Technology for Trade

New tools and new rules for water use and allocation in agriculture and beyond

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In the Columbia River Basin, as in other basins across the western United States, water allocation decisions and processes are important for making the most of naturally variable water resources for diverse instream and out-of-stream purposes. Tradeoffs inherently exist with so many competing uses for water, especially during drought years when available water is limited. Maximizing opportunities for water to be tasked to its highest valued potential use, both within agricultural systems and across its many competing uses, is important for making the most out of scarce water resources. New management approaches would be more effective with improved information, and emerging information technologies provide opportunities for enhancing the region's resilience to drought by making water use more flexible. Such information-related innovations are already changing the legal and management landscape of water resources in the western U.S.

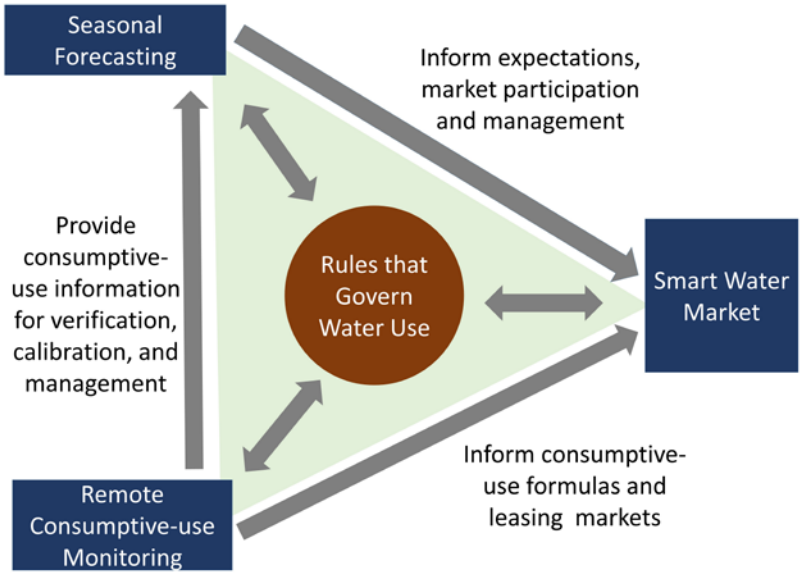

Figure 1. The three focal technologies of this project complement each other, and provide information that, in combination with the rules that govern water use, creates new opportunities for water use.

The *Technology for Trade* project, which will run from 2018 to 2023, is contributing to enhanced efficiency of water use by furthering the development of information technologies and complementary innovations in the rules that govern water use. In particular, the Technology for Trade team aims to further the development and application of three promising and complementary emerging technologies: improved seasonal forecasting, remote measurement of crop water consumption, and computer-aided 'smart' water markets. In addition, legal, regulatory, and contractual innovations can be important to allow water users to use these technologies as effectively as possible while protecting the water rights of others.

Improved Seasonal Forecasting. The forecasting effort will utilize seasonal climate forecasts that are currently available with lead times of about eight months (i.e. the North American Multi-Model Ensemble), and will explore regional translation to forecasts of water availability and related metrics. The seasonal forecasting effort will identify when, where, and what metrics can be forecast with enough lead

time, accuracy, and precision to be useful in decision-making. For example, improved seasonal water forecasting could help farmers plan their planting and water use activities earlier and with less uncertainty. Timely and informed decisions could then facilitate water transfers during times of shortage, including dry-year (options) contracts or public reverse auctions to augment instream flows.

Remote Consumptive Use Measurement. The Technology for Trade team will develop and field-test a method to estimate plant evapotranspiration via METRIC—a method that calculates evapotranspiration from Landsat images of the surface using an energy balance approach. The method in development will use a combination of existing satellite data along with data collected by drones. Evapotranspiration is closely related to crop consumptive water use. The focus of this technology is thus irrigated agriculture, which is an important economic engine and accounts for the majority of regional out-of-stream consumptive water use. This technology can provide a spatially explicit (e.g. 30 m x 30 m), estimate of water stress or crop water use, which might be used to better guide variable rate irrigation systems and improve yields. During dry years, consumptive use measurements could support improved deficit irrigation strategies, and perhaps partial leasing of water rights. At a basin scale, satellite-based imagery could help protect water rights against increases in consumptive use elsewhere in a watershed, and complement existing water metering efforts.

Computer-Aided 'Smart' Water Markets. The 'smart' water markets effort will tailor existing water trading software technology (from Mammoth Trading) to three watersheds within the Columbia River Basin (Figure 2), to reflect their unique legal and hydrological conditions, as well as specific trading goals identified within the watersheds. Smart markets ease the process of matching multiple sellers and buyers of water and help navigate the highly complex regulatory constraints for a successful trade. This could facilitate temporary transfers during times of shortage to the most valuable uses, both in-stream and out-of-stream, in ways that do not impair other water users.

The usefulness of these technological innovations will be affected by the flexibility of water use law, regulation, and other factors that frame water allocation decisions. This project will therefore explore how changes in legislative and administrative rules, contracts, and norms could change the context and incentives surrounding water use and allocation. The goal is to identify and explore how complementary changes in these factors could enhance the effectiveness of the technologies for helping water managers meet multiple, diverse demands for water.

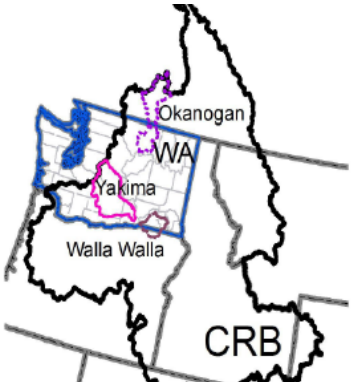

Figure 2. While these technologies and institutional innovations have the potential to be relevant across the Western U.S. and beyond, our focus in this project is on three diverse watersheds in the Columbia River Basin where water is in economic demand, and water security is of concern: the Yakima, the Walla Walla, and the Okanogan.watersheds.

This 5-year research and extension project (2018-2023) is led by Washington State University's State of Washington Water Research Center (WRC) and is supported by USDA National Institute of Food and Agriculture, project #1016467. The full Technology for Trade project team, and more information about the project, is available at https://wrc.wsu.edu/project/technology-for-trade/.