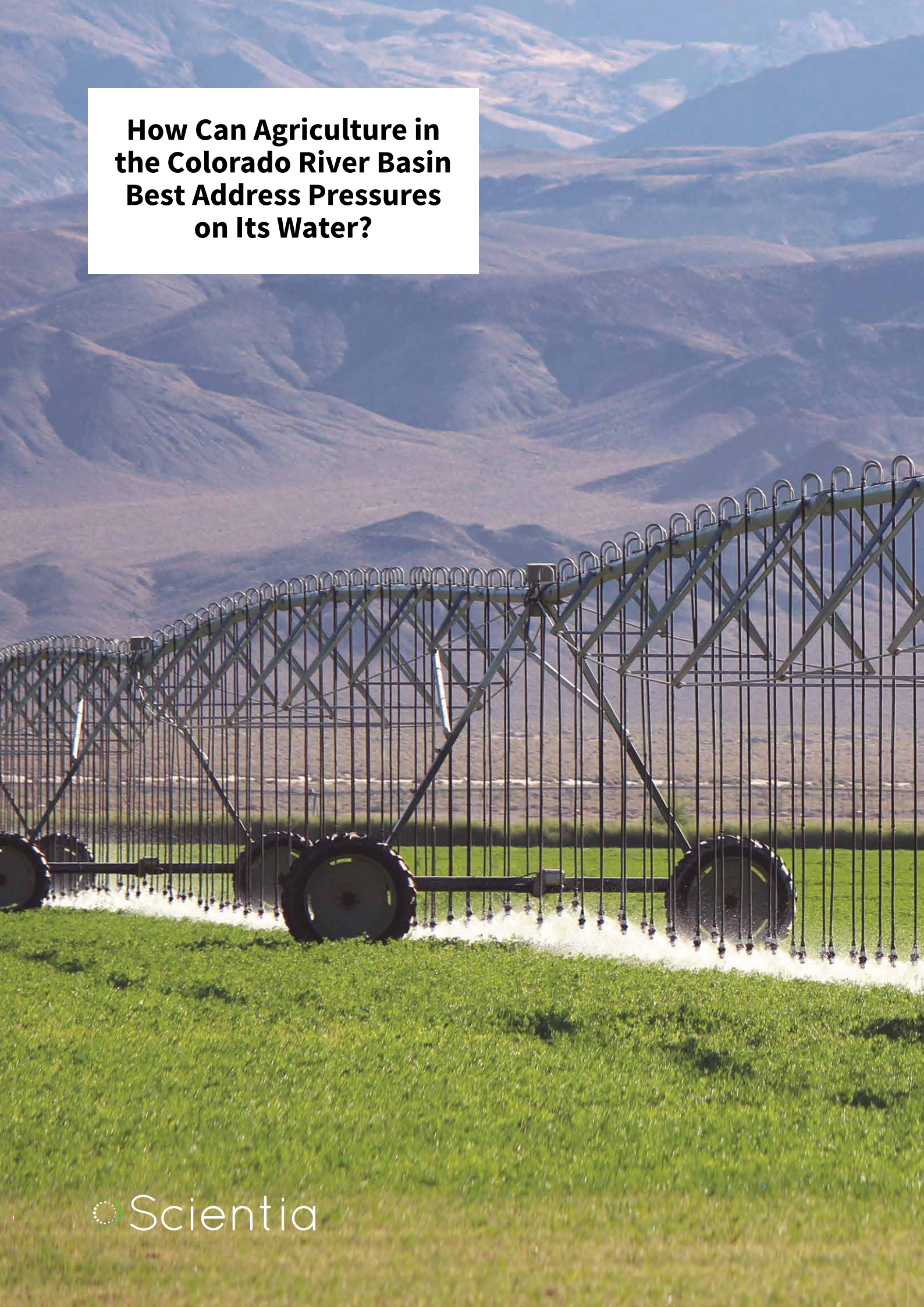
How Can Agriculture in the Colorado River Basin Best Address Pressures on Its Water?



Scientia

HOW CAN AGRICULTURE IN THE COLORADO RIVER BASIN BEST ADDRESS PRESSURES ON ITS WATER?

Water from the Colorado River is critical for agriculture, people and the environment. As populations burgeon and environmental flows are in jeopardy, many see agriculture as the 'go to' source to meet shortages. A group of researchers at Colorado State University has been working with Colorado River Basin agricultural producers and water managers to address this question: Can agriculture cooperate with other sectors to meet water shortages without compromising their ability to produce food and fiber and maintain the viability of rural amenities we all enjoy?

The Colorado River is a major source of water for seven western US states and Mexico, with more than 35 million people dependent on this over-appropriated resource. Urban growth, climate change, and increased recognition of environmental needs all play a role in the projected shortage of Colorado River water in the near future. Long-running drought has significantly lowered the levels of Lakes Mead and Powell – reservoirs key to interstate river water management and hydropower needs.

Diversions of water from the river are greater for agriculture than any other use, so agriculture is targeted for conservation, even though agriculture itself may need more water in the future to meet growing global food demands.

The US Bureau of Reclamation undertook a series of efforts to study the question of water shortages in the Colorado River Basin (CRB) and what might be done to address it. A recommendation of their Basin Study was that one million acre-feet of water currently being used in agriculture could be freed up to meet growing municipal and environmental demands. Many doubt whether that goal is feasible.

The Complexity of the Term 'Ag Water Conservation'

The term 'Ag Water Conservation' has been used by many outside agriculture, and is often seen as a panacea. 'If farmers would conserve water, there would be plenty for other uses,' is a common call. There are decisions farmers can make, and practices they can employ, to use less water. But for those decisions and practices to result in water that can be used for other purposes – such as leaving water in the stream for fish or transferring water to cities – a complex maze of issues must be addressed. And the trade-offs could likely include reduced crop production and loss of wetlands initially created by agricultural practices.

Irrigation efficiency improvements are an important tool with multiple benefits, but to determine the potential role of irrigation efficiency improvements in conserving agricultural water, one must delve into such complexities as 'crop consumptive use' and 'return flows' – the intricacies of which confound not only the public but sometimes agricultural irrigators themselves.The phrase 'use it or lose it' has been used and misused by many, adding to the confusion.

The Colorado River Basin

funding provided by: USDA United States Department of Agriculture National Institute of Food and Agriculture

The institutional and legal framework that governs how water can be applied under the prior appropriation doctrine has worked in the CRB since the late 1800s as a means of fairly distributing water for agricultural and later, urban diversions. It's a system based on private use, however, and the needs of the environment have only recently been integrated into the framework and are therefore usually junior. Whether some water currently being used in agriculture might be temporarily transferred, through fair compensation, to meet urban and environmental needs while preserving our food supply, the wildlife habitat and rural ambiance agriculture provides, is a difficult and complex question. It's the question a group of researchers at Colorado State University set out to explore.

Two CSU Projects for the USDA

For the past seven years, in two USDA funded projects, the Colorado Water Institute at Colorado State University has engaged with CRB agricultural producers and those who manage their water to explore how agriculture might best respond to pressures to free up water to help meet increasing demands for Colorado River water.

For the first project, CSU was advised by a team of water research institutes from the land grant universities in the CRB states – Arizona, California, Colorado, Nevada, New Mexico, Wyoming, and Utah. Extensive interviews and a survey provided insights into what farmers, ranchers and their Ag water managers consider to be pressures and how they're dealing with them.

Building on the first project, CSU's second USDA project drilled into the question: 'What do CRB Ag producers and water managers see as strategies they might take to free up Ag water to meet projected water shortages while securing irrigated agriculture into the future (http://crbagwater.colostate.edu/)?

Addressing the Question from Agriculture's Perspective

Worldwide food demand is projected to increase greatly. As a land grant institution, CSU approached the question from the agricultural viewpoint, recognising the need for the sector to face the demands for water in ways that position them to make water for agriculture more secure rather than more vulnerable. They believe that water security is bolstered when agriculture aims to be part of a complex solution instead of taking a staunch 'don't try to change us – hands off our water' attitude. The research team recognises that agriculture is more than just an economical venture and set out to tackle the myths about irrigated agriculture in the CRB.

Demonstration of Irrigation Efficiency Improvements

CSU researchers worked with No Chico Brush, a grassroots farmer group, to install and test a variety of irrigation management and equipment improvements. Their motivation is not to free up water for use by cities. Instead they want to put their water to its very best use to maximise its productivity for crop production/profit and to stretch it further in times of drought. They believe that by showing they are using their water as efficiently as possible, they can avoid future political pressure to sell their water for other uses (http://crbagwater.colostate.edu/objective1.shtml).

80+ Cases of Ag 'Water Sharing' Compiled

The team combed the literature to find more than 80 cases in the CRB and beyond where agricultural water has been changed in a temporary way to meet multiple uses. These cases offer examples of success as well as occasional failure, illuminating factors at play that influence why and how such projects were undertaken (http://www.cwi.colostate.edu/media/publications/sr/27.pdf and http://crbagwater.colostate.edu/files/Case%20Studies%20for%20Website%202%2024%2016.pdf).

CRB Ag Water Conservation Clearinghouse

The team created a CRB Ag Water Conservation Clearinghouse (http://CRBawcc.colostate.edu/), which compiles information regarding agricultural water conservation in the CRB to help build collaborative relationships between and among agencies, and to offer detailed information and technical expertise on the management, policies, and laws surrounding Ag water conservation in the basin.

Sociological Investigation of Ag 'Water Sharing' for Multiple Benefit

CSU sociologists set out to document and analyse the legal, economic, and social barriers to conserve agricultural irrigation water in the CRB. The researchers conducted an extensive literature review and engaged in more than 50 in-depth interviews with producers involved in six cases of multi-stakeholder collaboration to provide agricultural water for multiple other purposes. The cases include:

- **Temporary leasing of agricultural water for municipal use in the lower Arkansas valley of Colorado**
- **A major rotational fallowing program in California to provide drinking water**
- **A pilot project in Arizona's Yuma County to generate saved 'system water' to offset the effects of drought on Lake Mead**
- **Managing river flows to benefit endangered fish species while improving agricultural irrigation results in western Colorado**
- **Employing 'split-season' irrigation agreements that pay ranchers to reduce their water use late in the season to keep water instream for fish**
- **Diversion structure improvements to improve irrigation management and stream flows on the tributary Verde River in Arizona**

The six in-depth case studies of multi-stakeholder collaboration for agricultural water conservation show that under the right structural and social conditions, such collaboration can prioritise agricultural security while temporarily freeing up water in ways that benefit multiple parties. Enabling structural conditions include: water's movement across geographic and social landscapes of diverse water uses in ways that simplify management of return flow injuries to third parties; allow shepherding of conserved water to intended beneficiaries; and permit effective coordination of the timing and intensity of water delivery for multiples uses. They include legal frameworks that allow for and incentivise water conservation and create safe administrative spaces for experimentation and innovation. Similarly, enabling local social and political conditions are needed that encourage diverse water users to come to the negotiation table and remain there for individual and community benefit. Collaborative water conservation also requires agricultural production systems, including soils, crop types, technology and markets, that allow farmers to derive more benefits from water conservation than risks to their livelihoods.

Dialogue to Strategize Multi-Benefit Approaches

In two major workshops, one in the lower CRB and one in the upper CRB, researchers brought together those interested in or concerned about agricultural 'water sharing' to discuss alternatives to permanent transfer of water from agriculture to meet other demands. These workshops were based on an extensive synthesis of alternatives to permanent fallowing research (http://cwi.colostate.edu/media/publications/cr/232.pdf). Several methods were discussed that are seen to have potential, including a pilot program to free up 'system water' for Lake Mead, if the problem of how to shepherd agricultural water from its origin could be solved (http://cwi.colostate.edu/media/files/shepherding/2017-11-14_Workshop-Report.pdf).

Within the state of Colorado, more than a dozen other workshops and meetings yielded significant insights about attitudes surrounding Ag water conservation. A better understanding of these attitudes and positions can be instrumental in improving collaborative efforts (http://www.cwi.colostate.edu/media/publications/sr/31.pdf).

The team engaged with the State of Colorado's Division of Water Resources to convene influential water lawyers, agricultural and conservation groups, and others to investigate the concept of 'use it or lose it', believed by many to be a major stumbling block to acceptance of Ag water conservation. Analysis of pertinent statutes in state law led to publication that is spurring needed dialogue among Ag producers and others (http://www.cwi.colostate.edu/media/publications/sr/25.pdf).

Engagement of Students in Dialogue about Water/Water Conflict

In a variety of settings, the team worked with students to share project findings and to engage them in dialogue about multi-stakeholder collaboration.

- Three groups of agricultural and natural resources students at CSU participated in facilitated dialogue to help them understand and bridge differences in values, leading to collaboration instead of conflict.
- Five graduate students received insights from facilitators and mediators active in the work of water stakeholder collaboration, and practiced skills learned.
- Eight Latino CSU students were chosen for an inaugural program – CSU Water Sustainability Fellows – designed to increase interest in water issues from underrepresented populations.
- Five CSU Water Sustainability Fellows were granted paid summer internships to work with six low-income high school students of color to learn about water issues related to the expansion of the national western stock show complex in Denver. Together, these eleven students planned a Denver Youth Water Summit.

Lessons Learned

- Many technical, legal and social obstacles to Ag water conservation can be overcome if safe space is created for ditch companies and irrigation districts to work and experiment with those from other sectors to lead to mutually beneficial outcomes.

- CRB water governance system is not set in concrete. Changes can be made and workarounds are possible at the local scale. The technical and social/economic sides ought to be pursued concurrently. Each ditch company and irrigation district is unique and there will not be a single approach that works everywhere.

- Getting Ag producers or groups of ditch companies to work together can be difficult, but it's a crucial first step. Various approaches tried in different places have yielded insights that can be instructional in showing what has and has not worked under certain circumstances. In many cases, it's not clear what's being asked from Ag. Clarifying that will lead to greater cooperation and less resistance from agriculture.

- Irrigation efficiency and Ag water conservation are not the same, yet the terms are often used interchangeably. Efficiency improvements may or may not contribute to river flows. True conservation usually means a reduction of crop consumptive use, which comes with a yield penalty and loss of revenue in many cases. Consistent use of proper terminology and understanding of the complexity is critical if we want to make the changes needed to meet specific objectives and achieve desired outcomes.

- What's needed is accurate and uniform quantification of diversions, crop ET, irrigated acres, and return flows. This can be tackled with current technology but most farmers at this point don't see a benefit for consistent volumetric measurement and may even oppose it.

- Switching to other crops requiring less water is often held up as a solution, but data and studies to date do not convince producers. Economics, markets, climate and water availability largely determine crop and livestock choices, as well as irrigation system type. Other sectors and the public need to realise the costs and trade-offs required for crop switching to be realistic.

- The current Ag economy in the upper basin states of the CRB cannot absorb the costs of system improvements to be more efficient. Financial incentives do not exist for forage crop producers to become more efficient without significant external incentives.

- Ag is not just economics or purely business; there are social, cultural, generational complexities at play. In many cases, farmers have rational reasons to wait before they make changes in their operations.

- Small projects can be successful locally, but they alone are not going to bring the system into balance. To make a significant difference in the basin scale water balance, coordinated system-wide actions at the head gate are necessary to reduce diversions while maintaining return flows. This will require significant public investment and likely some market-based solutions.

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WHAT IS NEEDED NOW

Quantification
Tackle the science, data and modelling needs to quantify consumptive use and return flows on a parcel basis that can be spatially scaled through remote sensing.

Irrigation Efficiency Measures
Take a close look at the irrigation efficiency improvements recommended under the Regional Conservation Partnership Program of the USDA's Natural Resources Conservation Service. To what extent will irrigation efficiency improvements affect return flows, delivery patterns, junior water rights holders, and the ecosystem services of the impact areas?

Markets
What market-based conditions could incent farmers to conserve, reduce or forego diversions, and engage in short or long-term transfers? Are water market solutions (temporary and permanent transfers) more cost-effective than spending funding on irrigation system improvements (looking at long-term agricultural and food security?)

Shepherding
The problem of shepherding conserved water from the point of conservation to an intended use elsewhere (up or down) on the stream is a major obstacle. This requires consideration of hydrological, legal and social-organisational factors.

Legal / Institutional
Investigate the challenges and possibilities of legally and politically institutionalising the conservation of water as a formal beneficial use by a user and therefore, protecting the conserving water user's existing water right.

Closing

Virtually all those using water for agriculture in the CRB are involved in some degree of conflict, much of which is related to water leaving agriculture for urban uses. Another large part of the conflict is disagreement over the permitting of new or enlarged storage projects seen by most agricultural water users as critical for wise use of resources and seen by some environmental groups as detrimental to natural habitats.

Some of the wild cards include water rights held by energy developers who are not yet calling on those rights, unquantified tribal claims amounting to as much as 2 million-acre feet of Colorado River water, and the vulnerability of large cities like Denver who have relatively junior rights to Colorado River water and could be called out if the lower basin states do not get the water to which they are entitled.

Solutions to both long and short-term water shortage emergencies on the already over-appropriated Colorado River need to be devised in close consultation with irrigators before the inevitable drought or other shortage creates a crisis.

The dilemma of how to reconcile or manage competing demands for Colorado River water will never go away. Improving communication and relationships between agricultural, urban and environmental stakeholders will likely be the best tool we can use and improve going forward.