Synthesis Report from the 2018 INFEWS Stakeholder Advisory Group Meeting

May 8, 2018, Chelan, WA.

Georgine Yorgey, Associate Director, Center for Sustaining Agriculture and Natural Resources, WSU

Liz Allen, Research Associate, Center for Sustaining Agriculture and Natural Resources, WSU

Sonia A. Hall, Research Associate, Center for Sustaining Agriculture and Natural Resources, WSU

Jennifer Adam, Associate Professor, Civil and Environmental Engineering, WSU

Julie Padowski, Clinical Assistant Professor, State of Washington Water Research Center and Center for Environmental Research, Education and Outreach (CEREO), WSU

Sasha Richey, Assistant Professor, Civil and Environmental Engineering, WSU

Purpose and Organization of this Report

The purpose of this synthesis report is to document the outcomes of the Stakeholder Advisory Meeting on the WSU-led INFEWS project. As it will be shared with interested stakeholders who were unable to attend the meeting, the first section provides a brief description of the INFEWS project, followed by the synthesis of topics discussed and input received from stakeholders. The final section, beginning on page 6, focuses on next steps for the INFEWS research team, providing some perspective on what the research team took away from the meeting, and possible avenues for incorporating these take-home messages into the remainder of the INFEWS project.

The INFEWS Project in a Nutshell

Food, Energy, and Water (FEW) systems are tightly interconnected, such that decisions made in each sector have implications for the other two. Increases in population result in greater FEW demand, creating greater inter-dependencies and conflict. Climate change will also place stress on the system. Research is needed to understand how we can sustain human needs while protecting our environment.

Funded by the National Science Foundation and the US Department of Agriculture, the INFEWS project aims to increase regional- to global-scale resilience in Food-Energy-Water systems through coordinated management of water and energy storage and technological and governance innovations. The research team involves over 40 members from Washington State University, the University of Idaho, the University of Utah, Utah State University, and the Pacific Northwest National Laboratory and together spans the disciplines of agronomy, communications, economics, engineering, environmental sciences, geophysics, law, philosophy, and social sciences.

Project Goal: To identify and examine effective strategies to co-balance benefits among FEW sectors in the Columbia River Basin and increase sustainability & resilience across the integrated system.

Motivation: The Columbia River Basin (CRB) is one of the most highly-managed large river systems in the U.S., catering to a diversity of water users with growing demands for water, energy, and food. However, the CRB is also storage-limited, with reservoir capacity enough to store only between a third and half of mean annual discharge. Meanwhile, climate-related reductions in snowpack are decreasing natural storage.

Central Hypothesis: Coordinated management of physical and non-physical storage systems across the three sectors can increase FEW system resilience. Coordination increases effective storage of the overall system and enhances its buffering capacity to disturbance at multiple scales.

Approach: The INFEWS research project will develop, evaluate, and iteratively apply a framework spanning the continuum from theory (aim 1) to practice (aim 4) to understand FEW linkages, explore

innovative solutions across the FEW sectors, remove barriers to adoption, and increase system-wide sustainability and resilience to global change.

- Aim 1: Develop theoretical foundation characterizing our region's FEW system that is generalizable to national and global scales
- Aim 2: Integrate state-of-the-science computational models to capture FEW system interactions
- Aim 3: Evaluate benefits/impacts of FEW technological and governance solutions using the modeling platforms
- Aim 4a: Convene a multidisciplinary resilience workshop
- Aim 4b: Engage stakeholders to develop new strategies and remove barriers to strategy adoption

2018 Stakeholder Advisory Meeting

Participating Stakeholders: Approximately 30 individuals representing organizations that address food, energy and water management issues were invited to the first INFEWS Stakeholder Advisory Group meeting. Among those who were able to attend, participating organizations included utilities (Seattle Public Utilities, Chelan County Public Utility District, Avista), a conservation district (Palouse), federal agencies (US Geological Survey), state agencies (Washington Department of Ecology, Washington Department of Agriculture and Washington State Conservation Commission), a policy consultant (Mazza Research Organization Communication), and a global non-profit (Pure Blue).

Discussion Framework: We grounded our discussion of the Columbia River Basin food-energy-water system in a "transition state" diagram (Paul Ryan; Figure 1) that aimed to facilitate a discussion of desired states, current states, worst-case states, and the possible pathways between them. This thought exercise is useful for not only identifying high-priority strategies for achieving a desired state, but helps users think through potential unintended consequences by considering actions or responses that may push a system towards an undesired state.

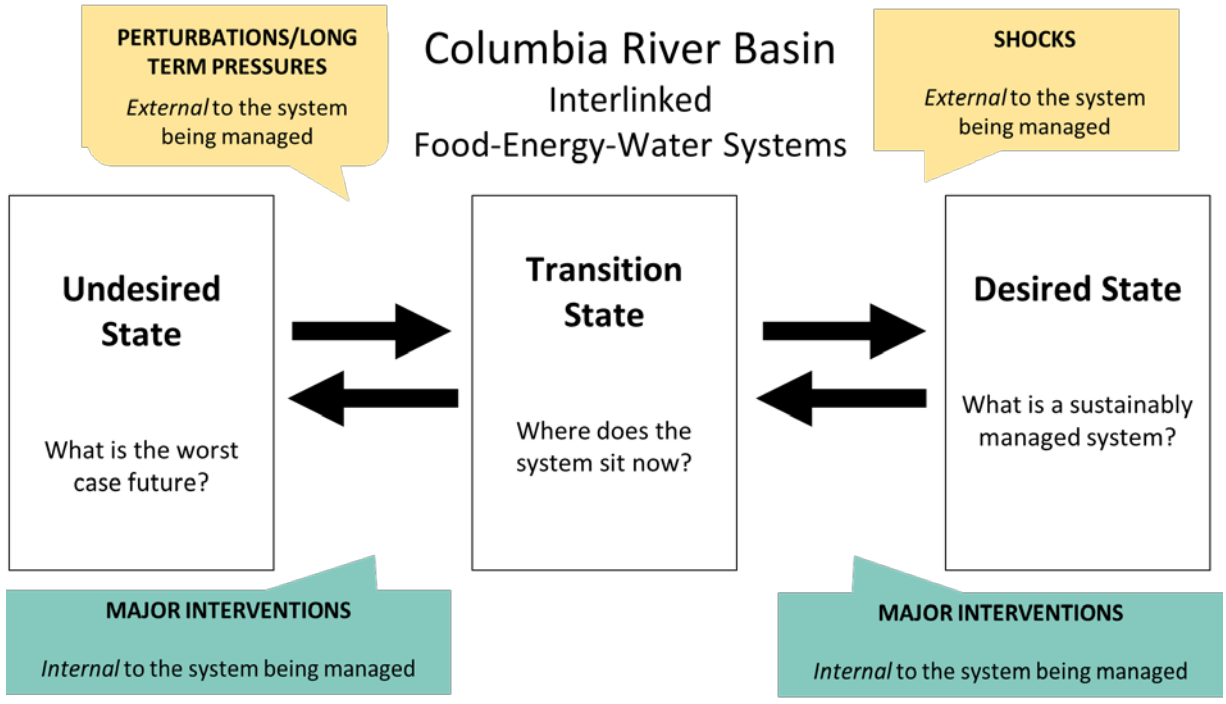

Figure 1. Generalized transition state diagram used for discussion between researchers and stakeholders in INFEWS annual meeting, May 2018.

Discussion Highlights

The discussion was wide-ranging, but here we summarize the major questions and discussion points.

Key question: What is the current state of interlinked food, energy and water management in the Columbia River Basin? What initiatives are stakeholders prioritizing currently?

Food Resources:

- Management for food safety
- Water quality efforts related to agriculture
- Waste management – anaerobic digester technology innovation
- Incentive-based conservation – technical and financial efforts
- State-level food policy planning
- Maintaining soil health

Energy Resources:

- Developing solar and wind energy resources
- Consideration of climate change scenarios

Water Resources:

- Drought response planning
- Working toward irrigation efficiency improvement
- Updating water resource management – goals of flexibility (adaptability) and reliability (predictability)

Social Aspects and Governance:

- Long term planning with stakeholders are ongoing throughout region

Key question: How do stakeholders envision an ideal future for interlinked food, energy and water management in the Columbia River Basin?

Food Resources:

- Successful management for food safety and water quality
- Pesticides/pesticide residues are minimized
- Preserve farming in the region, thriving rural areas
- Soil and water conservation approaches that are tailored to local context
- Carbon sequestration in agricultural and forest soils

Energy Resources:

- Investment in smart grid and smart meters
- 350 ppm CO_2
- Eliminate fossil fuel energy
- Diverse sources of renewable energy
- Infrastructure for carbon-free power (discussion about possible increased methane from hydropower? What does this mean in our region?)
- Integrated planning for storage
- Meet energy needs with least cost
- Bring increased wind and solar energy online

- Renewable natural gas – reduced methane emissions

Water Resources:

- Sustainable fish habitat
- Maximization of irrigation efficiency
- Continued groundwater availability
- Flexible water management policies (mechanisms for farmers to lease water rights back to the state)
- Maintain water quality

Social Aspects and Governance:

- Effective communication and collaboration across management sectors and between different stakeholders, including tribes, rural entities and citizens, cities and urban citizens, and power providers
- Policies informed by science
- Predictability for decision-makers and those impacted (for example, growers need to know when and where water will be available)
- Adaptable management plans
- Incorporate lessons from other regions
- Central data management and access
- Accept human role in the ecological system—management that accounts for an altered environment
- Maintain and enhance regional social wellbeing
- Manage uncertainty over long-term planning
- Diversity in governance and decision-making

Key question: What are important possible exogenous drivers of change in the region's FEW system?

- Decline in rural economies—there is a move toward larger industrial scale production, how does change in land tenure affect food and water management?
- Change in global market for certain crops—for example—apple production in China could lessen global demand for WA apples.
- Climate change impacts (discussion that there's at least a possibility that these could exceed what has been projected: e.g. if methane emissions brought about tipping points in the climate system)
- Local food movement: densification of urban communities, changing public values around food—what drives those changes in public perception?
- Innovation in energy storage, including using electric vehicles as storage. Power to gas, using surplus energy to enhance existing gas streams.

Key question: What possible innovations or interventions are stakeholders in the region most interested in (endogenous impacts on FEW system)?

- Precision agriculture technology adoption—conservation farming and improved nutrient management have potential big implications for water quality
- Direct payments to farmers or others for emissions reductions—target emissions reductions, based on the social cost of carbon, offset prices haven't provided enough incentives yet

- Change in "use it or lose it" water law: Drought response is currently dictated by legal interpretation—people lose their water right if they conserve water, what if we changed this part of the law?

Management considerations/Additional points of discussion not easily categorized above:

- Managers think in terms of ensuring predictability and reliability for resource users. In general, these objectives—as opposed to the more abstract concept of resilience—guide planning. There are big questions around long term ability of the region to sustain certain industries.
- Flexibility and adaptability are core goals. There is broad recognition that improved inter-agency communication and coordination are needed in the future. Built-in provisions should allow for changes from one year to the next and one location to the next.
- There is a need for tools that support managers in evaluating how to allocate funding when decisions must be made in the face of scientific and/or social uncertainty. What innovations and adaptations are worth the investment? It would be useful to quantify the effectiveness of proposed policies for carbon reduction for example. In practical terms we need to look at robust results first—communicate uncertainty and conflict for policy decision-makers. How do you get decision-relevant information from structural models that have built-in uncertainty?
- The scale of decision making matters. This affects how quickly can you make a change and how quickly can you react to a change in conditions. Concrete problems are best handled at local levels of government. But big picture policy has to be guided at the state or multi-state scale.
- Planning horizons are widely varied. Decadal-scale information is generally useful.
- There are some cross-sector efforts to consider the impacts of decisions on other sectors, but these efforts are incomplete in some ways. Understanding of cross sector impacts was high, and yet organizational mission may sometimes constrain stakeholders from acting on this understanding.

Discussion of Metrics, or Indicators:

- Stakeholders hold a common goal of improved data coordination, access and efficiency
- There is always a question of data quality, and we need tools and systems that can produce reliable information; these data need to be differentiated from less reliable data.
- Managers often get wrapped up in thinking that they need more data—but we always are operating on incomplete information and still need to manage—for example, in the region there is relatively good data about fish populations and managers have to work from that knowledge to implement best available solutions.
- Information about water availability is not consistently reliable and would be helpful to have seasonal projections available sooner.
- There is a need for more information about soil moisture, this directly influences decisions for dryland growers. For irrigators, soil moisture sensors at the farm level make a difference, can have precision control about where water is applied in field. For a high value crop like grapes the investment in precision irrigation tools is worth it.
- Legislators are concerned with the economics of climate change on food production in the region. A data gap exists in terms of linking climate events to impacts within specific industries.
- There is interest in increased use of biosensors for assessing water quality, including pollutant loading, heavy metals.

Next Steps for the INFEWS Team, Relating to Our Stakeholder Interactions

Based on both the discussions during the stakeholder advisory day and the team discussions following the stakeholder advisory meeting, the team anticipates that one of the most stakeholder-relevant portions of the project is likely to be related to the project's effort to examine the potential impacts of innovations. Based on team discussions, a tentative list of areas where we anticipate work includes:

- The impacts of decentralized energy storage.
- Decentralized water storage through managed aquifer recharge.
- Simulations of impacts of land use and land cover change on the FEW system in the Columbia River Basin.
- Investigation of protected production (e.g. with greenhouses).
- Impacts on the FEW system of more efficient irrigation technologies in the Yakima River Basin.[1]
- Impacts of potential changes in the Columbia River Treaty, and impacts of climate change, on FEW systems.[1]
- Remote sensing of consumptive water use (via METRIC) and relationship to governance in the Yakima River Basin.[1]
- Seasonal crop and water projections across the Columbia River Basin.[1]

This list includes both work being carried out within the INFEWS project, and through complementary projects (efforts being carried out primarily through complementary funding are identified with a footnote).

In some of these areas, modeling work is already underway, while for others, modeling tools are still in early stages.

STaR Calculator

The discussion of indicators and metrics launched with stakeholders during the SAG continued with team discussion of the SusTainability and Resilience (STaR) Calculator during the team's annual meeting. The team is currently exploring whether measures of quality within sectors (e.g. efficiency, reliability, flexibility, etc.) can be combined through weighting, similar to a "House of Quality" measure. We anticipate that as we develop this calculator, we will return to our stakeholder advisory group for additional input, including on how we can best put the results from this project's innovations work in context.

An additional aspect to this discussion relates to how the calculator, and the broader project, will cope with uncertainty, a theme that we spent quite a bit of time discussing during the stakeholder advisory group meeting. The team has grappled with some of the difficulties related to uncertainty in the past, and anticipates two related factsheets discussing uncertainty, and the use

[1] *These efforts are being carried out primarily through work that is complementary to INFEWS, but relies on other funding.*

of model scenarios, to be forthcoming in the next year. We also anticipate that the team will continue to discuss these issues as we work on the calculator.

Next Steps for Stakeholder Engagement

Individual researchers and teams within the project will be continuing with focused efforts relating to the project. We anticipate that team members may reach out to stakeholder advisory team members relating to their work on key innovations – and we will also be doing some planning related to outreach of results for innovations and/or case studies that we feel are most likely to be relevant to key stakeholder groups. **We would be happy to hear additional ideas about this, and you should feel free to contact Georgine Yorgey (yorgey@wsu.edu).**

We also anticipate that we will convene the stakeholder advisory committee either in-person or remotely in Spring 2019 for an update on progress.

Acknowledgements: The INFEWS research project has been funded by NSF EAR grant #1639458, USDA grant #2017- 67004-26131, and the Washington State University Graduate School. We would also like to thank each of the stakeholders who is willing to serve on the advisory committee, with thanks particularly to those of you who were able to take the time to attend our meeting and participate in these discussions.