American Water Resources Association
Washington Section
www.waawra.org
MARCH-APRIL

President's Notes

By Tyler Jantzen, P.E., CH2M Hill, AWRA-WA President

Having just celebrated the spring equinox, and now enjoying the added hour of light in the evening, I doubt I am alone in reflecting on the anomalous winter we just had here in Washington. Everywhere I go, I hear people talking about it – on the bus, at work, family gatherings, and even at my son's daycare. I imagine that most of you, as water resource professionals, have had similar conversations.

If you're like me, you spent much of the early winter with your head in the sand (because there was no snow to stick it in), thinking "maybe NEXT month will bring snow". Even the State Climatologist stoked my hopes, with a report on the historical March snow in Washington lowlands. However, with spring here, and most state ski resorts limiting hours and lifts (or closing up shop entirely), it is time to face the facts.

On March 13, Governor Inslee declared drought in three state regions in an effort to jump-start preparations for what is almost assuredly to be a water stressed summer for some parts of the state. As of March 23, the snow water equivalent in the Cascades and Olympics ranged from 5 percent to 45 percent, and averaging 26 percent of normal across the state.

Even the relatively normal pack in the Upper Columbia basin is only three quarters of normal. And despite hopes for improving conditions, the three month climate outlook calls for warmer than normal temperatures and normal to below normal precipitation.

So, are we experiencing climate change? One season does not indicate a trend, but it certainly adds to the wide body of evidence that our climate is changing.

Perhaps Amy Snover, director of the Climate Impacts Group at the University of Washington, said it best during her interview with KUOW : "this is the kind of year that all climate models tell us to expect…the future looks like this".

This all leads to my shameless plug for the AWRA-WA annual conference, which this year will focus on the intersection of climate change and water management in Washington. Keep your eyes out for an official announcement and save-the-date.

Who knows, maybe we could still get a big snow fall early this spring. But if we don't, it's a good thing we are talking and acting to best manage the limited water resources we have.

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The AWRA Washington Section Annual Conference East Coming!
April 9, 2015

This Year's Topic:

Rural Water Availability

Including a Tour of the Spokane County Water Reclamation Facility

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Collaborative Modeling in the Spokane River Basin: Engaging Stakeholders to Explore Basin-wide Water Management Strategies

By Melanie Thornton, Washington State University PhD Candidate, Student Fellowship Winner

Introduction

Water issues are among the most controversial, crucial and sensitive issues that face communities and governments today. Water resources planning and management is inherently challenging due to the uncertain and intricate nature of human and natural resource systems and conflicting interests of regional stakeholders. In the Spokane River Basin, management of the Spokane Valley Rathdrum Prairie (SVRP) aquifer and Spokane River is complex because of interstate, multi-jurisdictional responsibilities and the dynamic interaction between groundwater and surface water. Issues related to climate change and water resources cannot be understood from a single disciplinary perspective, thus collaboration among water resource decision makers and stakeholders with a vested interest in water resources is essential for addressing regional water resource management alternatives.

Collaboration brings together diverse perspectives through which problems and solutions may be discussed, which is important for finding consensus-based solutions to complex water resources issues. By integrating the principles of water resource modeling with collaborative public processes, decision makers can foster informed, meaningful dialogue on integrated management of shared water resources in the Spokane River Basin. A process that engages stakeholders from both Washington and Idaho may facilitate identifying mutually beneficial and acceptable water management strategies. Additionally, a more inclusive approach may promote stakeholder consensus by enhancing the legitimacy of management decisions. A collaborative modeling framework that engages stakeholders has the greatest potential to develop recommendations for a basin-wide, collaborative water management plan that integrate diverse knowledge forms, and address regional water resource needs and interests of stakeholders.

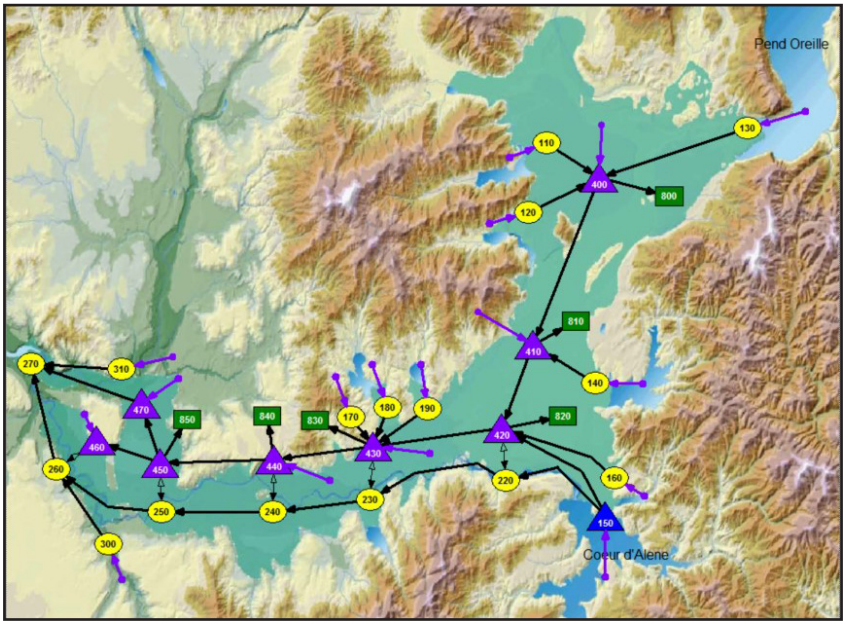

Figure 1. Spokane River Basin OASIS schematic. Each node is numbered for reference in the model code. Purple triange nodes that represent groundwater reservoirs. Yellow circle nodes represent groundwater inputs. Green square nodes represent groundwater withdrawals.

This project aims to utilize a collaborative modeling process to develop a tool, the Spokane River Basin (SRB) OASIS model, to explore basin-wide management strategies with stakeholders in the region. Collaborative modeling brings a variety of stakeholders that have a vested interest in water resources together to talk about pressing issues related to water in the Spokane River Basin and the SVRP aquifer. It allows stakeholders to talk about these issues and develop and discuss alternatives to current water management strategies.

The objectives of the collaborative modeling project include:

1. Developing future scenarios with stakeholders to ensure that information is relevant to specific stakeholder needs and questions
2. Exploring and evaluating different water management strategies that help facilitate adaptation to a changing climate, and
3. Developing recommendations for a basin-wide, collaborative water management plan.

This participatory process aims to explicitly consider how water resource decisions may be affected by climate change impacts in the region.

Research Methodology

Models have long been recognized as useful tools for integrating social, economic and environmental systems in a way that facilitates management decisions. Collaborative modeling is effective at creating a nexus of local and scientific knowledge that fosters discussions, problem identification and consensus-based strategies and solutions to current environmental issues. In a collaborative modeling process, models are used to facilitate dialogue, build discussion and discover what issues and needs are important to stakeholders. It is also an effective methodology based on developing a common language to integrate technical scientific information with local knowledge and expertise in simulation models. Collaborative modeling essentially builds a model with stakeholders, rather than for stakeholders. Through model development, stakeholders provide information about data needed to effectively model the problem. By engaging stakeholders and discussing issues related to their water resource systems, the modeler can then create a relevant model that addresses issues important to stakeholders and decision makers.

This ongoing collaborative modeling process in the Spokane River Basin allows stakeholders and scientists/modelers to

discuss important issues related to water resource management. Through this process, this project requires iterative work with stakeholders in the region to create a user-friendly model of issues relevant to local water resource management systems. The model used in in the collaborative modeling sessions is built using OASIS HydroLogics software.. OASIS uses a fully configurable linear programming solver to simulate water routing and optimize system operations for each timestep in the simulation period. The routing of water accounts for both human control and physical constraints on the system.

OASIS is a surface water resource specific software package designed to optimize system performance based on user-defined goals and constraints. While OASIS has primarily been used to model surface water systems, this project requires the development of a new feature with OASIS to model groundwater, because both the groundwater and surface water systems must be modeled to accurately address stakeholder questions in the basin. The OASIS modeling software has the capability to simulate in real-time, and it is useful in collaborative modeling sessions when simulating various "what-if" scenarios designed by stakeholders. Exploring various scenarios with stakeholders via a simulating model allows individuals to go through a decision-making process without actually having to go through the real experience. Utilizing OASIS in a collaborative modeling framework creates a powerful platform that allows diverse stakeholders, often decision makers, with different management objectives or conflicting goals to work together to develop mutually agreed upon water management strategies and solutions.

OASIS Model Domain

The Spokane River Basin encompasses an area of approximately 2,400 square miles, roughly the size of the Los Angeles metropolitan area. The Spokane Valley Rathdrum Prairie aquifer and the mainstem of the Spokane River are the focus of this modeling effort. The Spokane River Basin OASIS model is being constructed to simulate groundwater, and the movement of water within a coupled groundwater and surface water system. The schematic of the SRB OASIS model is shown in Figure 1: the purple triangles are nodes that represent the groundwater reservoirs, and the aquifer system is broken into 8 sub-regions that have similar hydrologic properties; the blue triangle is a node that represents Coeur d'Alene Lake; the yellow circles are also nodes, but they represent lake inputs to the groundwater system, points of interest, such as tributary inflows and gage sites; the green squares are demand nodes that represent groundwater withdrawals for municipalities, agriculture, and industry and from domestic wells; and, the black lines connecting the nodes are arcs, which represent movement of water in the system, this includes: streamflow in the Spokane River, flow from/to the groundwater system to the surface water system, flow through the groundwater reservoir, flow from lakes to the groundwater system, or flow to meet water demand.

Research Plan

The SRB OASIS model is still in model development phase and the operating rules are continuing to be updated, as the model is better refined. The next steps of my research project include model calibration, and continuing to

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Water Resources News Roundup

By Eric Buer, RIDOLFI Inc.

The Ohio River and many of its tributaries in the American midwest spent most of March at or above flood stage due to a mix of melting snow and heavy rainfall. With an enviable snowpack on the eastern seaboard more flooding may be on the horizon in New York and New England depending on how the spring thaw unfolds in the next few months. The high waters have maintained a relatively low media profile but may get more attention with the increase in flood insurance rates that went into effect as part of the Homeowner Flood Insurance Affordability Act on April 1st of this year. The increase is aimed at addressing the approximately $24 billion debt owed by the National Flood Insurance Program to the U.S. Treasury that has stacked up in the past decade.

Closer to home, while snowpack in the Cascades have been miserable (see notes from the President), water supply forecasts in the Columbia River Basin performed by the Northwest River Forecast Center are slightly more optimistic, although still mixed. Forecasts for Eastern Washington outside of the Columbia River, southern Idaho, and western Oregon oscillate around 50-percent of average (I said slightly more optimistic, not good). Eastern Oregon will be drier still with average values falling around 25-percent of average. But a green fringe remains along the northern and eastern borders of the basin in British Columbia, western Montana, and near Jackson, Wyoming.

To the south, the U.S. Bureau of Reclamation announced this February that without "unusually heavy precipitation over the next few months" many agricultural water contractors will be facing their second year of receiving no water from the Central Valley Project. Reduced supplies for urban uses were also expected and even senior water rights holders were told to expect facing reduced deliveries. The Golden State's extensive reservoir system is currently at just 26-percent of its storage capacity. The Sierra Nevada snowpack reached an all time record low of 8-percent of historic average at the end of March; wiping out the previous record of 25-precent of average during the same period in 1977[1].

Unusually heavy precipitation did not arrive over the month of March, and on April 1st California Governor Jerry Brown announced mandatory water restrictions that are intended to cut urban water use by 25-percent across the state. However, California's agricultural industry -- a consumer of 40-percent of the total water budget in the state[2] -- was exempted from the reductions. Environmental uses make up 50-percent of the State's remaining water budget.

This has led to criticism that the Governor is targeting easy water savings rather than significant water savings and that homeowners might feel more inclined to watch their lawns and landscaping die if they knew they weren't

Continued on Page 6: Roundup

1 More recent data available on CDEC now has the statewide average at an even more parching 6-percent.

2 Agriculture consumes 80-percent of the "developed" water in the state. Thus the 25-percent cut in urban use can variously be viewed as 2.5-percent of all the state's water, or 5-percent of the state's developed water.

Febrary Dinner Presentation Review: Kelley Susewind

By Erin Thatcher, CH2M Hill, AWRA-WA Board Member

The February 24, 2014 dinner meeting focused on the Washington Department of Ecology (Ecology) Draft Rule on surface water quality standards for the protection of human health. Special Assistant to the Director Kelly Susewind told the story of the Draft Rule development and provided details on the inputs to the calculation of the standard. One of the most significant changes to the human health criteria calculations is the fish consumption rate input, revised from 6.5 grams per day to 175 grams per day, reflecting a shift from using the mean consumption rate of the general population to the mean consumption rate of a highly exposed population.

Fish consumption varies by species (right down to individual salmon runs), region, and by population segment. Other alternatives included 225 grams per day (based on Suquamish Tribe survey data) and 125 grams per day (the mean of three Puget Sound Tribes). The decision to select 175 grams per day was based on the precedent set by Oregon (who also adopted this rate) and general consensus that this rate adequately represents the most vulnerable population.

Human health criteria calculations also incorporate assumptions for carcinogen risk levels, body weight, and relative source contributions for non-carcinogens. The discussions on carcinogen risk level were particularly emotional, and the value of 10-5 for the criteria calculation can result in higher standards for some chemicals, lower standards, or in some cases no change to the numeric standard. Because Governor Inslee directed Ecology to avoid backsliding into less protective standards, in some cases the existing standards have been upheld in lieu of a revised calculated standard.

Several regulated entities are concerned that the standards are not reasonably achievable and could cause economic harm. In response, Ecology has developed a set of Implementation Tools (criticized by some as "loopholes") that allow for compliance timelines (up to 10 years in certain cases) and interim limits.

The public comment period on this Draft Rule ended on March 23, 2015. Ultimately, EPA must approve the current Draft Rule -- thus making it final -- or promulgate

Continued on Page 6: Susewind

Conference Review: River Restoration Northwest

By Tyler Jantzen, AWRA-WA Board Member

The 14th annual Northwest River Restoration Symposium, hosted by River Restoration Northwest (www.rrnw.org), was held February 2-5 at the picturesque Skamania Lodge, in Stevenson Washington. The Symposium was a great chance to talk about the latest stream restoration technologies, share successes and failures, and to work collectively toward improved stream and river ecology across the northwest. Most speakers were local, although a few came from as far away as the east coast and United Kingdom.

One of the highlights for me was Session 5, with four separate talks on the challenges of stabilizing (and eventually restoring) Mount Saint Helens sediment in the Toutle and Cowlitz River basins. Having worked on sediment transport, sediment abundance, and sediment starvation issues in many other rivers, I still had a hard time comprehending the magnitude of the sediment supply in the North Fork Toutle River basin.

This series of presentations were a good reminder that the nearly 35-years since the eruption is but a blip on the geologic time scale, and that ecologic systems can be slow to repair, be it from damage caused by human or natural causes. The engineered log jams designed to stabilize the North Fork Toutle are some of the largest I've ever seen, and are moderately successful at beginning to stabilize the planform of this otherwise constantly shifting river.

Another favorite of mine was Chad Tinsley's presentation in Session 3 describing a somewhat-automated GIS method of evaluating riparian restoration using a combination of LiDAR and Multi-Spectral Imagery. By combining a "height above the ground" layer derived from LiDAR and the unique spectral signature of specific types and species of vegetation, Chad was able to develop a highly accurate tree canopy layer that could then be used to analyze solar radiation, effective shade, and to guide stream temperature TMDLs. Perhaps the most exciting feature of this technique is that it can be performed with datasets that cover broad geographic areas, and which are becoming commonly available and less expensive to obtain.

There were a variety of other fascinating talks, the full program and presentations are posted on RRNW's website.

An example of serving portions cut from a full size salmon fillet. While the current consumption rate is set at 6.5 grams per day, a single restaurant serving of fish typically ranges between 85 to 175 grams. (Image courtesy of RIDOLFI Inc.)

Chars: The River Islands of Bangladesh

By Rabia Ahmed, ENVIRON International Corporation, AWRA-WA Board Member

It was during one of my once frequent visits to Bangladesh in the late 1990s that my aunt gave me a book to browse. It was written by one of her colleagues at the University of Dhaka, M.A. Baquee, and was about the lives of communities living on these river islands called "chars" in the local language. I was intrigued, not only by the way these char dwellers survived, but also by the whole phenomenon of the formation of these new emerged lands.

Bangladesh was, and continues to be, formed by sedimentation and accretion of rivers as they flow from the Himalayas to the Bay of Bengal. A country prone to flood and river bank erosion and natural disasters, its coastlines are constantly moving. It receives silt deposits year-round as a result of erosion brought on by the annual monsoon, as well as by melting snow. Bangladesh consists mainly of riverine and deltaic deposits of three large and extremely dynamic rivers entering the country: the Brahmaputra, Ganges, and Meghna. The average flood discharges of these rivers (individually) are within the range of 14,000 to 100,000 m^3/s. Islands and bars are very common features among them all. Surveys, based on satellite images, have shown that each year there is a net accretion of around 12 square miles; newly formed land of about 32 square miles minus eroded land of around 20 square miles. With the high population density in the country, this means that each year tens of thousands of people lose their land. For many of them, the newly accreted land, or chars, offers an alternative home.

There are two main classifications of chars, island chars and attached chars. Island chars are defined as land that, even in dry season, can be reached from the mainland only by crossing a main channel. Attached chars are accessible from the main land without crossing a main channel during the dry season (crossing lesser channels may be required), yet is inundated or surrounded by water during the peak of a 'normal' flood.

The type of char formed depends on the classification of rivers. The wide variety of river and stream channel types that exist in limnology (the study of inland rivers) can be divided into two main groups by using the water flow gradient - low gradient channels for streams or rivers with less than two percent flow gradient, or high gradient channels for those with greater than a two percent gradient. The low gradient channels of rivers and streams, found in Bangladesh, can be divided in to braided rivers, wandering rivers, meandering rivers (or single thread sinuous rivers), and anastomosing rivers.

The formation process and characteristics of these chars are different in braided, wandering, and meandering rivers, while within a river the char characteristics may differ in a lengthwise direction. Generally, chars upstream consist of coarser materials compared to those downstream. Height of the chars above low or average water levels depends on the annual water level variations. The Jamuna is basically a braided river and produces unstable and semi stable sand bars within the river channel. How-

Continued on Page 7: Chars

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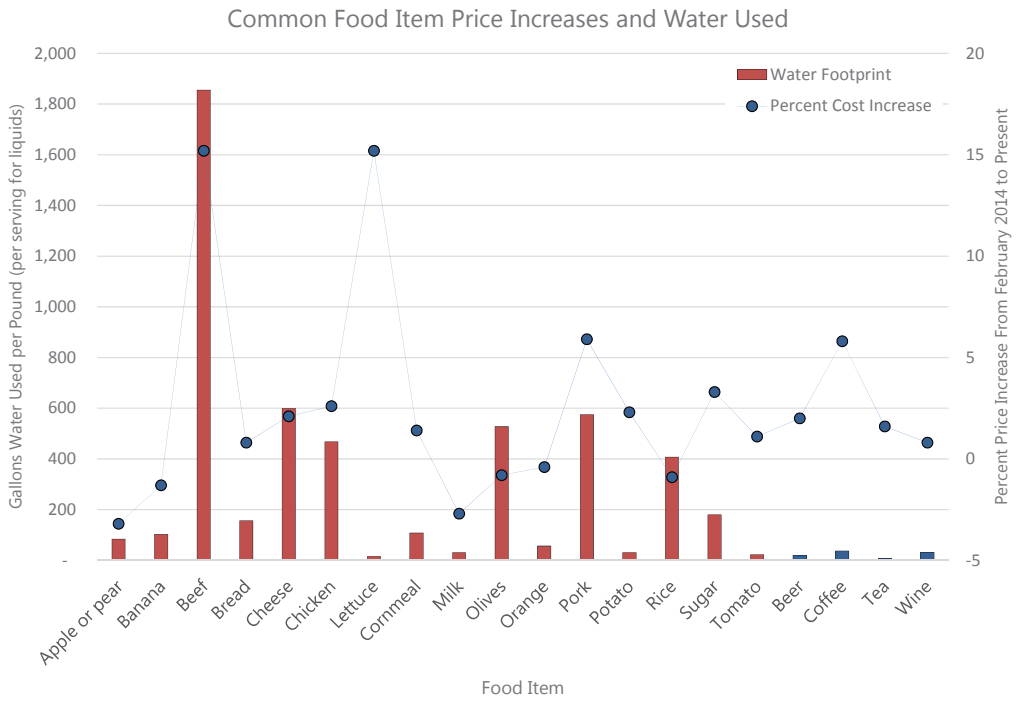
2015 AWRA-WA BOARD MEMBERS

Roundup: Continued from Page 3

the only user group being asked to do so. Agricultural interests have responded by pointing out that demand for food has remained strong despite the drought. And while some fields where annual crops are grown can be fallowed, others such as nut and fruit orchards most certainly can not without killing the trees.

California produces roughly half of the nation's fruits and vegetables, and as the drought out west presses on its impact on the national food supply has begun to trickle down to consumers. As many readers will be quick to point out, water budgets for meat are particularly high. A pound of beef requires approximately 1,850 gallons of water to produce; a pound of pork, approximately 575 gallons (estimated values from waterfootprint.org).



A plot of common food item water footprints and their corresponding percent-change in price since February of last year. Pricing data provided by the U.S. Bureau of Labor and Statistics, water fooprints from waterfootprint.org.

As the drought has impacted feed crops and left some fields fallow, the hyperconcentration of water in meat production appears to have resulted in more significant price increases that what was observed for fresh fruits and vegetables. The one exception appears to be lettuce, which is water intensive to grow, perishable, and produced primarily in California and Arizona -- both of which are experiencing moderate to severe droughts.

Susewind: Continued from Page 4

its own rule to be used within the state. The last date to adopt this Draft Rule is August 3, 2015.

Mr. Susewind provided additional insight into the Governor's related legislative package: the Toxics Reduction Initiative. This initiative gives direction to Ecology to develop a a prioritized list of toxic chemicals for which to develop action plans, and includes authority to direct reduction alternatives, including bans on certain chemicals. The initiative also includes funding for facility tours, water quality monitoring, and development of green chemical alternatives.

Details regarding the Draft Rule, including specific changes associated with individual chemicals and a cost-benefit analysis, are provided on the Washington Ecology website: http://www.ecy.wa.gov/programs/wq/ruledev/wac173201A/1203ov.html

AWRA-WA Eastern Conference

Location: Spokane County Water Reclamation Facility, 1004 N Freya Street, Spokane

Date: 09 Apr 2015 8:00 AM PDT

Keynote Address by Bob Haynes, Idaho Department of Water Resources (Retired)

Event Information

In cooperation with the Idaho Section of AWRA the Washington Section is presenting a half – day seminar on Rural Water Availability. The seminar will focus on the legal background, current situation, and mitigation options for rural water resources in Eastern Washington and Northern Idaho.

Sessions will be held between 8:00 am and 1:30 pm on April 9 at the Spokane County Water Reclamation Center.

Refreshments will be provided before the sessions and during the mid – morning break. The meeting will close with a box lunch and Keynote presentation. Following the lunch and Keynote presentation there will be a guided tour of the County's state of the art water reclamation facility for those interested.

The cost is $25 for WA and ID AWRA Section members and $35 for non-members. Membership information is available on Section websites (Washington registration and Idaho registration) Full time students at regional educational institutions will be admitted free.

Register on the AWRA-WA Website Today!

Chars: Continued from Page 5

ever, Ganges and Padma show meandering characteristic and generally produce stable attached chars to the riverbanks.

Three levels of bars are present in the Jamuna River, one of the largest braided rivers in the world: island chars, braid bars, and very low level bars associated with dunes. In a braided river, the formation of an island char would deflect the river flow to both sides, tending to widen the river through bank erosion. This process of widening of the river and sediments becoming available from the eroding banks would enhance the process of continued bar-building.

In a meandering river, two types of reaches exist, bends and crossings. Meandering bends are always associated with point bars. Point bars are formed through secondary currents, which erode the outer bank of a meandering bend and deposit the sediments in the inner bend. The topography of this type of char has a typical pattern; it is elevated at the upstream part of the inner bend and gradually slopes down in the downstream and from the bank towards the river. Point bars, as attached chars in a meandering river, are different from attached chars in a braided river (discussed later). In these rivers, attached char develop from an island char by the abandonment of an anabranch near the floodplain. Attached chars in braided rivers would thus have the same characteristics as a medial bar, in the sense that these will be elevated at the tip of the bar, with the slope gradually declining in the downstream and toward each of the flanks.

Ganges and Padma are both wandering rivers, with similar char formation processes. Large sweeping meandering bends produce point bars in these rivers. However, island chars are also created in these rivers in areas where chute channels remain active in both the dry and wet seasons. Once these chute channels disappear, such island chars become attached chars. Medial bars emerge as island chars in the braided reaches, which may become attached chars if the channel reach becomes meandering or the anabranch near the floodplain is abandoned. Given this order of development, it is likely that in the wandering rivers, the attached chars are older than the island chars.

A char consists of sand of approximately the same coarseness as the bed material of the river reach when it first emerges. However, at the lee side of a medial or point bar, fine materials are deposited. When the bar elevation reaches close to average flood levels, a layer of silt and clay is deposited over the sand layer, facilitating the development of vegetated islands/chars. As the chars grow older, their levels increase and attain the height of the adjacent floodplains. This process might be interrupted by subsequent lateral erosion of the chars, as these are prone to acute erosion and flooding and are periodically submerged.

Chars can be semi-permanent or temporary. The semi-permanent chars have life spans between five and thirty years, and are continuously changing their shapes due to bank erosion. The temporary chars are even shorter lived, with life spans between a few months to a few years. The entire process of char formation of the semi-permanent chars is typically completed within twelve to fifteen years. After fifteen years, these become stable chars. However, these nomadic islands continue to be extremely vulnerable and are temporary due to constant erosion caused by the powerful flow of adjacent rivers.

Despite the fact that they are flood and erosion prone, many people still choose to settle on these chars, because they provide land for settlement and because the soil is very fertile. But, these newly emerged chars are pockets of extreme poverty, and the char communities face multiple vulnerabilities including cyclones and storm surges, floods and drainage congestion, droughts and salinity intrusion, erosion, and deteriorating ecosystems. These are combined with legal hazards and lawlessness. These uncertainties are exacerbated by the consequences of climate change, with a greater probability of cyclones and storm surges, increased rainfall during the monsoon season, less precipitation in winter, higher temperatures, and sea level rise. Needless to say, the stability of char has a positive relationship to the stability of livelihoods of char dwellers. The livelihoods of these communities are more vulnerable in the dynamic char than stable char, and in terms of economic status, people living on island chars are poorer relative to those dwelling on attached chars. In addition, char dwellers in the meandering river chars are more resourceful than those in braided river chars.

Note: Some text in this article has been used as-is from local literature to preserve the essence of the scientists' research.

Spokane: Continued from Page 3

work with stakeholders in the Spokane River Basin, which includes both Washington and Idaho. Next steps in my research include:

- Meeting individually with technical scientists and hydrologists to begin the model vetting process,
- Attending monthly Idaho Washington Aquifer Collaborative meetings, as this provides a good opportunity to stay connected with stakeholders and updated on water issues in the region,
- Planning and hosting multiple collaborative modeling workshops (Fall 2015) to continue scenario development and simulation with stakeholders in the basin, and
- Potentially develop recommendations with stakeholders for a basin-wide water management plan.

In sum, coordinated development and management of water resources is necessary, particularly because water resources are an integral component of the ecosystem, a natural resource, and a social and economic good. Collaborative modeling provides a way of integrating diverse values and knowledge into water resources objectives that can assist in problem identification and meet long-term community needs. Thus, collaborative modeling is a useful technique for envisioning new, mutually beneficial regional water management strategies for the Spokane River Basin.

Melanie Thornton received one of the AWRA Washington State Chapter fellowships in December 2014. She is a PhD Candidate in the School of the Environment at Washington State University, and plans to complete her research in Fall of 2016. She can be reached at: melanie.thornton@email.wsu.edu

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