Institute for Water and Watersheds, Oregon State University

Willamette Water 2100
2015 Capstone Workshop Summary

Chemeketa Eola Events Center, Salem, Oregon—December 4, 2015

About this Summary

The WW2100 research team appreciated the time and involvement of 87 people at our December 2015 workshop in Salem, Oregon. This document recaps the meeting, summarizes comments participants made during roundtable discussions, and summarizes the research team's response to these comments.

About the Project

The Willamette Water 2100 project is a six year collaborative research effort by Oregon State University, Portland State University and the University of Oregon to evaluate how climate change, population growth, and economic growth will alter the availability and the use of water in the Willamette River Basin on a decadal to centennial timescale. The project team has developed a computer model, called Willamette Envision, that integrates aspects of hydrology, ecology, and human systems, and allows scientists and stakeholders to explore the interaction between land and water management policies, economics, climate, and ecology. The project is supported by grants from the National Science Foundation. It began in 2010 and will be completed in September 2016.

For more information about the project visit: http://water.oregonstate.edu/ww2100.

The National Science Foundation · Oregon State University · University of Oregon · Portland State University

Workshop Purpose and Participants

This workshop was an opportunity for researchers working on the Willamette Water 2100 (WW2100) project to meet with water managers, policy makers, and other stakeholders to share and receive feedback on project findings and plans for the project's final year. The purpose of the workshop was to:

- Describe key findings of the project to date with an integrated narrative of water scarcity under different scenarios of climate change, population and income growth, land use change, and policy.
- Provide stakeholders with key messages and supporting evidence to inform decisions.
- Facilitate in-depth conversation of WW2100 findings and communication between researchers and stakeholder constituencies.
- Identify unmet needs and ways to use WW2100 tools into the future.

The participants at the workshop represented many different organizations and regions of the Willamette River Basin. They were recruited from previous WW2100 events (see water.oregonstate.edu/ww2100/stakeholders), the professional contacts of the research team and their collaborators, and other persons who expressed interest in the project at regional conferences, association presentations, or after learning about the project online.

(a) Organization Type

(b) Area of Expertise

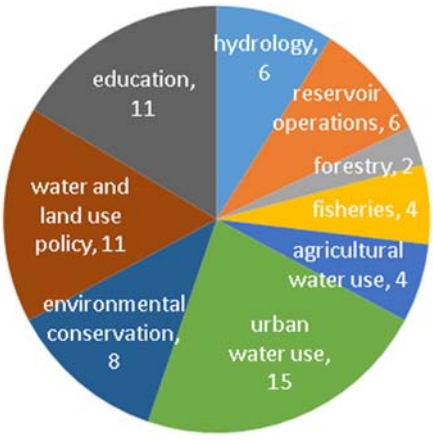

Figure 1. Stakeholder participants according to organization type (a) and by area of expertise (b). In addition, 19 project researchers and students attended the meeting. In total, 87 people participated.

Synopsis of Presentations

During the morning session, scientists presented cross-cutting themes from project findings. In the afternoon, they gave short topic-focused presentations that were followed by more detailed round table discussions. Here we summarize key points from the presentations and provide links to online materials.

Willamette Basin Water Budget

Dr. Roy Haggerty began the meeting by describing the seasonal water cycle in the Willamette River Basin, as modeled by the *Willamette Envision* computer model. He used "water budget" diagrams to quantify precipitation, storage, human and ecological uses, and discharge to the Columbia River. On an annual basis, our basin is water rich. Water demand for irrigation, municipal uses, and environmental flow requirements at Salem equal only about 10% of the precipitation that falls over the basin in a year. But because precipitation is highly seasonal, human and ecological systems can experience summer water scarcity and have come to rely on natural and engineered storage reservoirs to supply water during dry summer months. Dr. Haggerty contrasted the size of major seasonal reservoirs. In simulations with historical climate conditions, average snowpack stored a similar amount of water as the USACE Willamette Project, and that amount was four times smaller than the water held seasonally in soil and groundwater.

Water Scarcity in the 21st Century

Dr. Anne Nolin and Dr. Bill Jaeger contrasted the potential effects of climate change and population growth on water scarcity in upland and lowlands regions of the basin. Climate warming is likely to be the major driver of water scarcity in the uplands. In model simulations, warmer winters caused less precipitation to fall as snow, and this reduced the amount of water stored in snowpacks by 63-95%. Hotter, drier summers also led to a 200 to 900% increase in forest wildfires. Fire disturbance opened up lands to transition to new forest types and reduced the water demand of mountain ecosystems.

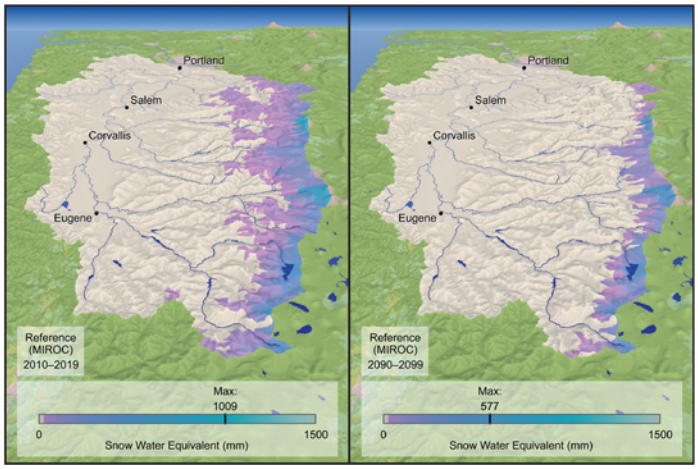

Figure 2. Projected average annual snow water equivalent for the first and last decades of the WW2100 Reference Scenario. The reduction in snow results from climate warming. Mean annual air temperatures increase by ~4˚C (~7.5˚F) over the century in this scenario and are derived from the MIROC5 global climate model.

Online Resources—
http://water.oregonstate.edu/ww2100/workshops

- *Draft Willamette Water 2100 Executive Summary*. This 23 page summary was given to workshop participants at the meeting and is also available online. The WW2100 team invites feedback on this draft document through April 1, 2016.
- Annotated slide sets from workshop presentations.
- *Water*, a children's book illustrated by area K-12 students.

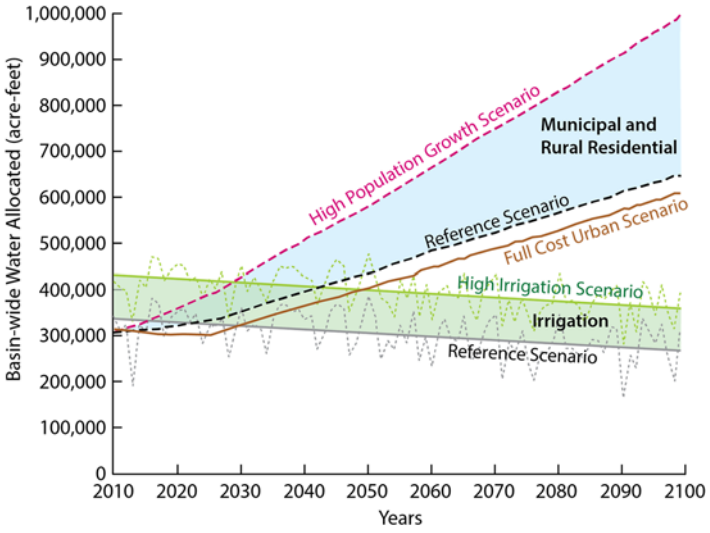

Figure 3. In modeling simulations, population growth led to greater demand for municipal water supplies while water demand for agriculture declined as expanding urban areas displaced farmland.

In the Willamette valley, economics and demographics, as well as institutions and infrastructure will be critical determinants of water scarcity. In modeling simulations, demand for municipal water supplies more than doubled but could largely be accommodated within existing municipal water rights. Despite the available supply, urban users may experience water scarcity in terms of rising water prices caused by the need to replace and expand infrastructure, add seismic resilience, and respond to water quality regulations. Water scarcity for agriculture is highly location and use specific. In modeling simulations, the cost to transport water prevented substantial growth in new irrigation contracts. Demand for irrigation also declined in some sub-basins, as expansion of cities displaced farmland.

Climate warming and land use change also affect stream water temperature which is likely to play a significant role in water management because of requirements for threatened and endangered fish. In an analysis outside of *Willamette Envision*, project scientists found that the likelihood of occurrence of native coldwater species, such as juvenile Chinook salmon and cutthroat trout, would decrease substantially if future river temperature increased by 2˚C or more.

Afternoon Science Presentations

Afternoon presentations and table discussions provided an opportunity to discuss project findings in greater detail by topic areas including: modeling scenarios, climate, snow, forests, hydrology, reservoir operations, urban water demand, agricultural water demand, and fisheries. Annotated slide sets from these presentation are online at: http://water.oregonstate.edu/ww2100/workshops .

Learning and Action Network Feedback

Round table discussions throughout the day asked participants to reflect on presentations and provide feedback to project scientists. The discussion questions, listed in the box to the right, guided conversations. Tables 1 and 2 highlight key themes that emerged in the roundtable discussions. A complete list of comments is available online.

Roundtable Discussion Questions

1. Ice breaker—describe a positive and negative experience you had with water during 2015, an unusually dry and warm year?
2. Morning discussion focused on interpretation of morning synthesis presentations —
   - What stands out or is surprising?
   - Do the results make sense?
   - What needs clarification?
3. Afternoon discussion focused on project next steps—
   - What do you think should be priority activities for the project's remaining nine months?
   - What should be priorities for new projects and additional research?

Table 1. Example Responses During Morning Breakouts

Describe a positive and negative experience you had with water during 2015, an unusually dry and warm year?

Positives:

- Increased public awareness of drought, water supply.
- Stories of farmers and water users adapting to drought.
- Analog for future snow packs.
- Bio-solids application earlier.
- Better planting and harvest.
- Water to cool off when it got hot.
- Higher water demand led to better economic situation for water utility.
- Saw new bird species.

Negatives:

- Delayed field trip to hatchery— chum could not migrate.
- Noticed for first time odor/taste in Corvallis municipal water.
- The need to regulate (shut off) water users.
- Trees dying in abundance.
- Work load reviewing water right applications for groundwater.
- Warm temperatures and low flows facilitated need for more water quality sampling due to concern about algal blooms.
- Fish [hurt] on both ends—lower quality for Steelhead in spring, lower quality for Chinook in fall.

What information in the morning synthesis presentations was surprising or stood out?

- The small volume of water storage in snow.
- How tiny urban water demand is compared to water needed to maintain regulatory flows.
- That urban expansion leads to decline in total human water demand in some sub-basins.
- How dramatic the changes in forests could be, and that forest fires lead to lower evapotranspiration.
- Water temperature will be a bigger factor than water quantity; surprising its not in the model.
- What about unanticipated consequences? For example, would earlier planting dates lead to earlier fertilizer and pesticide application and a decline in water quality?
- How fortunate we are because we live in a water-rich region.
- That agricultural water demand will decline, for an alternate view refer to Oregon Water Resources Department (OWRD) water demand forecast.

How can scientists improve their synthesis presentations?

- Unclear about total water use trends—is loss of irrigated lands enough to offset increase in urban water demand?
- Slides are not clear enough for those who do not have the vocabulary; needs to be clear enough to explain to the public why they might need to pay more for water.
- Water budgets useful, but it would help to show four seasons, rather than two and use units of inches for the public and acre-feet for water managers.
- Socio-economic discussion needs more focus and clarity. The four points about what makes our basin lucky was good.
- Need to communicate uncertainty and assumptions better.

WW2100 Next Steps

In the afternoon, project researchers asked participants to share their priorities for remaining project modeling capacity and ideas for future investigations. Table 2 summarizes this feedback and describes how the research team is incorporating this feedback into their future plans.

Table 2. Feedback on Project Next Steps

Learning and Action Network Priorities	Post-Meeting Response from WW2100
Focus on summarizing and communicating results. • Synthesize findings for utilities managers and decision makers—identify key issues, at risk places, at risk resources. • Publicize concise general summary for the public. Develop infographics around key findings. Provide speakers. Partner with regional groups. • Tell findings through specific stories that emphasize findings and adaptation strategies. Example story idea – dams now necessary for fish (because they help maintain cooler water temperatures) previous story, dams bad because they cut off habitat. • Share and package sub-basin results including sub-basin water budgets. Compare and contrast future scenarios in different sub-basins, e.g. one with and one without federal reservoirs. Align with OWRD collaborative planning regions. • Develop adequate documentation. Maintain website to ensure access to project data and findings. • Develop a simplified modeling tool or educational game that the public and students could use to learn about local water issues.	The slides and draft executive summary shared on December 4 were our first effort to synthesize project findings for regional audiences. We welcome your comments on these drafts and will incorporate comments received by April 1, 2016 into future outreach products. The executive summary will be part of a web-based project report that will summarize project findings by topic area and link to model documentation, data and publications. Since Dec 4 we have also met with the OSU Extension & Experiment Communications group to discuss ways they can help us communicate project findings to diverse audiences. The ideas stakeholders shared on December 4 will help inform our planning with Extension.
Identify policy and planning implications and recommendations. • Disseminate more information that's relevant to policy – "What should we do?" Can't report diagnosis without also suggesting treatment. • Create a table listing key findings, evidence and associated policy recommendations. • Need more specifics such as "in order to meet water needs of double population we need to do x, y, z." Or "we need to invest in infrastructure because…" or "if we don't change x then y will happen". • Some sort of infrastructure needed to "carry knowledge you gained today" forward. Not necessarily WW2100's job, but there is a need for transfer of these finding into decision making arenas (e.g. legislature, local government bodies, NGOs) and some means of scaling and sorting data to fit local issues and questions.	For many of us, our expertise is science, and making specific policy recommendations is outside our expertise. However, we recognize the importance of this request. As a follow up, Sam Chan, lead of our Broader Impacts group, will convene a Technical Advisory group meeting in April 2016 to receive advice on communication strategies, stories, and ways to link WW2100 findings with current policy issues relevant to your stakeholders. Outcomes from this meeting will help inform a "WW2100 Summary for Policy Makers".
Continue and advance research on stream temperature; connect temperature model to Willamette Envision: • Incorporate stream temperature into model (mentioned repeatedly). • Evaluate options to manage and improve water temperatures; relate flow release/water volume to water temperature. • Model run of what it would take (adaptation) to limit stream temperature increase to below 2 degrees Celcius.	We agree that stream temperature is a top, long-range priority for follow-on projects and we are looking at several ways to incorporate stream temperature into the next version of Willamette Envision.

Table 2 (continued). Feedback on Project Next Steps

Learning and Action Network Priorities	Post-Meeting Response from WW2100
Ideas for additional model runs with *Willamette Envision*: • Water pricing—need a scenario with rate increases that reflect high costs for seismic upgrades, new reservoirs, etc. • Land use—something between unconstrained and no growth—UGB expansion is happening at a really slow pace and the result is higher urban densities. • Model alternative flow regime/reservoir releases: e.g. changes to the BiOp flows. • Model effect of floodplain restoration on flood risk. • Forests—effect of changing harvest policies. • Model runs that better demonstrate uncertainty, for example high/low, +/- 20% based on lawsuits.	We are addressing some of these suggestions (water pricing, land use changes) with offline analyses and follow up meetings with individual stakeholders. We are performing additional model calibration that will improve the quantitative assessment of reservoir operations. The additional calibration will allow us to have greater confidence in model output for sub-basins and reservoirs inflows.

Other research topics and suggested strategies:
• Groundwater – relate GW/snow/climate interactions with geology, upland groundwater; need closer look at late summer flows.
• Fish – do a better job of connecting the mainstem fish story to the headwaters; integrate fish model into hydrology.
• Forests –
  • What is effect of vegetation shifts on water temperature, chemistry?
  • What is the effect of fires on erosion/ stability, siltation in reservoirs, and flooding?
  • Explore the economics of fire-fighting, fire effects, fuels reduction (partner with PNW Research Station).
• Focus on economic valuation and effects of predicted futures.
• Follow up in 5 or 10 years and enter any changes in assumptions that have occurred.
• Create riparian modeling box to connect forest/ urban/agriculture.
• Shop model to specific agencies and consider how they can help keep momentum (Fish & Wildlife, Forestry, Federal).
	We appreciate these suggestions and hope to incorporate these ideas as we undertake new research projects and build on Willamette Water 2100. Moreover, we hope that your involvement with the project has helped strengthen your connections within the water management, education, and research communities and that those connections lead to new projects that benefit your constituencies in the basin.
	
	We plan to share lessons learned from the WW2100 researcher-stakeholder engagement process in two journal submissions and an Oregon Sea Grant Extension publication.

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