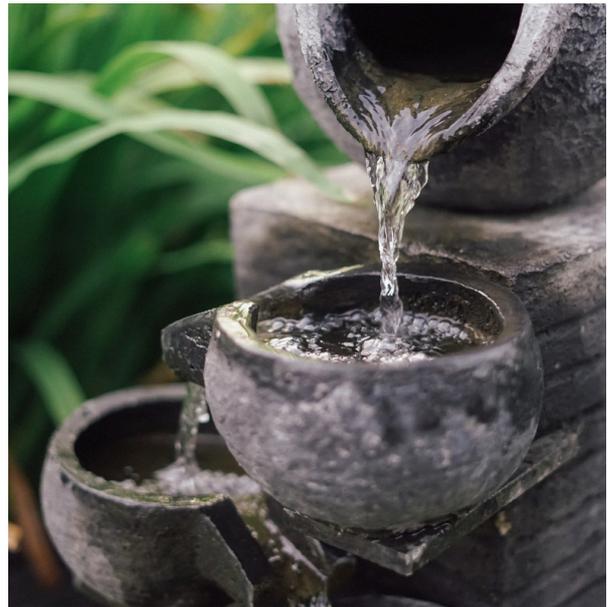


Coevolution of Technology and Law for Water Management in Washington State and Beyond

Technology and institutions like law, regulation, private contracts, and social norms evolve together to shape the way humans interact with our environment. This article examines the way in which water law and other water institutions have co-evolved with technology across different water resource and economic environments.

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This research highlight is based on a published work (see last page).

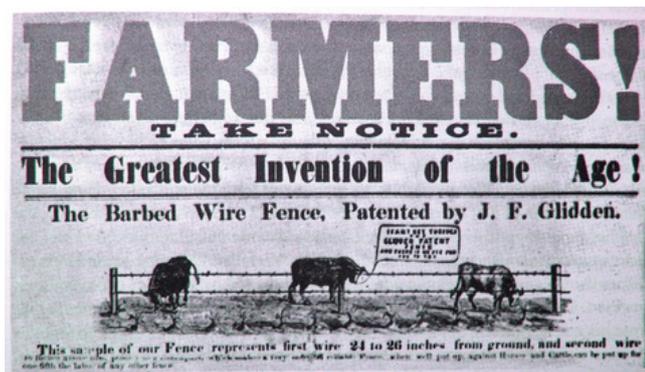


From the first stone agricultural land tilling tools and animal domestication practices to the latest in computer-aided climatological forecasts to support decision-making, humans have adapted technologically to their environment.

Social institutions including norms, law, government organizations, and other forms of social contracts also evolve through innovation in response to physical and social challenges in our environment. And these technological and institutional

innovations are often interdependent. For example, in the American West, barbed wire was widely adopted between 1880 and 1900 to reduce crop losses and encroachment by livestock, but it would not have been as useful without laws supporting secure land rights such as the Homestead Act of 1862. In turn, barbed wire fostered changes in law requiring ranchers to fence livestock in or face liability for crop damage. The combination of low-cost barbed wire and the subsequent shift in land use law facilitated a drift toward stronger private property rights and increases in land value and economic productivity during this period.

Advertising in an unknown newspaper of the Texas area (1874). Source: Wikipedia



Similarly, water law has and continues to evolve depending on the environment and the state of available technology. In the eastern U.S., water is administered under riparian rights, which provide landowners the right to use water bodies adjacent to their land. This legal doctrine worked poorly in the arid western U.S., and a new legal framework called the Prior Appropriations doctrine evolved to suit the environment. The right to divert water was, and still is, based on beneficial use of the water. During droughts, holders of earlier rights have priority in use over more recent claimants. This seniority system evolved to address difficulties measuring and enforcing appropriative rights, and to allow for legal clarity about who receives water (and who does not) during seasonal drought. Its evolution has also been driven by technological constraints. Agricultural irrigation accounts for most water diversions, and technological innovations have led to major changes in water use efficiency, leading to lower return flows per gallon of water diverted and therefore less water available downstream for users.

The fact that water rights are based on diversions is no accident, and it has important consequences for water use. Diversions are easy to monitor: they can be measured at one (or a few) points with relative simple instrumentation. Conversely, return flows are very hard to measure except in rare circumstances. The difficulty of monitoring and measuring return flows is arguably the reason that rights are based on diversions rather than actual water

“ *New methods for improving estimates of consumptive use of irrigation water via satellite data, drone, and other data sources can help improve yields through more precise crop-water application...*

consumption. But diversion-based rights have consequences. Reductions in return flows stress the Prior Appropriations doctrine itself because for any total quantity of appropriated diversions, more water is consumed and downstream flows are diminished, potentially harming downstream users and benefits from streamflow. In response, states have adopted rules to restrict the spreading of diversion “savings” from irrigation efficiency improvements to limit overall

harvesting based on expectations of seasonal water availability. Currently, our best seasonal climate forecasts are only available at coarse spatial and temporal resolutions with lead times of about 7 months. Improved seasonal forecasting could provide critical information for producers, irrigation districts, and regulators to help improve productivity and reduce losses due to unplanned contingencies, and help cities target investment in water rights and water infrastructure given limited fiscal resources. Concurrently, changes in the way consumptive water use is measured could offer substantial benefits to both water users and water regulators. Traditionally, irrigators have made estimates of crop consumptive water use by relying on standards set in the



Irrigation technology and precision has improved yields and irrigation efficiency.

Source: <https://ilovehi story.utah.gov /topics/water/irrigation.html>

increases in consumptive use. Science, technology, and the nature of water itself have played an important role in the design of water law and administration, and in turn how, and how efficiently, we use water. Agricultural irrigators make decisions about planting, irrigation timing, and

Water Irrigation Guide (USDA, 1997). New methods for improving estimates of consumptive use of irrigation water via satellite data, drone, and other data sources can help improve yields through more precise crop-water application, and can help regulate against increases in consumptive use that harm

downstream water rights holders. These and other technological advancements can improve how water rights are leased or sold in water markets by reducing transaction costs and minimizing the administrative burden of transactions on water regulators.

The use of “smart markets”, or computer-facilitated water markets could help match sellers and buyers and allow them to more easily navigate the highly complex regulatory constraints for successful trades.

The usefulness and value of technological and institutional innovations are tightly interdependent (Figure 1). New technological applications often call for institutional innovations, and institutional innovations change the way in which technology can be effectively used. To improve water use efficiency in our changing environment requires careful consideration of both of these dimensions of the water management challenge.

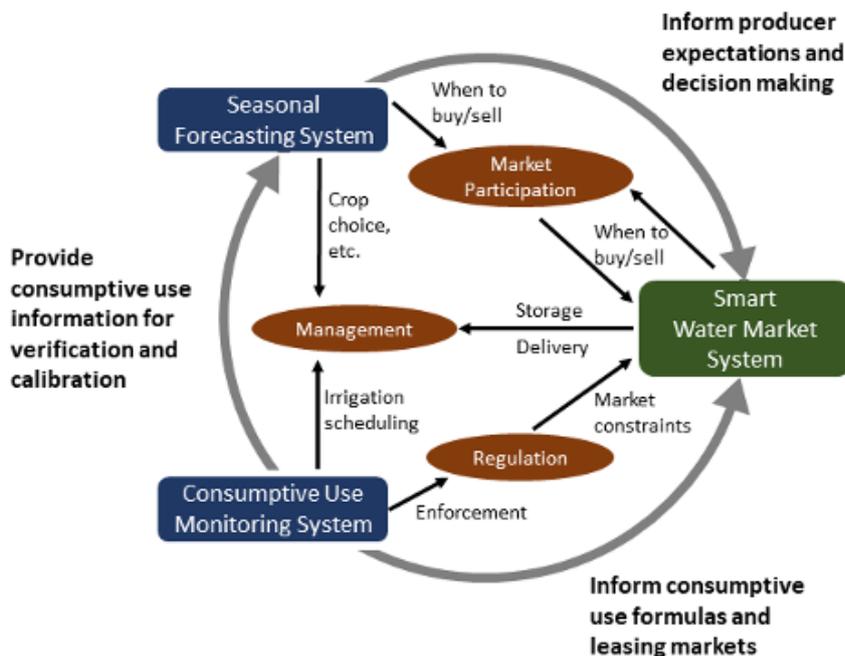


Figure 1. Technology for Trade project: Relationships between technology and institutions

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Full paper available at:

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https://wpcdn.web.wsu.edu/cahnrs/uploads/sites/6/2020/01/WASO_2020_v2_nobleed.pdf

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