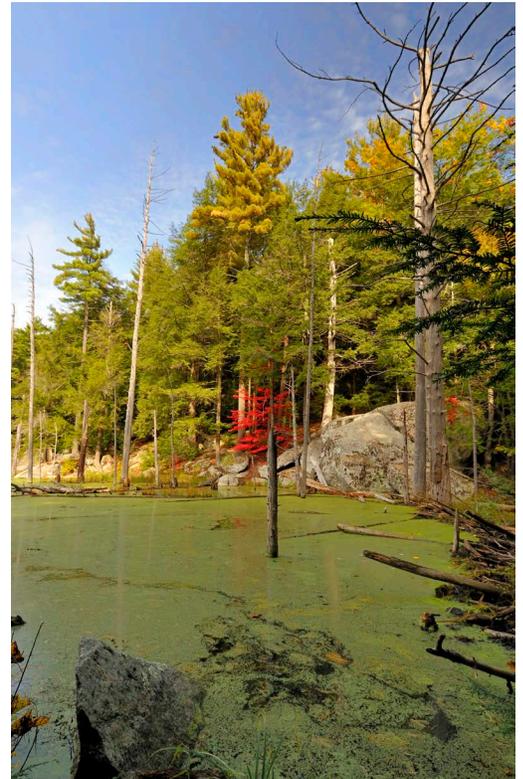
Traditionally, we protected watersheds - often after they have been damaged - by developing policies with new regulations and oversight agencies to protect those watershed values. Indeed, the founding motivation for the United States Forest Services (USFS) was the devastation wrought in New England’s forested watersheds from uncontrolled timber harvest, leading to steep declines in water quality and quantity. Various laws, both state and federal, have been passed to limit harvest to protect water supplies and quality. While these policies and actions help limit harm, they do not actively promote conservation or management for watershed health or function, per se.

Today, watershed condition is compromised for multiple reasons ranging from neglect to climate change, increased fragmentation and development pressure. Regulations and limits alone won’t solve these problems. Further, we need landowners to be directly rewarded for actively restoring and then maintaining watershed health. The scale of issues involved is beyond the scope of these traditional approaches

to watershed conservation. Whole watersheds can be large - up to millions of acres. The degradation is often severe, requiring years of sustained restoration. The need for water security is urgent, and action must be rapid. A new scale of financing - billions of dollars rather than millions - is required. It needs to be timely, reliable and long-term.

Further, a new approach to these actions, with comprehensive, integrated planning and implementation is also essential. A new scale of workforce, equipment, and permitting is required. Underpinning this is a need to apply infrastructure financing and systems thinking to watersheds, just as we do for the built infrastructure of dams, canals and pipes.

While there has been a tip of the hat to “green infrastructure” solutions in some of the increased attention to infrastructure financing, such as in the Water Infrastructure Finance and Innovation Act (WIFIA) or Water Infrastructure Improvements for the Nation (WIIN) Act, overall the focus is virtually exclusively on new built infrastructure. Actual investments in watersheds for water security lag or are non-existent. There is an old saying that those who do not learn from history are doomed to repeat it. And, as the New England precedent illustrates, if you don’t take care of your watersheds, you won’t have reliable water supplies. This was the motivation



New England algae covered lake
(Photo credit: Mike Cherim, iStock)

for developing new policies to level the financing playing field for forest watersheds in one of the most complicated, sophisticated, expensive and intensely fought over water systems in the world, California.

Addressing Watershed Policies

California recently passed a new policy formally incorporating watersheds into the state's water infrastructure and its water system. The state has long recognized that dams and other built infrastructure have to be maintained to have reliable function, and created a payment system to help finance construction, repair and maintenance of that built water infrastructure. Payments for repair and maintenance are made regardless of how much water is delivered in any given year to any given entity, as this is influenced by the water year and other limiting factors. AB2480, signed into law in the end of 2016, amended Water Code 108.5 to make it applicable to watersheds feeding the state water system. This law thus enables the repair and maintenance of those watersheds that feed the state water system to be financed the same way as the built infrastructure of the system. The law affects how watersheds are understood, planned for and managed—as essential infrastructure that is part of the water system rather than as “somebody else's problem”—and how their conservation and restoration can be financed.

AB2480 was constructed recognizing that watershed restoration and conservation management are typically simply costs for landowners. Therefore the actions that can be funded/financed under it are the typically non-commercial management that benefits watershed function: fuels reductions and prescribed burning, wet and dry meadow restoration, road removal and repair, stream channel restoration, and conservation, primarily through working lands conservation easements. These actions increase natural water capture and storage, reduce sedimentation, reduce flood and fire intensities, and maintain watershed integrity and function for the long-term.

California augmented this policy in 2018 through AB2551, codified as PRC §71365. PRC§71365 recognizes the most productive watersheds for the state water system— those that supply the Oroville and Shasta/Trinity reservoirs, as a distinct region needing conservation management. These watersheds are the backbone of the state's water supply for drinking and agricultural irrigation water, as well as providing the largely majority of freshwater to San Francisco Bay. This new policy called for comprehensive implementation planning in these key watersheds, development of a facilitated permitting process focused on restoration, and set up a fund account into which large scale, coordinated funding can be aggregated to fund this scale of work.

Effectively, this sets up a way to pay for forest watershed services, funding overall forest ecosystem function. This distinguishes, and complements, the approach of the forest carbon market – also pioneered in California – where a commodity market approach can support forest conservation financing. It also recognizes that the scale of up-front funding

needed—in the billions of dollars-- is really only available and cost-effective when funded as an infrastructure project. A “pay as you go” or “funding when times are good and we can pass a bond measure” are simply insufficient to adequately address



Shasta Dam in California (Photo credit: slobo, iStock)

the watershed maintenance needs.

The approach has some precedent, as seen with New York City's (NYC) watershed conservation and restoration efforts. Like California, NYC's watersheds are remote and have multiple owners and communities that benefit from the water. However, while NYC's action was driven by water quality requirements, California's water system is a filtered one, and the actions are in response to the need for water security and reliability. Investments in California's watersheds will have major benefits for increasing natural storage in wet meadows and groundwater, increasing inflow and timing of inflow to reservoirs, as well as reducing flood intensities when intense precipitation events can overwhelm dams. These watershed investments increase water availability when it is most needed (summer) and decrease it when it isn't needed as much (winter/spring runoff). There are major co-benefits of this work: sustainable resource employment in the northern part of the state where the water originates, reducing fire costs and impacts, enhancing adaptation, and contributing to solutions in the state's troubled Bay Delta ecosystem.

Montana recently passed a similar law, making watershed infrastructure explicitly a focus for financing, and Colorado is discussing the potential of this policy tool. While still in the early stages, these new policies should unlock significant new funding and financing for forest conservation while reducing risk, providing greater water security and protecting the myriad ecosystem services forests provide. ■

Laurie Wayburn co-founded the Pacific Forest Trust in 1993 with Connie Best and is Co-CEO and President. Laurie is a preeminent authority on the climate and ecosystem benefits of forests and works to unite conservation and sustainable management with market-based approaches.

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FEATURE

New Funding for Source Water Protection and Reducing Land-based Pollution: Farm Bill and WIFIA

G. Tracy Mehan, III

The new five-year Farm Bill and the Water Infrastructure Finance and Innovation Act of 2014 (WIFIA) are two important and significant funding opportunities to deal with land-based pollution, unregulated nonpoint or diffuse runoff, negatively impacting water quality and drinking water sources.

The Backstory

LAKE ERIE IN AUGUST 2014 suffered an algal bloom affecting the drinking water of 400,000 people. Lake Erie, along with the other Great Lakes, has been subject to regulation of its point source discharges, the traditional discrete pipe or conveyance of pollution, under the Clean Water Act for many decades. Yet, there, and across the nation, the most prominent uncontrolled sources of nitrogen and phosphorus are nonpoint sources, diffuse runoff from regulated urban stormwater and unregulated agricultural

stormwater. These agricultural nonpoint sources, with the exception of large, concentrated animal feeding operations (CAFOs), are unregulated under federal law. Moreover, they are unlikely to be regulated in the future given the breadth and reach of agricultural operations across the landscape.

Source Water Protection

It is helpful to understand how drinking water utilities approach their responsibility to provide safe, potable water under the Safe Drinking Water Act, beyond simply complying with its "end-of-pipe" regulations. Utilities seek to provide the public adequate quantities of high-quality water at affordable rates utilizing a "multiple barrier approach." This approach is comprised of: (1) selecting the highest-quality source water possible; (2) protecting the source; (3) treating the water; (4) maintaining quality in the distribution system; (5) monitoring quality at all of these stages; and (6) when necessary, if the other barriers fail, implementing emergency response procedures.

In terms of developing effective partnerships, say, with agricultural producers in their watersheds, utilities focus on "(2) protecting the source," or "source water protection"

"The primary objectives of SWP [Source Water Protection] programs are to maintain, safeguard, and/or improve the quality of a given water source...pollution prevention is often preferable to remediation or treatment of contaminated source water." The obvious benefits derived from this preventive approach include cost savings, increasing public health protection and, in the case of some land-based practices, generating other environmental benefits such as habitat and aesthetics. There are estimates that \$1 trillion is the price tag to repair and expand the country's drinking water infrastructure. Water utilities and communities are turning to a solution as old as our nation itself: protecting forested watersheds.

The six main elements of developing and implementing



Lake Erie pollution and algal bloom. (Photo credit: wilgory, iStock)

To better understand the need for water quality

a successful SWP program are a vision; stakeholder involvement; source water characterization; goals; an action plan; and periodic evaluation and revision of the program.

Farm Bill

Surveying the current situation, including the vibrancy of the U.S. Department of Agriculture's many and varied conservation programs available to the agricultural communities, the American Water Works Association (AWWA), as part of its Total Water Solutions initiative, has embarked on a sustained effort to reach out to the U.S. Department of Agriculture (USDA), Congress and the agricultural community at large to forge effective partnerships with the object of promoting SWP in watersheds and source areas benefiting from such collaborations.

An example is the, Beaver Water

program element in USDA during the current effort to reauthorize the Farm Bill. In addition to calling for funding for the conservation title to be maintained at current levels, or even increased, and that conservation policy gains from the Agricultural Act of 2014 be retained, AWWA advocated for an explicit emphasis on protecting source water to safeguard drinking, i.e., potable, water and public health; expanding opportunities for the NRCS to work with water systems to prioritize SWP activities in each state; increasing benefits for farmers who employ practices that benefit downstream water quality; and allocating at least 10 percent of conservation program funds be focused on the protection of drinking water. Furthermore, the Secretary of Agriculture should be authorized to work with drinking water utilities and State Technical Committees to identify local priority

programmatic emphasis at USDA and NRCS. Indeed, the administrative language to the bill's conservation title places an emphasis on source water protection for the entire title.

Another key feature of the bill is increased authorized funding for the RCPP to \$300 million a year along with some streamlining of program administrative processes.

Water Infrastructure Finance and Innovation Act of 2014 (WIFIA)

An entirely new opportunity to finance source water protection, at scale, again still untried, is the new federal loan and guarantee program authorized by the Water Infrastructure Finance and Innovation Act of 2014 or WIFIA which provides long-term, low-cost supplemental credit assistance for regionally or nationally significant projects covering or funding basically anything already allowed under both the Clean Water Act and Safe Drinking Water Act State Revolving Loan programs. WIFIA is run out of EPA headquarters.

Water and waste water utilities usually have a high credit rating and, collectively, the sector has only a 0.04 percent default rate. Given the leverage potential, this presents a great benefit to borrowers and the taxpayers. In terms of the ratio of infrastructure investment supported by WIFIA-49 percent of the project cost-to the amount of the congressional appropriations to cover subsidy costs, EPA staff estimates the current leverage ratio of the existing loan portfolio at 100-1! Here are a few more details on the program.

Eligible borrowers include local, state, tribal and federal government entities; partnerships and joint ventures; corporations and trusts; Clean Water and Safe Drinking Water Acts state revolving loan programs. Besides traditional gray infrastructure, the acquisition of property or easements if it is integral to the project or will mitigate environmental impacts-all these are eligible. EPA staff report that they would, for instance, consider a major project, say, to protect a headwaters forest as eligible as long



Sunset on the White River, Arkansas (Photo credit: Jenniveve84, iStock)

District (BWD) project in northwest Arkansas where BWD worked with its 13 partners to form the West Fork White River Watershed Project garnering more than \$8.5 million for conservation practices from 2016- 2021. Its \$1 million contribution has leveraged nearly nine times that amount including a Regional Conservation Partnership Program (RCPP) project from USDA.

Most notably was AWWA's efforts to incorporate SWP as a basic, organic

areas in each state.

In December 2018, a new five-year Farm Bill went into law containing virtually all of AWWA's requests to strengthen the protection of drinking water sources. H.R. 2, the Agriculture Improvement Act of 2018, will amount to an astonishing \$4 billion over 10 years to source water protection.

It makes source water protection a specific goal of conservation, effectively, a more formalized

as the borrower can handle the debt and loan terms and is competitive with other applicants in any given cycle.

Recall that, according to a 2008 report of the National Research Council, "the forests cycle water from precipitation through soil and ultimately deliver it as a streamflow that is used to supply nearly two-thirds of the clean water supply in the United States." Deforestation or forest fires threaten source waters, reservoirs and public health. So financing forest restoration or protection makes sense for utilities. It is no stretch of the imagination to envision doing something at watershed scale to deal with agricultural runoff in the source water area of a downstream drinking water utility including widespread implementation of management

practices such as saturated buffers and various end-of-field treatments.

While the minimum project size for *large* communities is \$20 million, it is only \$5 million for *small* communities with a population of 25,000 or less. The maximum portion of an eligible project to be funded by WIFIA is 49 percent. Repayment of the loan can be deferred 5 years after completion of the project, and 35 years is the maximum final maturity.

The challenge of dealing with source water or watershed protection at a scale necessary to remediate pollution from widespread row crop agricultural, forest fires, deforestation and the like requires commensurate financial resources. The new Farm Bill and WIFIA programs offer the opportunity to address land-based pollution.

There is much work to do, but the drinking water sector is committed to work with its partners in agriculture to do the right thing for farmers, ranchers, woodlot owners and utility customers in the quest for safe drinking water and public health. AWWA intends to engage with the entire range of agricultural partners both in Washington and, more importantly, across the country. ■

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Imagine a Day Without Water Draws National Attention

Lisa Beutler

I AM EVER GRATEFUL to live in place where I have potable tap water on demand. This is a luxury to most of the world and to far too many people in the United States. On October 23rd, AWRA, along with Olympian Michael Phelps, joined with 1,236 other celebrities and organizations (including many of our AWRA members), to promote a day of action titled "Imagine a Day Without Water." Sponsored by the US Water Alliance Value of Water Campaign, it was marked by social media messages, government Proclamations, editorials, tours of treatment plants and more. The goal of the day was to bring attention to the need for investment in water infrastructure and to highlight the frailty of many water systems.

After extensive research, the Water Alliance compiled tips to help water professionals communicate more effectively with the public about water investment needs. Following are their top eight ideas:

Messaging DOs

1. Draw parallels to other kinds of infrastructure that people can see (roads, bridges, etc.)
2. Detail the age and condition of the system
3. Focus on public health consequences of failing infrastructure
4. (Related to Item 3) Know how to talk about Flint as a validator of public health risks of neglecting infrastructure

Messaging DON'Ts

5. Assume the public has any working knowledge of water infrastructure
6. Point to the low cost of water as a rationale for investments in water infrastructure (this particularly relates to comparisons to things like milk or gas – as water is not as a comparable commodity)
7. Focus on natural disasters or climate change as a threat to water in inland communities
8. Stress direct job creation as a reason for infrastructure investment (while this might work for elected officials, it is not effective with the public)

Learn more about the Value of Campaign and the Imagine a Day Without Water activities at <http://thevalueofwater.org>. ■

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FEATURE

Financing Urban Resiliency by Capturing the Shared Benefits of Integrated Infrastructure

Lisa Beyer and Todd Gartner

CITIES ARE FACING IMMEASURABLE COSTS in addressing the current impacts of climate change and preparing for the expected consequences over the next 20+ years. With increasing intensity of storms, hotter temperatures, rising seas, and a level of uncertainty as to future conditions, communities are struggling to plan and finance infrastructure improvements that will mitigate and adapt.

How we use, reuse, and retrofit land will influence the long-term impacts and the resilience of our communities today. More than half of the world's population live in cities and urban population is above 80 percent in the United States, according to the UN Department of Economic and Social Affairs (2018). While the challenges are great, the opportunity for collaboration and innovation also thrives in urban areas where social interaction and connections beget creativity. By working together on multi-objective public infrastructure, cities can reinforce neighborhoods to soak up larger storms, connect people to place, and cool the public realm. New approaches to finance must be developed and implemented.

Bringing Nature Back into the City

This year marks the 50th anniversary of the Ian McHarg's seminal work *Design with Nature* (1969), where he argued that the role of nature is critical to the successful development of human landscapes. He taught us to look at the ecological processes in nature as the guide for healthy cities. We are now seeing a shift towards the use of nature-based solutions to manage stormwater, cool neighborhoods and mitigate air pollution. One reason is that trees and plants, our landscape infrastructure, are multi-functional, generating oxygen, sequestering carbon and other pollutants, shading streets and parks, providing homes for birds and critters, absorbing rainfall, slowing runoff, increasing mental health, and the list goes on. Green stormwater infrastructure and the urban forest are two nature-based approaches to improve our cities. As we now can quantify these benefits the finance value becomes clear.

Cities4Forests

Each of us relies on the powerful work of our global forests for clean air, clean water, climate mitigation and more, however, many do not see the connection between these benefits and trees, especially our far away forests. Cities4Forests (<https://cities4forests.com>), initiated in 2018 at the Climate Action Summit in San Francisco, is a movement to catalyze political, social, and economic support among city governments and urban residents to integrate the inner (such as city trees and urban parks), nearby (such as green corridors and watersheds), and faraway forests (such as tropical and boreal forests) into city development plans and programs and secure financing to protect, restore and

In the last decade, water utilities began to include green infrastructure as part of their stormwater management portfolio. For more than a hundred years prior, we have constructed elaborate networks of "hard" infrastructure: water, sewer and stormwater piping to distribute and collect these resources, energy systems to heat and cool our cities, streets and transit systems to move people and cargo. Rather than piping runoff to a treatment plant in a hidden network below our streets, cities are using green roofs, rain gardens, stormwater planters and bulbouts to manage rainfall where it lands. These green infrastructure tools utilize the plants, roots, and soil to naturally manage runoff with the added benefit of air quality improvement, traffic calming, and stress reduction from the incorporation of trees and plants in our streets, schools, and parks. Cisterns and rain barrels capture rainfall for reuse watering gardens and larger landscapes. Constructed wetlands create floodable areas upstream and can mitigate impacts from sea level rise and buffer neighborhoods from storm surges near our shorelines. Together these new infrastructure elements achieve utility goals and expand greening in our communities.

In addition to stormwater management and carbon sequestration, the urban forest reduces temperatures and cleans the air. Urban forests are the network of trees in city streets, open spaces and parks, and private properties. The urban canopy cools our communities by shading sidewalks and buildings. Trees improve air quality through the natural process of evapotranspiration where they absorb pollutants and release oxygen. The annual benefits derived from U.S. urban forests due to air pollution removal, carbon sequestration, and lowered building energy use and consequent altered power plant emissions are estimated at \$18.3 billion (Nowak and Greenfield, 2018). The ecosystem services provided by our urban forests help to regulate the climate and protect our air and water. Cities are using green infrastructure and urban forestry to tackle urban resiliency and are looking for new ways

manage these important resources. The 60 member cities from around the world share an aspiration to help reduce deforestation, restore forests (including more trees in cities), and manage forests more sustainably. The World Resources Institute, in partnership with a consulting firm Pilot Projects and a communications company, REVOLVE, provide technical assistance to align local policy, share knowledge and amplify current best practices, and facilitate peer-to-peer learning and communication activities in order to help cities take climate action together. By putting technical, financial, and science-based resources into the hands of governments and communities across the globe, this program raises awareness and secures protection of our forests, near and far.

to scale up these nature-based solutions.

Limitations of the Current Practices for Planning, Financing and Delivering Capital Projects

Our current model for public infrastructure implementation discourages cross sector collaboration. Cities are generally organized with individual departments responsible for providing various public services: planning, streets, parks, transit, utilities, housing, health and safety. This ensures that each of these services, critical to a functioning city, has dedicated staff accountable to the public for their provision. The flipside is that each of these objectives are planned, designed, built and operated separately, resulting in single purpose projects that don't achieve the co-benefits of integrated projects. Business as usual in municipal governance and project delivery is that each department issues bonds to pay for the benefits that they are responsible for delivering to the public. Communities experience this dysfunction when their block is under construction for utility improvements, then later for landscaping and traffic calming, and yet again for bicycle improvements.

Resilient infrastructure must be implemented at the district scale rather than a parcel or street corridor. Stormwater flooding, sea level rise, heat island effect and air pollution affect large sections of a city. The solutions require us to consider large-scale integrated projects that cross the jurisdictional boundaries of city departments. Coordinating development and operation of multi-objective projects can be an immense challenge that involves project teams from each department coming together to co-locate their services. City departments have their own budget cycles and schedules for financing capital improvements that often do not align with the other departments. It is also difficult to gain political and financing approval for these more complex resilient designs because the co-benefits beyond the project's traditional purpose, while desirable, are not fully quantified or valued in the capital project prioritization process of city departments.

Joint Benefits Authority for Urban Climate, Water and Equity Improvements

Nature-based infrastructure is a powerful tool that cities can use to retrofit existing systems into multi-purpose infrastructure, while addressing the goals of several city departments. By working together from the very beginning, in the initial planning and financing, through the design and implementation, cities will be able to pursue projects that manage stormwater, provide recreation and education opportunities, cool neighborhoods, increase biodiversity, address mobility, and expand housing.

City governments need a new way of collaborating internally on integrated solutions to build resilient infrastructure that benefits those communities most impacted today. The Joint Benefits Authority idea is a new mechanism that will allow departments within a city to jointly plan, implement and finance these types of transformative projects by quantifying the range of benefits that cross agency mandates. Integrated projects that involve our departments of streets, transit, parks, schools, and utilities could jointly finance these resilience efforts by bringing the value of their land/assets and capital dollars from their own budgets.

The World Resources Institute (WRI), in collaboration with

the financial advisory firm Encourage Capital, is partnering with cities in western US to develop and pilot a Joint Benefits Authority that capitalizes on the shared benefits of integrated infrastructure solutions. This effort is part of the Cities4Forests program (see Box 1) focused on the inner forests, our urban forests.

Singapore Case

In Singapore, a successful partnership to build integrated infrastructure resulted in a revitalized neighborhood when the Public Utilities Board (national water agency) and the National Parks Board (parks agency) worked together to reimagine an underutilized park space that was divided from the neighboring public housing by a concrete drainage channel (Figure 1).

"The Kallang River-Bishan Park project is a new vision for blue-green city infrastructure which addresses the dual needs of water supply and flood management while creating spaces for people and nature in the city." (Ramboll Studio Dreiseitl, 2012) At a cost of 75 million SGD to construct in 2009, the project is estimated to provide 105 million SGD in benefits annually.



Figure 1. Bishan-Ang Mo Kio Park (Singapore) was delivered by a partnership between the Parks Department and the Water Agency. Source: Pagodashophouse on Wikimedia Commons [CC BY-SA 3.0 (<https://creativecommons.org>)]

The Challenge

The challenge ahead is to provide cities with a successful mechanism for departments to collectively envision, plan, finance, build and operate resilient infrastructure. There is urgency for work to begin adapting our existing public infrastructure to new climate conditions today and the changes anticipated in the next few decades. These public needs cross sector boundaries and necessitate bringing partners in government, non-profits, and the public together using a new approach. The opportunity for cities to reimagine a resilient future could be realized by working together on large-scale integrated nature-based solutions that bring multiple benefits to communities and strengthen neighborhoods. ■

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FEATURE

Financing Watershed Health with the Forest Resiliency Bond

Nathalie Woolworth and Phil Saska

IN NORTHERN CALIFORNIA'S NORTH YUBA RIVER

watershed, where dry conditions, overgrown forests, and dead trees increasingly define the landscape, the threat of catastrophic wildfire looms large. The Tahoe National Forest, the primary land manager in North Yuba, supplies and filters water that flows to an array of downstream users, including the water/hydroelectric utility and flood control district Yuba Water Agency (YWA). As climate change aggravates drought conditions across the watershed, wildfire risk has more than doubled, causing the U.S. Department of Agriculture's Forest Service (Forest Service) and YWA to consider new pathways to mitigate risk. In North Yuba these non-traditional partners have come together around a project that employs an innovative finance model – the Forest Resilience Bond (FRB) – to finance the upfront costs of unfunded Forest Service work to restore forest health and reduce wildfire risk using low-cost private capital.

Fire Risk: The Challenge and Solution

While Forest Service modeling estimates the risk of catastrophic wildfire over the next 30 years to be as high as 60% in parts of the North Yuba watershed, a fire event of any size could have major ramifications on the water supply flowing from the Tahoe National Forest. Woody debris and ash resulting from a fire could settle in reservoirs, clogging YWA's hydroelectric generation and conveyance system. The potential for post-fire flooding could exacerbate these issues. Beyond water resources, a wildfire could put lives, property, and habitat at risk, damage local recreation and forest-based economies, and incur significant suppression costs for resource-constrained land managers and public agencies.

To mitigate the risk of large-scale wildfire in North Yuba, the Tahoe National Forest has planned projects that rely on an array of proven treatments to improve forest health and resilience. The treatments employed, broadly termed "forest restoration," focus on the ecological thinning of small diameter trees and removal of dead and excess vegetation using methods like mechanical thinning and prescribed burning. The goal is to reduce the hazardous fuel loads that grow and sustain large-scale fires, while also restoring overall forest health.

Financing Watershed Restoration with the Forest Resilience Bond

While proven solutions have been identified, and in many cases forest restoration projects have been planned and

permitted, the Forest Service's funding limitations constrain the pace at which these projects can be carried out on the Tahoe National Forest and beyond. With an estimated 58 million acres in need of restoration nationwide, Forest Service appropriations do not come close to funding restoration need across National Forest System lands; in California alone, the agency estimates there to be a 30-year backlog of unfunded restoration work. In addition, the annual nature of funding cycles slows the pace at which work can be undertaken and completed. This puts communities, forests, and other human and natural resources at risk.

The FRB, an innovative finance tool developed by Blue Forest Conservation in partnership with World Resources Institute and Encourage Capital, addresses this funding challenge directly. This model enables investor capital to cover the upfront cost of already-planned work to restore forest health, and brings together stakeholders that benefit from healthy forests to repay investors over time. These beneficiaries sign contracts that jointly cover the project cost plus a modest return to investors, meaning that no one stakeholder shoulders the burden of repayment alone.

Piloting the Forest Resilience Bond in the North Yuba River Watershed

In the fall of 2018 Blue Forest Conservation launched its first FRB project in the North Yuba River watershed after working closely with the Tahoe National Forest to identify a planned, NEPA-approved restoration project that lacked funding to move forward. The FRB tool accelerates the pace at which the Tahoe National Forest can implement already-planned projects, and provides stakeholders like YWA who also benefit from healthy forests with a way to share the cost of restoration.

For its inaugural pilot Blue Forest raised \$4 million in private capital through the FRB to fund mechanical thinning, prescribed burning, aspen regeneration, and meadow restoration treatments that reduce wildfire risk across 15,000 acres of the watershed. Four investors – the Rockefeller Foundation, Gordon & Betty Moore Foundation, Calvert Impact Capital, and CSAA Insurance – each provided \$1 million to cover the upfront cost of the project. The Yuba project enjoys different types of support from four project beneficiaries, including the Forest Service, the Sierra Nevada Conservancy, CAL FIRE, and the Yuba Water Agency. As project activities are implemented, funds from beneficiaries will repay the two foundations with a 1% return, and the two market rate investors with a 4% return. The Tahoe National Forest provides support

through in-kind contributions associated with project planning and permitting. The National Forest Foundation manages the implementation of treatment activities on the ground.

Work on the North Yuba project (Figure 1) began just two weeks after the FRB deal closed on November 1, 2018. While early snowfall halted progress on implementation just a week later, ecological thinning was completed on 40 acres in 2018. Midway through the 2019 field season implementation remains on budget and on track to be completed within a three to four year timeframe, less than half the time required to complete similar projects relying on Forest Service appropriations.

Benefits to the North Yuba River Watershed

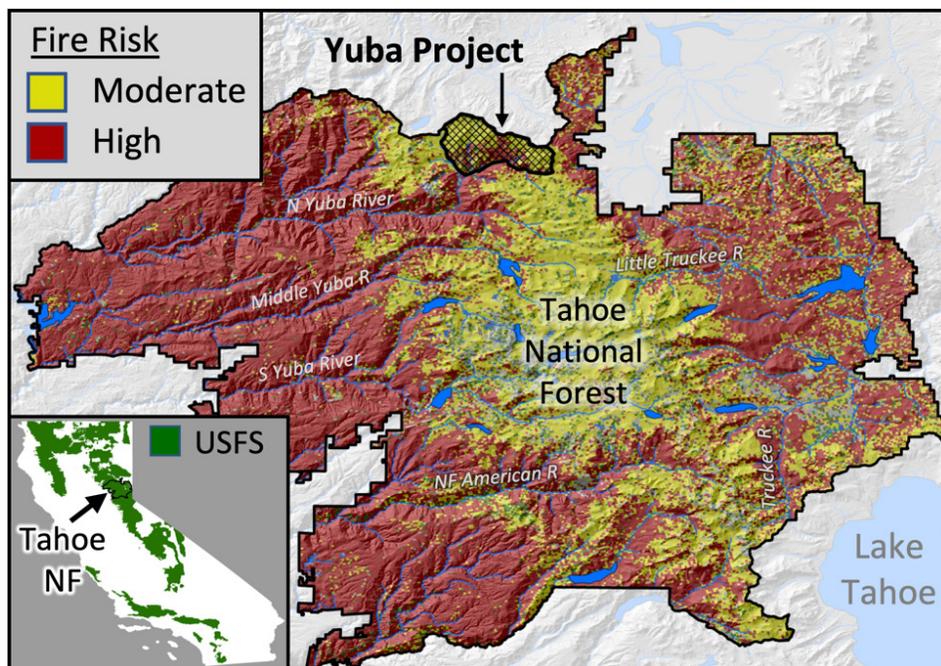


Figure 1. North Yuba Project and Surrounding Area

Along with research partners at Stanford’s Natural Capital Project and Water in the West, and the University of California Merced’s Sierra Nevada Research Institute, Blue Forest is tracking, and where possible quantifying, the many benefits associated with implementing the North Yuba project.

Reducing fire risk in North Yuba through FRB-funded work protects homes, lives, and infrastructure, and avoids costs related to fire suppression and post-fire rehabilitation. Using data collected on costs associated with large-scale fires in other areas, Blue Forest estimates the present day value of avoiding catastrophic wildfire in North Yuba over the next 30 years to be a minimum of \$25 million.

Blue Forest and its partners have also quantified expected increases in water flow to downstream users, a critical benefit for YWA. Using satellite-based vegetation monitoring that estimates changes in forest evapotranspiration, the research team estimates a projected 20%-30% reduction in vegetation from thinning treatments will increase stream flow volumes by more than 1,000-acre feet in year one – equivalent to water

supply for 1,300 households and an additional 1,150 MWh of hydropower. While gains in water quantity will decrease over time as vegetation regrows, Blue Forest expects the quantity increases to persist for a decade or more following implementation. Changes in water quantity will be tracked during and after implementation, using satellite-based monitoring to verify project outcomes.

In addition to these quantifiable benefits, avoiding wildfire in North Yuba also protects water quality by preventing sedimentation and woody debris from accruing in water supplies and reservoirs. Proactively reducing wildfire risk can save utilities, in this case YWA, the heightened costs of

infrastructure replacement as well as heavy operational expenditures following a catastrophic wildfire. Implementation of the North Yuba project will also enhance wildlife habitat and recreation opportunities, support jobs and economic opportunity in rural communities, and avoid the large carbon emissions associated with extreme wildfire.

Perhaps most importantly, this project brings together non-traditional partners like the Tahoe National Forest and YWA, stakeholders with similar goals around forest health, to collaborate in new ways and share in the costs and benefits of watershed management for planned projects that might otherwise remain on the shelf. In fact, since the North Yuba FRB was finalized, another partnership effort has come together with a goal of planning and implementing restoration across the entire 241,000 acre North Yuba watershed over the next 20 years.

This is the increase in pace and scale of forest restoration Blue Forest hoped the FRB would catalyze to address wildfire risk at a landscape scale. ■

Nathalie Woolworth is National Partnership Coordinator at the USDA Forest Service and holds a joint position between the Forest Service and partner Blue Forest Conservation, the designers of the Forest Resilience Bond (FRB). Nathalie works to implement pilot projects that employ conservation finance models on National Forest System lands, and to grow capacity for conservation finance across the USDA Forest Service.

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FEATURE

Water Quality Trading is the Sleeper of the Conservation Finance World. Here's How to Wake It Up.

Genevieve Bennett, Kristiana Teague Witherill, and Jan Cassin

WATER QUALITY TRADING IS A PERENNIAL

underperformer compared to other environmental markets and financing strategies – which is surprising. Trading is a flexible instrument that allows participants to find the most cost-effective strategies for clean water. Often, land-use improvements or ecological restorations have strong business cases compared to traditional engineered water quality solutions. In those instances, trading results in extra benefits in the form of biodiversity conservation, carbon sequestration, improved air quality, healthier soils, or more beautiful, livable communities. Given all of this, and the scale of water quality problems in the United States – more than half of assessed rivers and streams in the country are impaired– you'd expect interest in trading to be high.

But relative to other environmental markets, water quality trading remains small potatoes. An estimated \$40-45 million in credits is transacted every year in the United States, compared to \$3.5 billion in wetland and stream mitigation credits sold annually, \$354 million in species/habitat offsets, or the \$63 million-a-year California market for forest and land-use carbon offsets. Today, about 60 water quality trading programs are in place. Yet most are very small or only intermittently active.

In general, we find robust water quality trading where 1) a strong regulatory driver exists, such as numeric nutrient criteria; 2) it is otherwise very expensive or difficult to meet compliance; and 3) regulated entities know they have support from regulators to pursue trading. A fourth factor is also common, although harder to measure: utilities and other buyers engaging in trading usually have a champion inside their organization willing to go to bat for this approach.

Today, the largest programs are in Chesapeake Bay watersheds in Virginia and Pennsylvania, in North Carolina, and in Connecticut's Long Island Sound. Elsewhere, markets are often "thin," with low or volatile levels of trading. Many trading programs struggle with high

transaction costs, inadequate regulatory drivers, or buyer perceptions (real or otherwise) that trading is too risky.

The Demand is Out There

Last year, the National Network on Water Quality Trading (NNWQT) and Forest Trends' Ecosystem Marketplace undertook an assessment to get a clearer picture of trading's potential for scale in the United States, and barriers standing in the way. We interviewed more than 50 stakeholders, evaluated lessons learned from other environmental markets, and mapped potential demand. The results have informed an

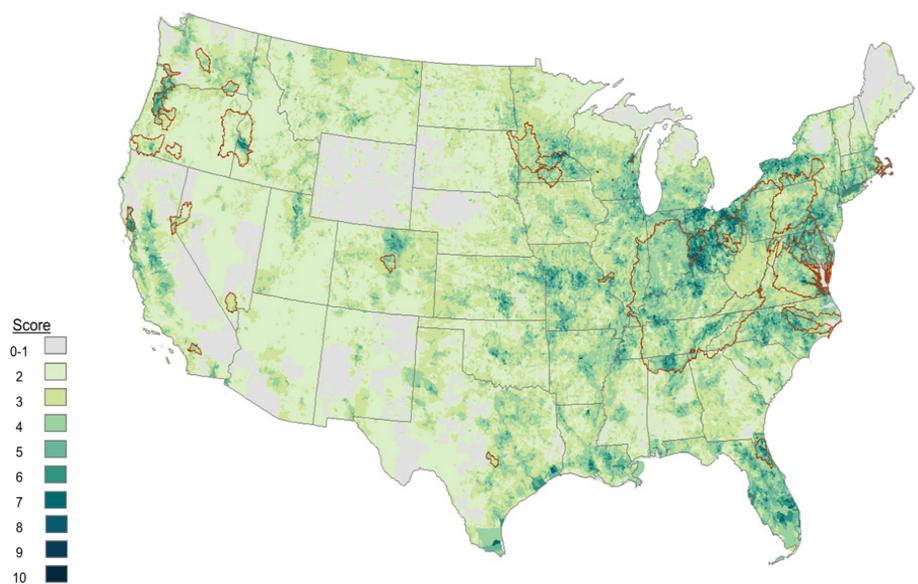


Figure 1. Potential Demand for Water Quality Trading in the United States, and Active and Developing Trading Programs as of 2018. [Higher score indicates greater demand for agricultural water quality trading credits.]

Note: This map indicates potential demand for agricultural water quality credits. A master score of potential demand was developed by building three submodels summarizing biophysical, economic, and policy/regulatory indicators of demand at the 12-digit HUC level. We normalized and combined these submodels to create master indices for demand potential for agricultural water quality trading and stormwater trading. For a similar map of stormwater trading potential, and a detailed explanation of methodology, please see: Bennett, G. and M. Gallant (2018). Mapping Potential Demand for Water Quality Trading in the United States. Forest Trends Association: Washington, DC. <http://bit.ly/35aG44j>

action agenda for scaling up water quality trading.

To evaluate prospective demand for trading, we mapped known biophysical, economic, and regulatory drivers. The results suggest clearly that the problem is not a lack of potential demand (Figure 1).

Beyond basins where trading is already being pursued

(including Chesapeake Bay Basin states, North Carolina, the Willamette Valley, the Ohio River Basin, and Boise), analysis indicated that strong potential also exists in areas including Sacramento, Akron, Cleveland, Toledo, Buffalo, Lexington, Fort Collins, Kansas City, and major cities in Florida and along the Gulf Coast, including Houston and Lafayette.

Similarly, although only one metropolitan area in the country has an active stormwater trading market in place (Washington DC), dozens of other cities could be candidates, including the greater New York City area, Rochester, Syracuse, Ithaca, Providence, greater Chicago, Green Bay, Coeur d'Alene, Fort Collins, St. Louis, Lexington, Chattanooga, greater Charlotte, Durham, Memphis, Birmingham, Mobile, New Orleans, and most of Florida's major cities.

Unlocking Demand for Trading

NNWQT and Forest Trends have proposed a broad national agenda, summarized below.

1. Simplify water quality trading program design and application.

For the utilities, municipal governments, agricultural producers, regulators, environmental groups, and practitioners involved, trading is often just too heavy a technical and/or administrative lift. We need a simpler, more predictable process for building programs.

Sometimes, "trading" itself can be simplified. Alternative delivery mechanisms, including pay-for-performance procurement contracts, in-lieu fee programs, nonpoint source incentive payments, or revolving funds might be a better fit. All share DNA with trading – in the sense of marketing quantified water quality improvements – but may be administratively simpler or more appealing to buyers.

2. Ensure state regulatory agencies have adequate capacity and resources to engage on water quality trading.

Regulators have the ability to fundamentally shape demand. This is particularly true for water quality trading, where trading program rules and market infrastructure are developed at the state or local level and vary from each other substantially. We need to ensure that regulators have the necessary funding and capacity to support trading.

At the same time, buyers need to ask regulatory agencies for a trading option. Without expressed interest, it is difficult for regulatory agencies to allocate resources.

3. Clarify each administration's and the US Environmental Protection Agency (US EPA)'s position on water quality trading.

Our agenda was released in October 2018. Encouragingly, the US EPA Office of Water issued a policy memo in February 2019 declaring strong federal-level support for water quality trading.

Additional steps US EPA could take include updating its 2003 trading policy, or formally integrating trading into Clean Water Act programs through legislation or rulemaking.

4. Actively address real and perceived risks for buyers.

Trading has its risks, but they are consistent with the risks associated with engineered infrastructure: the project (whether an agricultural BMP or a new pipe) might underperform or fail, regulatory drivers might change, or contracted services may not meet expectations. Yet it seems that permittees are still more comfortable mitigating for risks associated with traditional engineered treatment solutions, and leery of trading. We need to demystify trading for buyers, and address the question of risk head-on.

5. Identify and address risks of litigation.

One absolutely real risk associated with trading is the threat of legal challenges. Documenting potential risks of litigation and preparing responses could help build stronger, more defensible programs.

6. Create guidance on trading for stormwater.

Municipalities across the country are already experimenting with markets for stormwater retention. Developing national guidance for stormwater trading can help interested parties assess feasibility.

7. Build stakeholder relationships and trust.

Trading programs requires strong relationships and communication between many stakeholders, some of whom may have a contentious history with one another. Trust and good working relationships require an investment of time and effort at both local and national levels.

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Genevieve Bennett is Director of Communications at Forest Trends. She has nearly a decade of experience in analyzing in environmental markets and finance, and has written extensively for Forest Trends' Ecosystem Marketplace as well as trade and academic publications including *Environmental Finance*, *Civil Engineering*, and *Nature* on topics including biodiversity finance, natural infrastructure, eco-entrepreneurship, strategies for scaling public and private conservation investments, and other market cross-cutting issues.

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WEBINAR: Dealing with Complex
Water Systems: Deceiving Modeling
Assumptions and Misleading Policies

SPEAKER

Kaveh Madani
Henry Hart Rice Senior Fellow
Yale University

December 11 | 1-2 PM ET

WEBINAR: Troubled Water: What's
Wrong with the Water We Drink?

SPEAKER

Seth M. Siegel
Entrepreneur
Water Activist and Author

FEATURE

Interview with Jessica Fox – “Let’s See What We Can Get Done”

Lisa Beutler and Patrick Coady with Justin Sauble

Jessica Fox is a Sr. Technical Executive at the Electric Power Research Institute (EPRI), where she leads efforts on water quality trading, ecosystem services, sustainability, biodiversity conservation, and the business case for conservation. Ms. Fox is a pioneer in environmental credit markets, including: water quality, biodiversity, wetlands and carbon. She is creator and manager of EPRI’s Ohio River Basin Water Quality Trading Project, the world’s first interstate trading program for nutrients (<http://wqt.epri.com>).

THE PROJECT HAS ADDRESSED CRITICAL SOCIAL, scientific and economic issues, and has become a model around the world.

EPRI’s Water Quality Trading Program

An excess of nutrients, primarily nitrogen and phosphorus from agricultural systems, are having serious impacts on ecosystems and waterways throughout the world. Water quality trading is an innovative market-based approach to achieving water quality goals through programs that allow permitted dischargers to purchase nutrient reductions from another source. Control costs for any one nutrient can differ from one emitter to another, and water quality trading provides an option for meeting discharge requirements in a cost-effective manner. No laws or regulations require industries or landowners to participate in water quality trading programs. The incentive to participate is based on the likelihood that credit sellers will receive attractive financial benefits and that permitted dischargers will have the flexibility to cost-effectively meet their environmental permit requirements.

See <http://wqt.epri.com> for more information on the Ohio River Basin Water Quality Trading Project. Informational videos are here: <http://bit.ly/30ZesMI>.

Her work focuses on compelling businesses to consider the ecosystem in day-to-day corporate decision making. Ms. Fox’s background consists of species conservation genetics, sustainable agriculture, human genome sequencing and mapping, invasive weed management, threatened and endangered species recovery, and comprehensive watershed conservation. This technical foundation, combined with communication skills, team building, conflict resolution, and fundraising provides a foundation for solving complex

challenges that span environmental, social, and economic spheres.

One theme of this issue of *Water Resources IMPACT* is that every watershed needs a “champion.” Eighteen years ago, Fox was recruited by EPRI following the completion of her Master of Science degree from Stanford University. While working in the belly of one of the most environmentally challenged industries was not her plan, she still accepted the job. Times were interesting: power company managers were generally male and “mature” (i.e. over 50); the industry was coming off historic rolling blackouts that led to deregulation; the international scientific community was beginning to rally around irrefutable evidence of anthropogenic causes of climate change. Demographics and paradigms would certainly prove challenging, but she liked the idea of working directly with companies who had the immediate ability to change how natural resources were managed. Usually the youngest in the room, and often the only woman, Fox continually advocated for a conservation mindset that could be integrated into business models and overall philosophy. In a sphere that needed help considering the perspective of the ecosystem, she became the voice of biodiversity and water.

“Trust and Authenticity” Based On Something Real

A bedrock belief of Jessica’s is that progress and results are built on trust and authenticity. But trust and authenticity, Jessica points out, happen only when the people involved know that you understand their needs and perspectives, and that you will create a path forward that considers them. When a project aligns with the core values of everyone involved AND the people trust the leader, a lot of hard times can be navigated. Staff, employees, executives, farmers and others must be confident that other parties involved will have the best interest of a project in mind, and that the project leader will take into account the needs of all the people. Defining the shared vision of the effort is critical and can anchor large groups of people to stay focused on the end goal, versus the immediate decision. Even when everyone doesn’t get their ideal “win” today, if they understand how the decisions are made and they fundamentally trust the authenticity of the leader, real things can get done.

More Than Leadership Training - A Leader’s Instinct

Jessica talked a lot about the value of emotional intelligence as being integral to leadership. She believes it is important to be able to understand where people are coming from and how they feel at specific moments. She talked about a number of occasions when she walked into a meeting and knew something was off. What’s important, she notes, is knowing how to react or switch gears. At a pivotal conference in Ohio, amidst an

audience representing 88 counties in Ohio, she was invited to discuss the possibility of a water trading program. The room was very quiet. The spokesperson in the room said to Jessica, "We don't want your program here in Ohio." Jessica responded, "Okay. We don't have to do it in Ohio. But before I leave, I'd really like to understand your concerns." Just 45 minutes later, the program was moving forward.

About five years into in her job as a project manager at EPRI, Jessica was tested for her leadership qualities using the classic Zenger Folkman Extraordinary Leader 360 peer review survey. After being judged by 35 colleagues across 15 leadership qualities, HR called her in to say, "Jessica, we have some concerns over the results of your leadership survey." Holding steady, Jessica responded. "Okay, what is the concern?" Her peers rated her as displaying 13 of 15 leadership qualities; the Zenger Folkman methodology suggests you need only five to have potential as a great leader. She recalls a very personal and candid conversation with the skillful HR manager who told her she was a natural leader. "Jessica," she asked, "What do you want to do? What are your plans? We want to support you." This created a new challenge for Jessica . . . she was going to have to step up and accept her skin as a leader.

From the School of Hard Knocks to Stanford University

Jessica grew up in Palo Alto in a small apartment that later became affordable housing for low-income families. Working hard in every aspect of her life, she developed a get-it-done attitude that would remain with her to date. Scraping money together to submit a college application to the University of California-Davis, she began her academic journey and was accepted into the challenging pre-med program. Being an animal lover and frequent lost-dog-rescuer, she chose UC-Davis because it was the best veterinarian school in the country. But she changed gears as her sympathies for the Earth, water, and species developed, and she longed to work on conservation issues that had global reach. After graduating, she studied tropical biology in Costa Rica, worked at the Bureau of Land Management, mapped genes as part of the Human Genome Project, joined a biotech start-up company, and then set her eyes on Stanford for graduate school. She applied to only one school. When she wasn't accepted, she took coins to an aging pay phone outside the biotech start-up company where she had become a manager, calling Stanford Admissions. "I'd really like to attend Stanford," she explained. "What can I do next time to improve my chances for the next application period?" She was admitted the following week.

Grit & Commitment

At her core, Jessica is a happy introvert, much preferring to sit at the library studying. In her mind she is clearly desirous of turning over the reins, and doesn't fundamentally need to be the face of projects. But, she admits to believing progress has been made as a direct result of the amount of time she, herself, has spent on projects. But she continues to be interested in mentoring others, as she has benefited greatly from generous mentors in her own life. Upon arriving at Stanford, Jessica was inspired and later mentored by Gretchen Daily, author of *The New Economy of Nature*, which in many minds was the start of this era of conservation finance. The conservation field has a tradition of passing the baton and Jessica is always the first to

support the new kids on the block, especially during the weeks that you have no extra time to spare.

Moving forward often means not looking back. For Jessica, a setback is an opportunity to turn the corner. It is the opportunity to figure out what wasn't working in order to find the right path forward. She points out the value in being trained as a conflict mediator. "Once you are trained, you just sit and wait for the conflict to arise so that you can use your skills! You are not scared anymore because you know you can handle it." One event still troubles her though. On the cusp of an extremely important meeting, she received a threatening letter from an environmental group. She had to add security protection to the upcoming meeting and worried about moving forward. Nothing more came of the threat, but the incident left a scar. In her best form, Jessica reached out to the environmental group. They refused to meet.

"Finally," Jessica suggests, "when all else fails, nothing is working and you are out of ideas, go for a run! Get that blood flowing and get away from your office. Even if you don't come up with a new idea, at least you got some exercise and fresh air."

Looking ahead, Jessica has started a national "Power-in-Pollinators" initiative. EPRI is leading progressive pollinator research by leveraging participation to collaboratively build tools, metrics, and communication resources. Launched in October 2017, it is already the largest program of its kind.

We suspect it all started with "Let's see what we can get done." ■

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Lisa Beutler is Senior Principal, Water at Stantec helping organizations and communities make decisions and plan for the future. Her professional background, covering more than 35 years, includes organizational development, law enforcement, natural resources, and experience in local and State government. Lisa specializes in collaborative strategic planning and directing a water management portfolio. She is president of the American Water Resources Association. **Contact:** lisa.beutler@stantec.com

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Scientific Policy and Decision-Making Require an Investment in People, Process and Institutions

David L. Wegner

Scientists and water experts occupy a very small percentage of the global population yet provide critically important knowledge and information in making local, national and global science policy and decisions. It is imperative that we use our accumulated knowledge and experiences to foster both the use of science and encouraging future scientists to engage and participate.

Developing the next generation of scientific leaders that can effectively address policy and decision-making takes commitment and a plan. Over 40 years of working with scientists, policy and decision-makers have led me to define several parameters that are important in getting science noticed. While there are many factors, I believe there are five key ones that will enhance supporting scientists and the ultimate use of science:

1. creating an **opportunity** for science;
 2. exhibiting a passion and commitment to **science**;
 3. developing **scientific capacity**;
 4. **communication**, and
 5. **strategic implementation**.
- Individually each of these five elements are important in supporting scientific development and when combined they produce a synergy of energy that can assist developing scientists to reach their full potential.

My objective is to outline these factors and provide scientists with an understanding on how to be effective,

relevant and heard in the scientific education, policy and decision-making arenas.

Factor 1. Creating Opportunities

Since the 1990s a global wave of interconnected knowledge has supported an expanding world economy with increased activity, growth and structural changes. Governments in many parts of the developing world view science and technology as integral to economic growth and development. Many countries are developing knowledge-intensive economies in which research, its commercial utilization, and intellectual property play foundational roles. Creating opportunities within the academic environment is a critical first step.

The challenges facing the globe from extreme weather events, climate change, environmental and engineering challenges, and an expanding population requires an intellectual workforce that is rigorously trained and has the capacity to integrate, network, leverage and synergize their knowledge.

Globally the United States leads in the traditional science and technology areas. However as global opportunities have opened over the last 20 years, the rest of the world science and technology capabilities are expanding and catching up. The rapid ascent of international science is driven by developments and investments by China, other Asian countries and the EU. They are manifesting this through the expansion of and increased access to higher education and development of world-class research, science and technology infrastructures.

Changing Academic Landscape. A 2015 report by UNESCO concluded, based on 2013 data, that there are slightly over 8 million Full Time Equivalent scientists globally. That represents about 0.11% of

the global population. Of the 8 million full-time international scientists, approximately 72% of them are employed in China, the European Union, Japan, Russia Federation, and the USA.

Academically there are currently 4,298 degree-granting post-secondary institutions in the US (2017-2018). Of these academic institutions, approximately 38% are public, 39% are private non-profit, and 23% are private-for profit. Since 2010 the number of colleges in the US has been declining. This is largely due to diminishing institution financial support, decreases in enrollment, lack of availability of student financial aid, and an overall declining birthrate.

In comparison, in 2017, China had 2,914 colleges and universities, and according to the BBC and Forbes, is increasing the number of universities at the rate of one per week. According to World Economic Forum in 2016 China led the world with Science, Technology, Engineering and Mathematics (STEM) graduates at 4.7 million while India was second at 2.6 million and the U.S. third at 568,000. Forbes also reports that India led the world in college graduates with 78.0 million, China second with 77.7 million and the U.S. was third with 67.4 million. The takeaway from these numbers is that to sustain our scientific leadership we need to attract and graduate more students in STEM related programs. Scientific advancement can only occur if we keep filling the knowledge bucket.

Funding of research is changing. Historically federal funds have been provided through the National Science Foundation and a plethora of federal agencies. Overall the Global Gross Expenditure on Research and Development (GERD) grew by 30.5% from 2007 to 2013, largely driven by private sector investment in research and

development. In the United States, private industry now funds 67% of all research and development. In the European Union private industry funding ranges from 70% in Germany to 45% in the United Kingdom. In Asia industry funding is over 60%.

Investments are being made around the globe to develop the scientific workforce needed for knowledge-based economies. The trend to more private industry investment in research and development is helping to maintain the United States' position in the global research arena. The reduction in federal funding to academic institutions is resulting in a reduction in landscape and innovative science that is important for developing public policy and for decision-making. Are private firms as likely to share their intellectual property for the betterment of public policy or will they want to focus on creating a return on their investment for stockholders? The current debates with social media, drug and energy companies gives a good indication that their sharing of knowledge will not occur quickly.

Factor 2. Passion and Commitment to Science

Inquisitive and curious minds need to be nurtured and supported. Several conditions have been shown to be important to young people in science – their access to learning, their early learning rate and the environment in which they live. From the building blocks of interest, the attitude to learn and the environment in which they develop learning skills provide the stepping stones to their scientific future. Developing a passion and commitment to science synergizes the opportunity that academic study provides and lights the scientific mind.

Our role as educators, mentors and leaders in science can either enhance or diminish the enthusiasm of developing minds. A small percentage of interested young people will be the prodigies that don't require stimulation, but in most cases that will not be true. The challenge is, how do we guide these young minds into the proper lanes of learning?

I was lucky. I was raised in a medical and science environment where doctors and researchers took the time to talk and show me the interesting side of science. My defining science moment came from a short-wave radio call from my uncle

stationed at the South Pole during the International Geophysical Year (1957-1958). There, scientists from all over the world gathered to collect scientific data and explore the integration of the physical and biological connections of the earth. My uncle's description of the work scientists were doing at the South Pole ignited a passion to learn about the earth and how science policy provided the road map for implementation.

We all have stories. Some may be more personal than others, but the important thing is we show people that we care about our chosen path in science. With only 0.11% of scientists making up the global population we must do everything we can to stimulate the next generation. Our enthusiasm and stories for science is what engages people. Once engaged, the education process can support and leverage their abilities.

Factor 3. Developing Scientific Capacity

The third major component in the equation for science mentorship is developing **scientific capacity** and the transfer of knowledge into policy and decision-making. Several key elements can help make science value-added to decision and policy making.

1. Developing knowledge-based approaches on issues. Let the data and scientific analysis provide the basis for discussion.
2. Identifying issues and options at national, regional and local levels. Identify if the issue is single or multiple purpose. Use terminology that will be heard and understood, not ignored.
3. Constantly educating committee staff, Congressional members, and decision-makers in agencies. Develop and hone your message so that it is free of acronyms and tells a story.
4. Translating your science so that it connects with an issue of importance to the decision-maker. Make it relevant. Do your homework.
5. Creating and maintaining a constituency. Network with those who will validate your analysis and support the scientific process.

6. Follow-up, follow-up, follow-up. Assist those who make a difference by helping to connect the dots on why and how your research matters.

There are many challenges facing our global community. In the US federal government alone, there are 26 agencies that have water in their mission statements. Aside from the obvious gathering and use of basic water data from the USGS and NOAA, a limited exchange of information exists between the federal water agencies. This "siloed" approach works for bureaucratic reasons but is poor for scientific exchange. In this era of complex and interconnected issues, we cannot afford to limit our range of inquiry to single issues. We need to synergize and leverage.

Factor 4. Communication

Communication is probably one of the more difficult activities that scientists must undertake yet is one of the most important arts we can learn to improve policy and decision making. Science is only useful as input for decision and policy makers when it is presented to them in factual and understandable language. They need to understand its relevance and value to the issue.

The importance of science and science communication in developing public policy has evolved in the United States. The first comprehensive federal effort to embrace science and policy took place in March 1863 when President Abraham Lincoln, who was occupied with the Civil War, took time to work with Congress and get the National Academy of Sciences authorized and funded. The role of the NAS remains today, to help the Nation make better decisions based on science. Following the Civil War, President Ulysses S. Grant's administration supported four western surveys of the United States to gather information to make national policies for the expansion of the nation west. The Wheeler (1869-1871, Hayden (1871), Powell (1869-1872) and the King (1867-1872) expeditions all looked at different areas and resources of the West and envisioned a much different approach to land and water settlement and use.

Major John Wesley Powell, who went on to become the Director of the U.S.

Geological Survey (USGS), communicated and advocated for a different approach to water management in the West, one based on river basins and federal oversight of watersheds and development of water resources. The importance of river basin management was embraced for the short-lived National Water Commission (1968-1973) and Federal Water Resources Council (1965-1983). Both programs began with communicating the objective to implement a national water assessment and water policy reform. Lack of funding and developing a constituency in Congress limited their ability to implement national coordination.

Today scientific communication on water and energy policy is more important than ever. Scientists must develop the appropriate communication tools that allow their message to be understood and interpreted correctly by legislators, decision-makers, stakeholder groups and the public.

Factor 5. Scientific Implementation

Each of us has a unique and valuable role in the scientific community. The importance of the role science and scientists play in shaping and making decisions and policy becomes all that more important when assessing the issues of climate change and water management. Our roles in the development and mentoring of future scientists who will be making future decisions, should evolve along a continuum of implementation.

Professional Support. As professionals in the water sector we all have responsibilities to help mentor and develop the next generation of decision-makers. Individually we must fight the ivory tower syndrome and ensure that our science and expertise is communicated and made available to the broader scientific community. This means we must publish, speak, and distribute the information in appropriate venues and forums.

Education. As educators we are on the front line for guiding the development of the next generation of scientists. It is our responsibility to teach the scientific process, to develop and implement knowledge-based approaches to inquiry, and we need to ensure that transparency and rigor that supports scientific credibility is embraced at all levels. Science be

championed, supported and protected at all levels of government.

Scientific Implementation. Good scientific policy does not just happen. It requires rigorous thinking and dialogue, debate, review, assessment and communication. Getting scientific policy that will provide the stepping stones to better decision-making and application requires continued vigilance and application. While it has been the traditional approach to let the data speak for itself, that has had varying levels of success in the formulation of science policy. Today in the social media world we live in, multiple digital and communication platforms exist to make sure your science is accurate, understandable, known and accessible.

Summary – You are the 0.1% Factor

Recently former Secretary of Energy, Dr. Ernest Moniz wrote in a *Science* magazine editorial that to address our climate and energy challenges we need to implement an innovation agenda. I would agree and add that this innovation agenda must be based on good science policy. Dr. Moniz wrote that there is bipartisan and global support for increasing the scale and scope of investments in technology, science and research. We need to implement innovative scientific and engineering approaches on multiple levels to navigate successfully the pathway to the future.

The adequacy of the U.S. science and engineering workforce has been an ongoing concern of Congress for more than 60 years. Scientists and engineers are essential to U.S. technological leadership, innovation, manufacturing, and services vital to our economic strength, security, and societal needs. In 2016 there were a combined 6.9 million scientists and engineers employed in the U.S., approximately 4.9% of total U.S. employment. The cycle of success that allowed the United States to develop global leadership in science and technology has long been fueled by research universities and the diverse student assemblage they attract. Academic institutions provide the creative environment for developing fundamental knowledge in science and engineering upon which the next generation of professors, scientists, technologists, and entrepreneurs will emerge.

Unfortunately, current funding in grants for young scientists is diminishing and according to several national associations is trending towards safe, risk-adverse projects and a reduction in discretionary funding. Our Nation's science leadership should continue our history of stimulating innovation and scientific inquiry.

Good public science and engineering policy does not just happen. It results from a combination of academic, entrepreneurial, and industry input supported by individuals and leaders in decision-making roles. To ensure public scientific policy is based on knowledge, it requires

1. creating opportunities for knowledge enhancement by supporting both applied and theoretical work;
2. passing on our passion for science to encourage the next generation of scientists;
3. continuously develop and expand our capacity of knowledge by synergizing and leveraging our knowledge with other disciplines and with decision/policy-makers;
4. embrace the need to communicate our knowledge to those who need it, and finally;
5. continue to expand our strategic implementation roles to nurture the next generation of scientists, engineers, agencies and policy makers. ■

David L. Wegner is retired from a senior staff position on the Natural Resources and Transportation & Infrastructure Committees in the U.S. House of Representatives. There, he worked on legislation that directly affected administration policy and federal agency actions related to the U.S. Army Corps of Engineers, the Departments of the Interior and Energy, the Environmental Protection Agency, Bonneville Power and Tennessee Valley Authority. He worked for over 20 years for the Department of the Interior managing water and science programs in the Colorado River basin and the Grand Canyon. He is currently on the Water Science and Technology Board of the National Academy of Sciences. The opinions expressed herein are his and his alone.
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WHAT'S UP WITH WATER?

Filling the World with the Spoils of Modern "Civilization"

Eric J. Fitch

Mr. McGuire: I just want to say one word to you. Just one word.

Benjamin: Yes, sir.

Mr. McGuire: Are you listening?

Benjamin: Yes, I am.

Mr. McGuire: Plastics.

Benjamin: Exactly how do you mean?

Mr. McGuire: There's a great future in plastics. Think about it.

Will you think about it?

- Dialogue from "The Graduate" Academy Award Winning Film, 1967

And God blessed them; and God said to them, "Be fruitful and multiply, and fill the earth, and subdue it; and have dominion over the fish of the sea, and over the fowl of the heavens, and over every animal that moves on the earth". Genesis 1:28

IN 1967, SCIENCE MAGAZINE (Issue 155: pp. 1203-1207) published a relatively short article by historian Lynn White entitled "The Historical Roots of our Ecological Crisis". This article laid the modern environmental crisis on the back of mainstream Christianity, and Roman Catholicism in particular. The argument revolved around the ideas that Christianity shaped Western culture and that interpretation of concepts in the Book of Genesis instructed humankind to "fill the Earth and subdue it". It helped to establish historical and theological analysis of what has come to be called "Dominion" theology. This one article generated a cottage industry of articles and collections across the spectrum of agreement, disagree and analysis across disciplines. There was not general disagreement that the interpretation of this passage of scripture did empower many adherents to treat Creation as the possession of humankind to do with as they will. Unfortunately, part of that "as they will" was to use all the biosphere as a waste dump. White did also point out the fact that there was an alternative Catholic Christian worldview

that advocated treating Nature as a co-creation which humankind had a responsibility to shepherd/steward as best expressed in the writings of St. Francis of Assisi.

From the Middle Ages until relatively recently, the Dominion concept has held sway and the natural world regarded as here for human use as we willed. This led to White's writing on the ecological/environmental crisis of which we became aware on a broad scale in the 1960s. Under the multidisciplinary, interdisciplinary umbrella of environmental science we have come to see that human activity and its negative impacts have touched literally every portion of the biosphere with impacts which often are irreversible, irretrievable and resistant to the passage of time.

In the post-World War II period, the United States, followed by the recovering world, reaped the benefits of discoveries/innovations in the emerging field of chemical engineering. Building on techniques developed to overcome problems in supply of critical war-making materials and supporting an ever growing human population, these modern day

alchemists took raw chemical feedstock from petroleum, natural gas, and other natural treasures and reshaped them into molecules, compounds and ever more elaborate syntheses to provide thousands of new materials to feed our material culture and populations. In the movie *The Graduate* the young protagonist Ben, just out of college, receives a sage bit of advice on what he should pursue as a career: "Plastics". This was a field to go into which would provide Ben with a surefire successful career and an income to support him, his bride-to-be and the family they were sure to have. Looking back over the 50+ years this movie has been out, plastics look less like the alchemy of turning base materials into gold of the legend of the Philosopher's Stone and more like Pandora's Box. Plastics, although delivering on many of their original promises have become one more scourge mankind has used to beat down Mother Nature.

In my youth, some teachers and other members of society held the view that Mother Nature (this was before the term biosphere was common parlance) was too big for us to permanently impact and that the "environmentalism" was an unscientific fad. "The solution to pollution is dilution" or "Ma Nature will clean up after us." Many foolishly thought that water pollution was mainly a problem of enclosed bodies such as rivers, streams and small lakes that with the passage of time would filter out debris and even toxins. Society gravely underestimated our ability to damage the biosphere and today we uncover knowledge of the extent of that destruction on a daily basis.

A recent report by the group Oceana highlights (lowlights?) the extent of plastic pollution in the oceans of the world. Best current estimates indicate a staggering 17.6 billion pounds of plastic goes from land-based sources into the oceans every year. Plastics don't go

away; they just break down into smaller and smaller particles. Many of these microplastics work their way into food webs and some are bioactive in nature.

Once upon a time, we thought that recycling would be a remedy to the problem of plastic pollution. The reality is that only 9 percent of plastics are recycled. Plastics permeate our freshwater and saltwater systems. It is estimated that there are 40,000 pieces of plastic floating in every square kilometer of ocean. Plastic densities in freshwater systems are variable, but the presence

is clear and growing. Studies by the Helmholtz Center for Environmental Research estimate that rivers collectively dump between 0.47 and 2.75 million metric tons of plastic into the seas every year. Ten major river systems are responsible for 93% of plastic trash into the oceans: the Yangtze, Yellow, Hai, Pearl, Amur, Mekong, Indus and Ganges in Asia and the Nile and Niger in Africa. Environmental controls in Europe and North America reduces the amount of plastics that reach aquatic systems but they are not perfect.

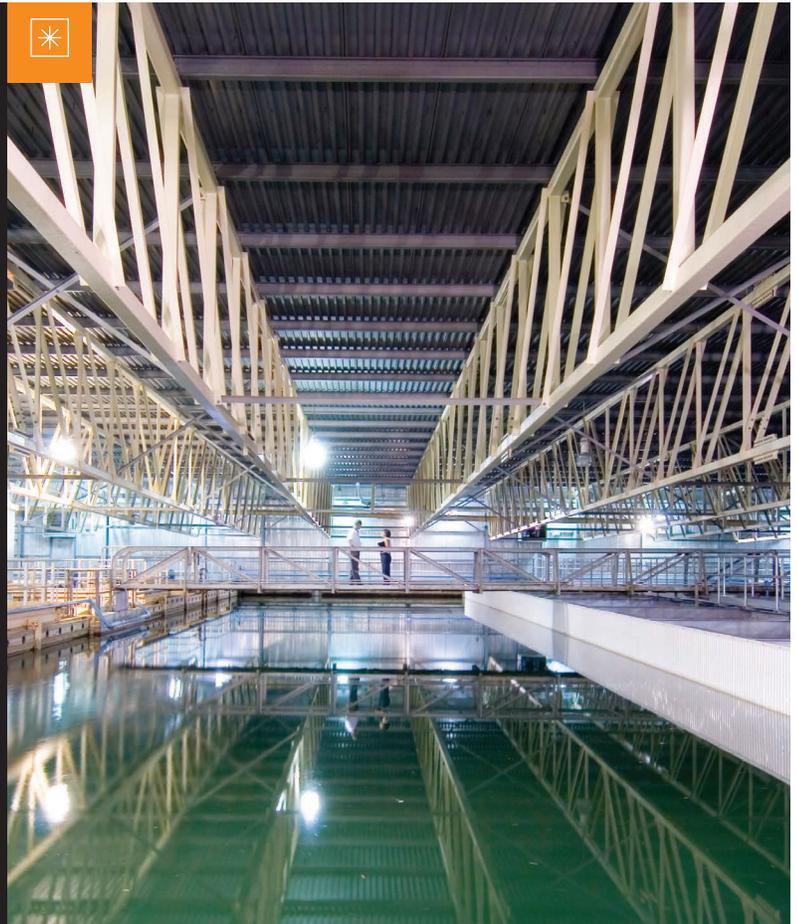
Through the vehicle of plastic pollution humankind has literally filled not only the corners of the land, but have also impacted every portion of the world's oceans and the life therein. Plastics, which were once envisioned as a modern scientific miracle, are now the source of environmental problems and impacts undreamed of in the post-WWII period. Now the challenge is to move from the Dominion perspective to the Stewardship perspective. ■

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The Power of an AWRA Conference

Jillian Young

SITTING ON A PLANE, I WAS REFLECTING on the past year with a new perspective as I realized how much things had changed. One year ago, I was a second-year master's student at the University of Delaware (UD) working as a Research Assistant for the UD Water Resources Center, and in the midst of completing my thesis. I was fortunate enough to attend the 2018 AWRA Conference in Baltimore, MD, but even more fortunate to have made some pretty influential connections.

One of the most beneficial aspects of the Annual AWRA Conference is the opportunity for students to have their questions answered. They can talk to a wide range of professionals or other students and get the answers they are looking for. The conference never gives off an overwhelming feel, instead it offers an open environment that makes one comfortable enough to approach any presenter, professional, or student.

AWRA makes it easy for students to network with professionals. There are luncheons, networking sessions, and a job- and-resume board. It was thanks to all of these networking opportunities that I met Jamil Ibrahim, my current supervisor. Jamil saw my resume posted and told me about Stantec. I knew that my interest was piqued; what I didn't know was that lying on the other end of that interest was my dream job.

I had always dreamed of moving West. I received both my bachelor's and my master's degrees from universities located on the East Coast, and before the conference in 2018, I had certainly never thought about a career in consulting. I always thought my career path would take me into the government or non-profit sectors. One of the most advantageous parts about conferences, specifically AWRA, is that they present students with the opportunity to see almost every single career path related to water. Not only can students hear about it, but they can talk to a multitude of professionals and receive feedback. I was a second-year master's student, who thought they knew the path they were destined to walk, but after that conference I saw that path change direction. My dream started to look more like an attainable goal. With Stantec now on my radar, a litany of new doors had opened for me and I happily found myself on a new path. While it was through Stantec that my dream became a reality, it's important to note here that this dream would still be in the "possibility" corner of my mind without the AWRA Conference and the networking opportunities it provided. I truly believe that I am where I am today—in both my career and my new home base in sunny California—because of the AWRA Conference.

Fast forward to the plane ride; it was there that I realized that for the first time, I would be attending a conference as an employee, not a student. I also realized that new dream came with a responsibility. Conferences are a place for the students' talent to shine, and I feel as though the professionals that are

present at these events have an obligation to recognize the talent that could be brought into our field.

At the 2019 AWRA Conference, I was able to speak with students and provide perspectives on the school to job career transition. A standout moment at the conference was observing how my education and newly Water Resources Planner role have molded together. I was able to make connections during sessions, such as Integrated Regional Watershed Management, and obtain knowledge that I can now use in my career.

We need to continuously grow and change because our climate and our world continues to grow and change. The water resources field needs to stay ahead of the curve in this respect which is why recognizing up and coming talent is so important. If I had to provide advice to students attending a conference, I would tell them to have a focus or goal, yet be open-minded to who you might talk to. Hear all possibilities before disregarding one and know that having a focus will lead to a successful conference.

Now, as a Water Resources Planner living in Sacramento, CA, who gets to work on projects that positively affect California's water and people, I look back at the door that was opened one year ago and the new path that was laid before me because of the 2018 AWRA Conference. I am so thankful for the opportunities I've earned through conferences and the professionals who have supported me along the way. It is an exciting time for students, both current and newly graduated. There has never been a greater need for more scientists to help combat the challenges that our planet's water faces than right now. ■

A recent master's degree graduate from the University of Delaware, **Jillian Young** is a Water Sources Planner at Stantec, in Sacramento, California. For more information, contact: jillian.young@stantec.com

AWRA 2019 Awards

This is the 55th year AWRA has recognized individuals, organizations, projects, state sections, and student chapters for outstanding leadership and service in the water resources profession. Following is more about the awards and this year's winners.

WILLIAM R. BOGCESS AWARD

Recognizes the author of a paper published in the Journal of the American Water Resources Association (JAWRA) during the preceding year, which best describes, delineates, or analyzes a major problem or aspect of water resources from either a theoretical, applied, or philosophical standpoint.

Presented for the paper entitled "Connectivity of streams and wetlands to downstream waters: an integrated systems framework," published in the October 2018 issue. Lead Author, **Scott Leibowitz**, US EPA's Center for Public Health and Environmental Assessment, Co-Authors, **Laurie Alexander, Heather Golden, Katie Schofield, Melanie Vanderhoof**, and **Parker Wigington**.

DAVID R. MAIDMENT AWARD

Recognizes Exemplary Contributions to Water Resources Data and presented to an individual or institution achieving a status of eminence in some aspect of the provision of data describing the Nation's waters.

Presented for a lifetime of accomplishment to **Jim Nelson**, Brigham Young University. Dr. Nelson has made exceptional contributions to the advancement of Water Resources Data around the world, pioneering scientific and global collaboration through the GEO Global Water Sustainability Initiative (GEOGloWS), and in open sharing of Earth Observation (EO) data.

IVAN JOHNSON AWARD FOR YOUNG PROFESSIONALS

Recognizes and encourages young professionals as the future leaders of water resources research, management, and education.

Presented to **Dr. Robert (Rob) B. Sowby**, Hansen, Allen & Luce, Inc. Ever since age eight, when he accompanied a humanitarian expedition to Mexico to construct a pipeline from a mountain spring to a small village, has been dedicated to advancing sustainable water supply. Dr. Sowby is now a sought-after expert in the planning, modeling, and energy management of public water systems.

MARY H. MARSH MEDAL FOR EXEMPLARY CONTRIBUTIONS

Recognizes an individual who has achieved a status of eminence in some aspect of public service related to water resources education and/or management. The individual chosen for this award must be one whose record of achievements in setting, designing, influencing, and/or implementing water-related policies, practices, or programs at the national, state, or local government level is extraordinary.

This year's awardee is **Anthony (Tony) Willardson**, Executive Director, Western States Water Council. Tony has been an active participant in AWRA activities for many years, supporting the Association's Policy Dialogues, conferences, workshops, publications, and technical efforts. Tony has educated lawmakers, advocated for scientific investments needed to support water-related decision-making, provided well-researched materials to his network of colleagues, and facilitated/supported critical data sets and publications.

N. EARL SPANGENBERG OUTSTANDING STUDENT CHAPTER AWARD

The Outstanding Student Chapter Award is awarded to the Chapter that demonstrates excellent leadership in multidisciplinary water resources education and activities at the university level.

The recipient of the 2019 for the 4th time in the last five years is the **University of Delaware**. AWRA has 27 student chapters and continually works with colleges and universities around the United States to start these amazing initiatives.

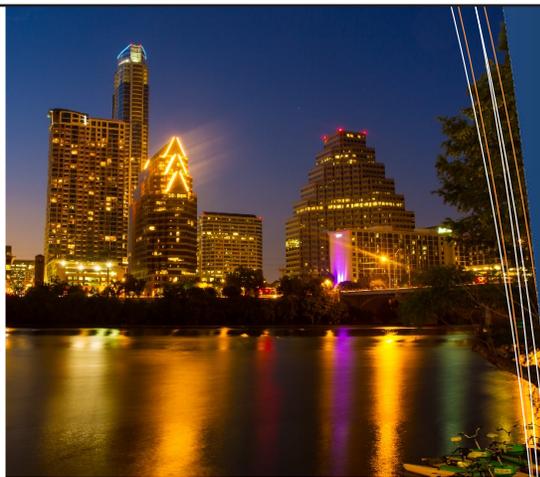
STATE SECTION AWARD

Recognizes the State Section which has provided outstanding service and leadership in accomplishing the mission and vision of AWRA.

This year, AWRA recognizes the **Florida AWRA State Section**, through its variety of activities, outreach to young professionals, and professional development and information exchange program throughout the Florida and the region

**MARCH 23-26, 2020
AUSTIN, TX**

2020 SPRING CONFERENCE
Geospatial Water Technology
Conference: Complex Systems.
Tribute to David Maidment



**NOVEMBER 9-12, 2020
ORLANDO, FL**

2020 ANNUAL WATER
RESOURCES CONFERENCE



DENVER, CO

2021 SUMMER CONFERENCE
Land and Water: Policy,
Planning and Management



AMERICAN
WATER RESOURCES
ASSOCIATION

SAVE THE DATES

Upcoming Conferences