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Western Landowners Alliance

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Agricultural Water Users' Preferences for Addressing Water Shortages in the Colorado River Basin

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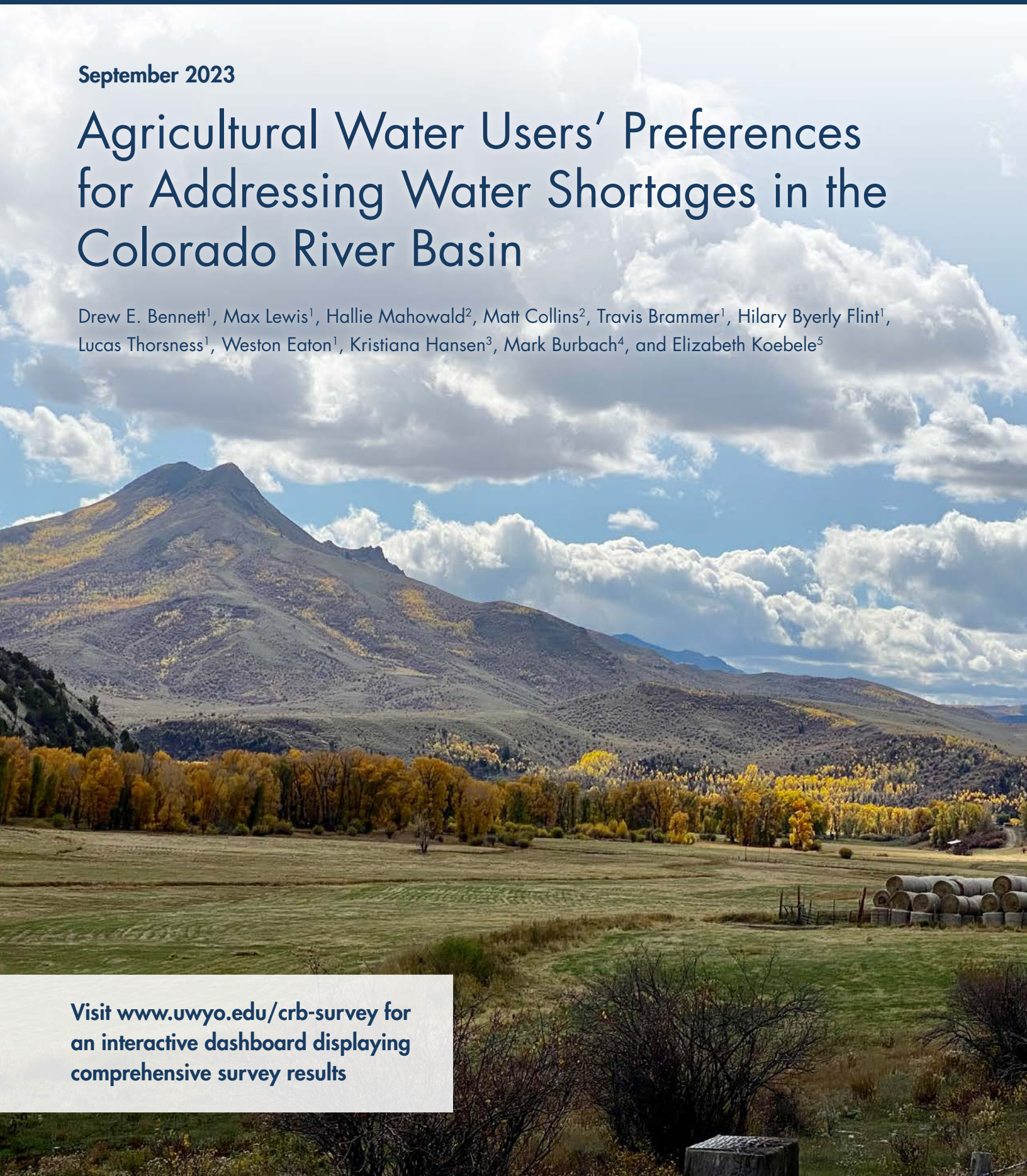

Visit www.uwyo.edu/crb-survey for an interactive dashboard displaying comprehensive survey results

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The Western Landowners Alliance advances policies and practices that sustain working lands, connected landscapes, and native species.

Executive Summary

The Colorado River Basin is in crisis. There is no longer enough water for all of those who depend on it. The agricultural sector is the largest water user in the Colorado River Basin, meaning that farmers and ranchers are central to both the impacts of and solutions to water shortages. Their involvement will be key to developing effective policy solutions to today's water crisis.

We surveyed 1,020 agricultural water users throughout six states in the Colorado River Basin to understand their perspectives on the present crisis, their current water conservation practices, and their preferences for strategies to address water shortages going forward. Agricultural water users were primarily concerned about how the current situation could impact water policy, constrain irrigators' own water use, and constrain other agricultural water users. We also conducted qualitative research to capture preferences for local approaches to managing water and provide additional context on dynamics in the Colorado River Basin, including interviews with 12 agricultural producers and water experts and a focus group with 10 agricultural water users in Colorado.

Perhaps unsurprisingly, **we found agricultural water users are already responding to water shortages. Roughly 70% of surveyed agricultural water users have already adopted one or more water conservation practices or adaptation strategies**. Importantly, many would consider adopting additional practices. Despite this, few respondents participated in or were aware of formal programs to support water conservation. One exception, however, was the Natural Resources Conservation Service's Environmental Quality Incentives Program (EQIP). A third of respondents currently or previously participated in EQIP and an additional 37% were aware of the program. Information gathered from interviews and the focus group identified multiple burdens to participation in EQIP and similar programs, and several participants thought the benefits were not worth the effort. These insights suggest an opportunity for revisiting how formal programs meant to incentivize water conservation connect with water users.

Most survey respondents were unlikely to adopt water conservation practices as part of formal demand management or system conservation programs to address water shortages. Only one of eight practices included in the survey – enhancing water delivery systems – had a majority of respondents state that they were likely to adopt the practice. The remaining seven practices had a considerably lower likelihood of adoption. **Respondents were also generally opposed to water transfers as a solution to shortages.** Opposition was strongest to permanent transfers broadly, as well as to temporary transfers from agricultural to non-agricultural uses. Only temporary transfers from agricultural water users to other agricultural water users had less than 50% opposition. **Major barriers to supporting water transfers included concerns about losing water rights, even in temporary transfer arrangements, as well as insufficient financial compensation.** Addressing these concerns will be critical to increase participation of agricultural water users in demand management or system conservation. Still, although support for temporary water

Photo by Louis Wertz

transfers and demand management practices was low, even equivalently low participation (e.g., 10% to 20%) could help address water shortages as part of a portfolio of strategies for the Colorado River Basin.

We also documented an overwhelming preference for local approaches to managing water shortages and a trust gap with non-local agencies. This was evidenced by respondents' preference for the local management of formal programs, such as some of the demand management and system conservation programs under consideration, as well as for the administration of funding for water conservation and other programs. Qualitative research participants communicated that strategies to address water shortages must account for the diversity of local contexts across the Colorado River Basin. These strategies could therefore be best implemented at the local level through existing delivery infrastructure and by managers with track records of success. State and federal water managers and agencies involved in program delivery should emphasize building trust with agricultural water users and gaining knowledge about unique features of local contexts. **Simply providing additional funding for formal water conservation programs may be inadequate to meet the diversity of challenges across an area of 246,000 square miles.** Developing opportunities for dialogue and listening can help foster relationships and improve trust among key stakeholders.

Given the importance of agriculture as the primary water user in the Colorado River Basin, **proactively engaging agricultural communities will be critical to successfully managing water shortages**. Understanding the perspectives and preferences of agricultural water users, as documented in this report, can help guide the development of solutions that work for producers and other users in the Basin.

Introduction

Photo by Max Lewis

The Colorado River Basin (the Basin) is in crisis. Declining flows of roughly 20% over the last century have increased pressure on water users throughout the Basin and created significant challenges for meeting multiple competing demands (Hoerling et al. 2019). Reduced water levels at the Basin's two largest reservoirs, Lake Powell and Lake Mead, have put hydropower generation at risk; prolonged drought raises the specter of the reservoirs reaching "dead pool" levels, where no water would flow below the dams.

The ongoing crisis has spurred multiple policy responses, including at the federal level. In 2022, the federal government called for the seven Basin states (Arizona, California, Colorado, New Mexico, Nevada, Utah, and Wyoming) to conserve 2-4 million acre feet of water in 2023. In May 2023, the Basin states presented a "consensus-based system conservation" proposal that would reduce water use in the lower portion of the Basin (below Glen Canyon Dam) over the next three years, if approved by the U.S. Department of Interior. A large portion of these reductions, as well as other water conservation initiatives throughout the Basin, will be funded through the Inflation Reduction Act and Bipartisan Infrastructure Law, with the goal of stabilizing the system in the near term. In June 2023, the federal government initiated another process to renegotiate river management rules after 2026, when several current policies expire.

Agriculture plays a critical role in the Basin, generating an estimated $8 billion in direct income in addition to other indirect and induced economic activity (de Souza et al. 2020). The Basin produces important food and fiber crops, including an estimated 90% of the winter vegetables for the United States (Cohen et al. 2013). Agriculture also accounts for approximately 79% of the consumptive use of water in the Basin, and agricultural users hold most of the senior water rights (Richter et al. 2020). In some parts of the Basin, flood irrigation and other water management practices create wetland habitat that is critical to sage-grouse, wetland birds, and other wildlife (Donnelly et al. 2016, Moulton et al. 2022). Flood irrigation can also recharge shallow aquifers that supplement late season baseflows of adjacent rivers (Peck and Lovvorn 2001, Fleming et al. 2014). Chronic water shortages significantly impact agriculture, and agriculture must be part of a long-term solution to addressing water shortages.

There is a current window of opportunity for agricultural operations to take advantage of the historic federal funding being directed to the Basin for water conservation efforts. Ensuring that such efforts are compatible with the goals of agricultural producers will increase their overall impact. The goal of this research is to understand agricultural water users' concerns and management preferences to inform ongoing policy processes. Our hope is that this effort can contribute to proactive engagement with the agricultural sector and help chart a path forward for managing chronic water shortages in the Basin.

Photo by Drew Bennett

Below we describe the research approach followed by our key findings and conclusions. Within the findings section, we describe who responded to the survey, document concerns about water management in the Basin, assess current water conservation practices and adaptation strategies, and detail preferences for future water conservation efforts. We present many of the results according to whether the respondent's operation is in the Upper Basin states (Colorado, New Mexico, Wyoming, and Utah) or the Lower Basin states (Arizona and California)[1]. Water is managed in distinct ways in the two areas of the Basin, and some similarities exist among agricultural water users in their respective geographies. We also provide additional information in the Appendices detailing the research approach and presenting supplementary findings and sharing the survey questionnaire.

In addition to the results presented in this report, we encourage readers to visit www.uwyo.edu/crb-survey for an interactive dashboard of comprehensive survey results. The dashboard allows viewers to display results using a range of filters including by state and operational characteristics.

Research approach

This research relied primarily on a scientific survey of agricultural water users in the Basin. The survey asked agricultural water users about characteristics of their operation, concerns about the situation in the Basin, information needs, current or previous water conservation practices, perceptions of water management in their state, and preferences for programs to address water shortages in the Basin. We developed the questions based on previous research and input from experts with a range of experience across the Basin.

We developed a stratified random sample of agricultural water users in six Basin states (Arizona, California, Colorado, New Mexico, Utah, and Wyoming). We developed the sample using Geographic Information Systems (GIS) mapping software to overlay county assessor parcel data with mapped irrigated agricultural fields, allowing us to extract properties intersecting with agricultural fields. We then randomly sampled 6,000 properties across the six states and weighted the sample for each state proportionately to the number of irrigated properties in the Basin (see Appendix A for additional details on the sample development).

We worked with the Wyoming Survey and Analysis Center (WYSAC) to implement the survey between November 2022 and March 2023. WYSAC sent each contact in the sample an initial letter with a link to an online version of the survey. After several weeks, WYSAC followed up with a physical copy of the questionnaire, followed by a reminder postcard and then a second physical copy of the questionnaire (see Appendix C for the full questionnaire).

1 Though a portion of Nevada is part of the Basin, we excluded Nevada from our data collection due to the small number of agricultural water users that rely on Colorado River water in the state. New Mexico also has agricultural water users in Upper and Lower portions of the Basin. Although a strong majority of water users are in the Upper Basin, we separated out responses for New Mexico when presenting results by Upper and Lower Basin.

We complimented the survey data with 12 interviews with agricultural water users and other experts involved with water management in the Basin, as well as a focus group with 10 agricultural water users in North Park, Colorado, on April 17th, 2023. We conducted interviews with agricultural producers and water management experts in every state except New Mexico and Nevada. These qualitative data collection methods provided additional context for water management at the local level and helped us interpret the quantitative survey data.

We elaborate further on the details of our research approach, including its limitations, in Appendix A.

Photo by Max Lewis

Findings

RESPONDENT CHARACTERISTICS

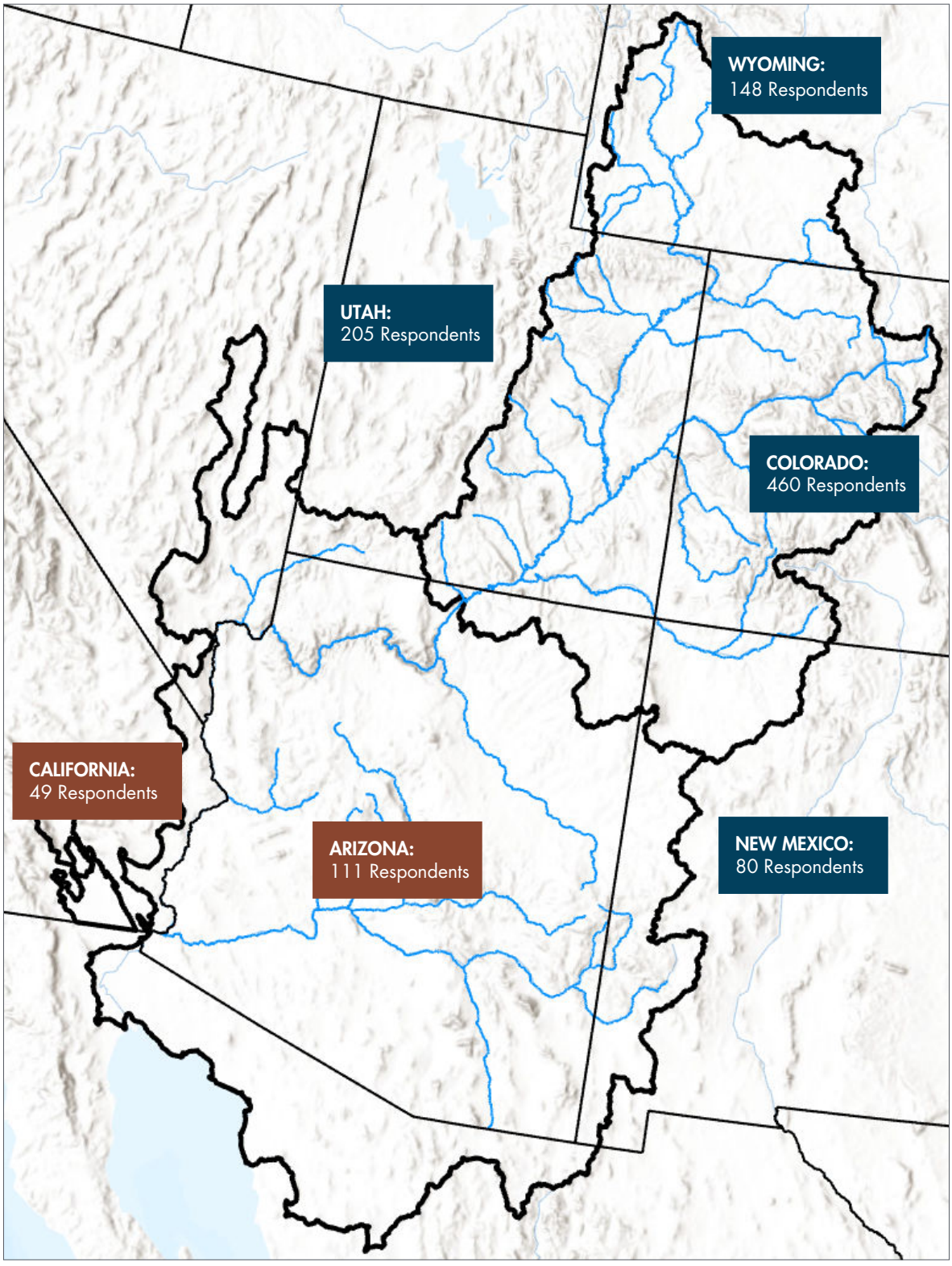
We received complete or mostly complete responses from 1,020 contacts included in our sample (state breakdown is shown in Figure 1). Taking into account undeliverable mailings, this represented a 20% response rate. We note that individual respondents may have skipped some questions, so our total number of responses varies for each question.

We collected 863 responses from agricultural water users in the Upper Basin and 157 responses from the Lower Basin (Figure 2). Responses from water managers in the Upper Basin represented roughly 201,000 acres, resulting in a mean irrigated acreage of 238 acres per respondent. In the Lower Basin, respondents collectively irrigated approximately 150,000 acres, for a mean of 966 irrigated acres per respondent. In the Upper Basin, 81% of irrigated properties were owner-operated, whereas in the Lower Basin 52% were owner-operated. In both the Upper and Lower Basin, 58% of properties have been in the owner's family for 30 years or more.

We received a much higher response rate in the Upper Basin (roughly 25%) than the Lower Basin (roughly 9%). This may be a result of different landownership patterns, the types of agricultural operations in the Upper and Lower Basins, or how we constructed our sample. Based on our data and interviews with experts, owner-operators are more common in the Upper Basin, while in the Lower Basin, leased land for agricultural operations is more common. Since we constructed our sample from property ownership records, owners that lease their properties to other operators may not have filled out the survey or shared it with the operator on the property.

Between the two parts of the Basin, there were notable differences in which agricultural products generated more than 50% of the respondents' income (Figure 3). Livestock accounted for a majority of the income for 42% of respondents in the Upper Basin and just 17% of respondents in the Lower Basin. Alfalfa, grass hay, or pasture produced the majority of income on 35% of responses in the Upper Basin and 38% of responses in Lower Basin while row crops were the dominant income source for 20% of properties in the Lower Basin and just 2% in the Upper Basin. No single source made up a majority of income for 17% of properties in either the Upper or Lower Basin.

*Figure 1. Map of the Colorado River Basin and number of respondents in each state**



*The number of respondents for each state includes multiple counts for respondents that irrigate in multiple states (n=33).

*Figure 2. Respondent characteristics in the upper and lower portions of the Basin**

	UPPER BASIN	LOWER BASIN
TOTAL RESPONSES:	863 WATER USERS	157 WATER USERS
TOTAL ACREAGE IRRIGATED REPRESENTED	201,419 ACRES	149,821 ACRES
AVERAGE IRRIGATED ACREAGE OF RESPONDENTS	238 ACRES	966 ACRES
OWNER OPERATED PROPERTY (%)	81%	52%
RESIDE ON IRRIGATED PROPERTY (FULL OR PART TIME) (%)	89%	47%
LANDOWNER (OR THEIR FAMILY) HAVE OWNED PROPERTY FOR 30 YEARS OR MORE (%)	58%	58%

Figure 3. Dominant agricultural products (> 50% of farm income) of respondents in each basin

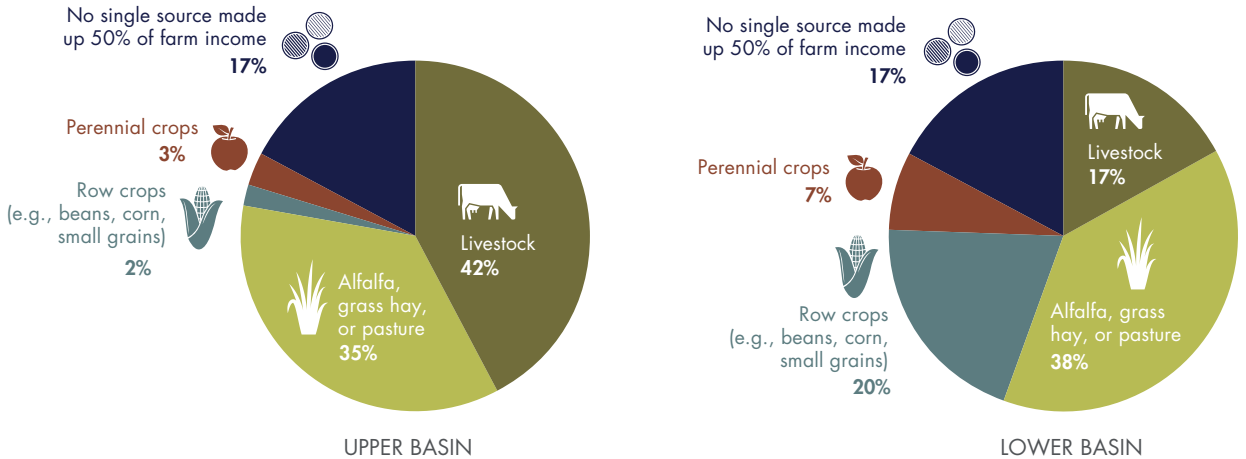
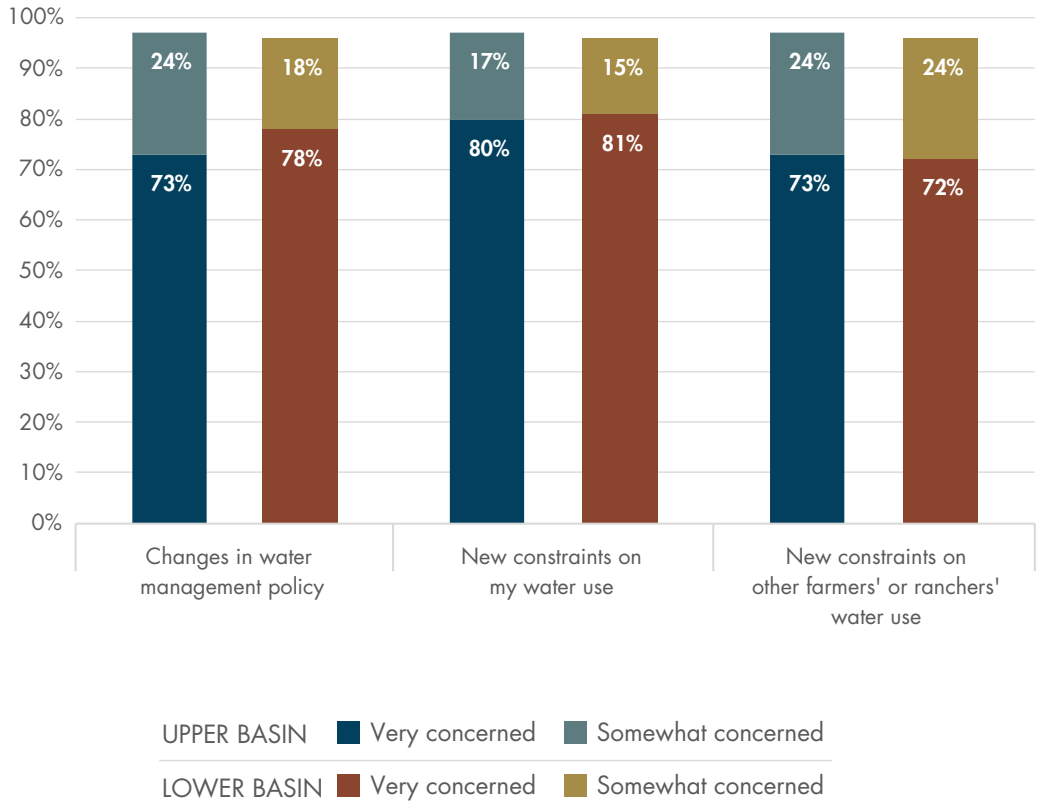


*Figure does not include respondents that irrigate in both the Upper and Lower Basins. Some respondents did not answer every question included in the figure.

CONCERNS ABOUT WATER SHORTAGES

Respondent water users have significant concerns about potential impacts from water shortages in the Basin. We asked about 11 potential impacts of water shortages, and a majority of respondents said they were "very concerned" about 6 potential impacts: new constraints on their water use, changes in water management policy, new constraints on other farmers' or ranchers' water use, inability to continue their operation, high costs of water, and high costs of water-saving technology. Over 80% responded that they were "very concerned" about the potential for constraints on their water use – the impact with the highest level of concern. This was followed by changes in water management policy and new constraints on other farmers' or ranchers' water use (Figure 4).

Figure 4. Concerns about potential impacts from water shortages in the Basin.



Concerns about potential impacts were largely consistent between the Upper and Lower Basins, although there were some differences for specific impacts. Respondents in the Lower Basin expressed higher levels of concern for the high cost of water (62% very concerned), inability to continue their operation (61% very concerned), and the inability to plan for their operation (57% very concerned) (Figure A1 in Appendix B). Those in the Upper Basin shared those concerns, but fewer respondents responded as "very concerned" (53%, 53%, and 49%, respectively). The higher level of concern for the inability to continue their operations in the Lower Basin may be related to the fact that Lower Basin states have historically overused their water allocation, and some users have already begun to face cuts in water deliveries as the drought has progressed. Cuts to water allocation on the Central Arizona Project (CAP) have hit irrigators

Photo by Elizabeth Koebele

particularly hard and many have pivoted to relying on groundwater while also fallowing fields to adapt to shortages. These dynamics raise considerable uncertainties about the long-term viability of agricultural operations in the region. During an interview, a farmer on the CAP system shared that there was little long-term hope for agriculture on the system. He saw groundwater as the only option in the near term, but questioned the long-term sustainability of groundwater resources. "There's not much to do [to address current shortages] and farming is going to have to go somewhere else…. There's enough [ground] water to pump for a while, but it won't last forever."

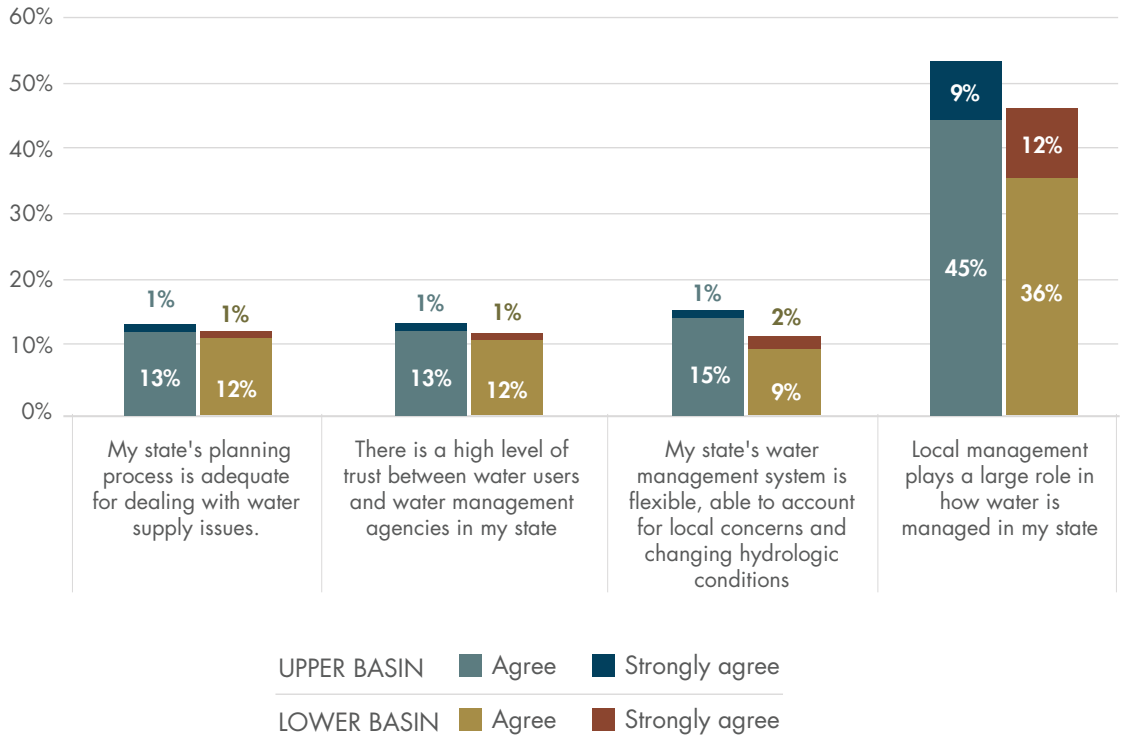
New constraints on urban residents' water use had the lowest level of concern among the 11 impacts we asked about, with just 31% of respondents in the Upper Basin and 32% of participants in the Lower Basin responding that they were "very concerned". Although this potential impact had the lowest level of concern, agricultural water users in interviews acknowledged the potential political ramifications of shortages to municipal water users. As a rancher in western Colorado expressed, "I have very senior [water] rights, but when the tap runs dry in Denver, we'll see how much that means."

Several interviewees expressed similar concerns, citing the belief that the political power tilted towards urban areas. If water shortages significantly impacted urban water users in their states, it increased the potential for policy changes to long-standing management under prior appropriation, a legal system under which agricultural users typically hold the oldest and most secure water rights. These interviewees felt that agriculture needed to be part of a solution to addressing water shortages in order to prevent policy changes, yet they also thought that municipalities and urban water users needed to do more to increase efficiency and manage their own growing demands.

Few survey respondents thought that current water management policies and practices in their state were sufficient for addressing shortages. Only 1% in the Upper Basin and 2% in the Lower Basin "strongly agreed" with the statement that "My state's planning process is adequate for dealing with water supply issues," with only 10% in the Upper Basin and 9% in the Lower Basin "agreeing" with the statement (Figure 5). The percentage of respondents agreeing or strongly agreeing with the statements "There is a high level of trust between water users and water management agencies in my state" was nearly identical across Basins (approximately 14%), while 16% of Upper Basin respondents and 11% of Lower Basin respondents agreed or strongly agreed with the statement "My state's water management system is flexible, able to account for local concerns and changing hydrologic conditions." Generally, these responses reflect a low level of trust in state water management institutions to effectively manage shortages.

Conversely, a majority of respondents "strongly agreed" (45% in the Upper Basin, 36% in Lower Basin) or "agreed" (9% Upper Basin, 12% Lower Basin) that "Local management plays a large role in how water is managed in my state" (Figure 5). These results reflect a sentiment expressed in interviews that local conditions are critically important to consider in implementing water management practices and policies. The divergent results between perceptions of state water management and the importance of local management points to a perceived gap among agricultural water users in coordination between state and local levels.

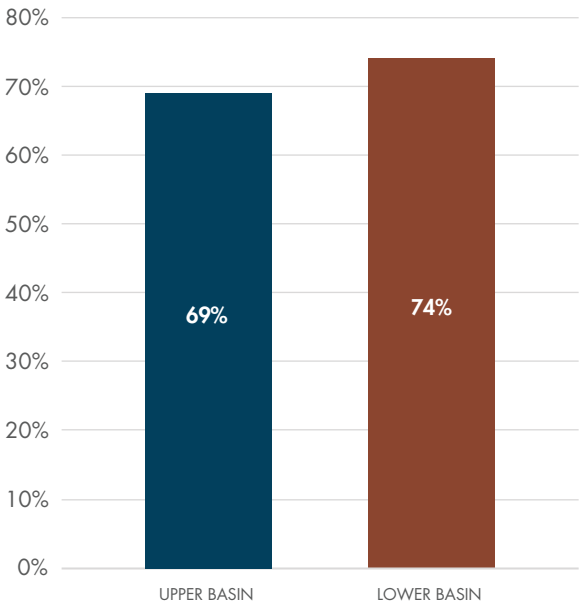
Figure 5. Level of agreement with statements about water management.



WATER CONSERVATION PRACTICES AND ADAPTATION STRATEGIES

Understanding agricultural users' current or previous water management practices and adaptation strategies can provide insight into new water conservation programs that attract participation from more agricultural water users, the largest water use sector in the Basin. We asked survey participants whether they currently or have previously adopted the following 11 water conservation practices or strategies to adapt to water shortages: plant crops that require less water, grow less water intensive varieties of the same crops, temporarily fallow fields, permanently reduce irrigated acreage, split season irrigation, switch irrigation method to one less water intensive, explore opportunities to purchase or lease more water, change to a livestock operation, reduce livestock herd, change to a crop operation, and change the location of farm/ranch. Participants were given the following response options: "Yes"; "No, but I would consider adopting in response to water shortages"; "No, and I would not consider adopting in response to water shortages"; and "Not applicable".

Figure 6. Percentage of respondents that have pursued one or more water conservation practices or adaptation strategies.

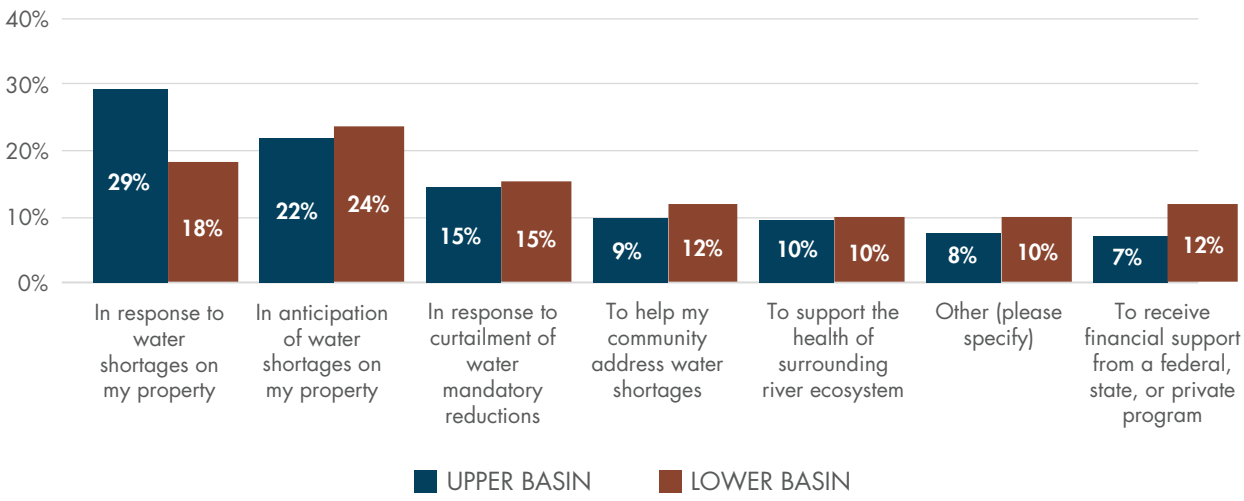


Sixty-nine percent of respondents in the Upper Basin and 74% of respondents in the Lower Basin have adopted one or more of the 11 practices or strategies included in the survey (see Figure 6), reflecting a generally high level of engagement with conservation. However, there were differences between the Upper and Lower Basins in the types of practices and strategies currently or previously adopted and respondents' willingness to adopt or consider adopting particular strategies in response to water shortages in the future.

For previously adopted practices, roughly 38% of Lower Basin respondents have temporarily fallowed fields, and 32% have planted crops that require less water (Figure A2 in Appendix B). In the Upper Basin, only 20% of respondents have adopted the same practices. This difference likely stems from the lower availability of alternative crop options and the multi-year agronomic impacts associated with fallowing in much of the Upper Basin, both due to the higher elevations and harsher climate conditions. Also in the Upper Basin, respondents were much more likely to have reduced their livestock herd (27% versus 10% in the Lower Basin). This difference is likely due to ranching being a more dominant type of agricultural operation in the Upper Basin.

When asked about the reasons for adopting conservation practices or adaptation strategies, the top responses were "in response to water shortages on my property" (29% Upper Basin, 18% Lower Basin) and "in anticipation of water shortages on my property" (22% Upper Basin, 24% Lower Basin) (Figure 7). While environmental motivations, such as maintaining instream flows, were important to a couple of agricultural users we spoke with during interviews, only 10% of respondents reported this as a reason for adopting conservation practices. This potentially reflects a broad fear of losing water rights if they are not put to a declared beneficial use.

Figure 7. Agreement with reason for adopting a water conservation practice or adaptation strategy.



To address future water shortages, respondents in the Lower Basin were generally more willing to consider adopting a practice or adaptation strategy, such as permanently reducing irrigated acreage (40% of respondents) than their counterparts in the Upper Basin (27% of respondents) (Figure A2 in Appendix B). This may, once again, reflect the fact that some Lower Basin water users have already experienced reductions in water deliveries. That said, while the Upper Basin states do not use their full allocation of Colorado River water, many users in the region have also experienced shortages in low streamflow years due to minimal reservoir storage in the higher parts of the Basin.

WATER CONSERVATION PROGRAMS

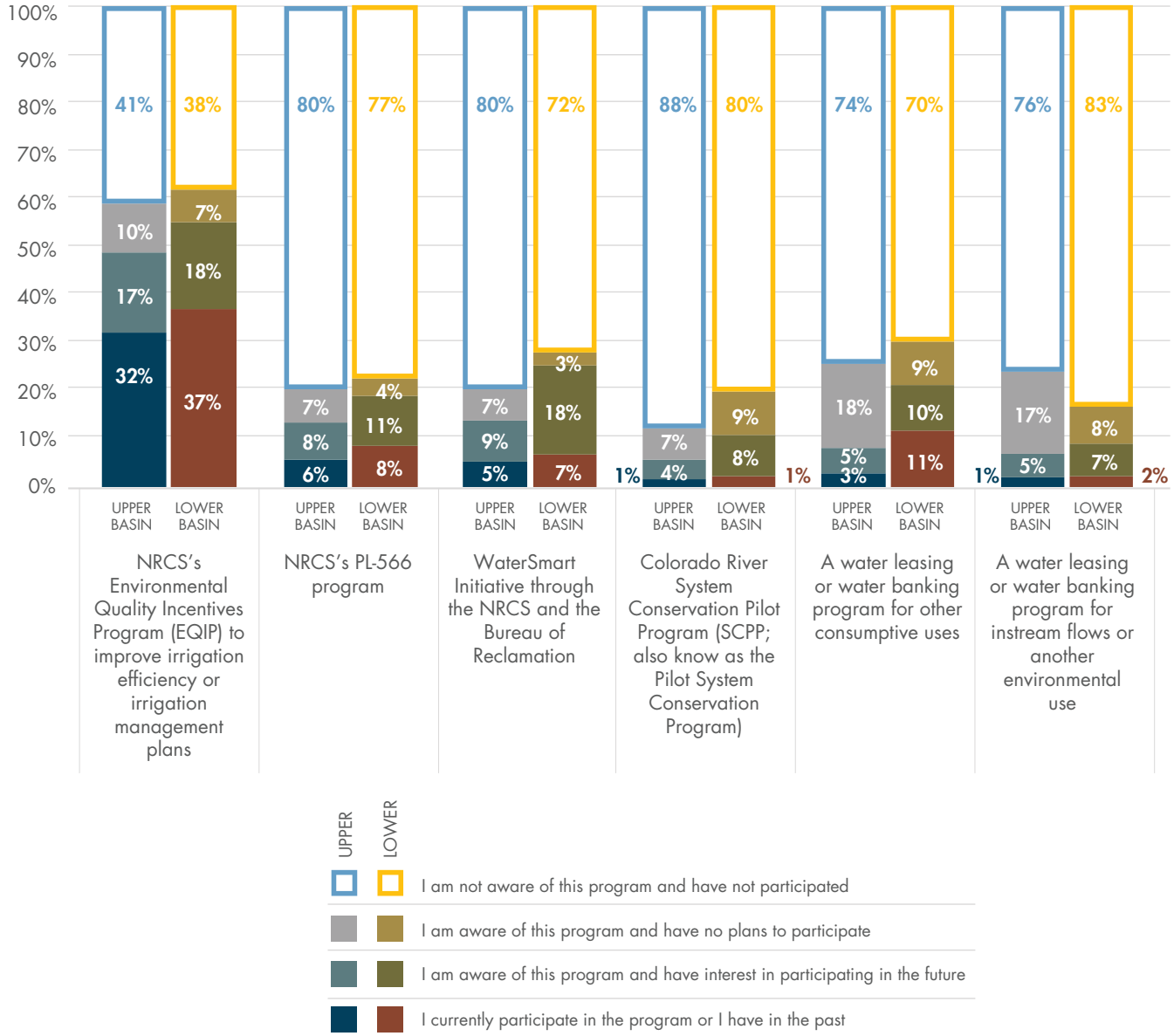
We asked about respondents' program participation in and awareness of four specific federal and regional water conservation programs: Natural Resources Conservation Service's (NRCS) Environmental Quality Incentives Program (EQIP), NRCS's PL-566 program, WaterSmart Initiative through the NRCS and the Bureau of Reclamation, and the Colorado River System Conservation Pilot Program (SCPP). We also asked about more general water leasing or banking programs for consumptive uses and instream or environmental uses.

A majority of respondents in both basins were unaware of the programs with the exception of the NRCS's EQIP, a program intended to address a wide range of natural resource issues including irrigation practices (Figure 8). Roughly 33% of respondents had participated in an EQIP contract related to irrigation and an additional 17% were aware of the program and had interest in participating in the future. Few respondents had participated or were aware of leasing or banking programs, such as the Colorado Water Trust's leasing programs for instream or environmental flows, which may be due to the limited geographic locations where these types of programs currently exist.

Although NRCS's EQIP was the best-known program of those we asked about and had the highest levels of participation and interest, participants in the focus group expressed significant frustrations with participation in NRCS programs. As one participant stated, "when we're talking NRCS projects and EQIP and that kind of stuff with all the hoop jumping… I'm still in the middle of a hoop jump that I'm never going to get through. I can just say, the definition of 'never' is to try to run an EQIP program with NRCS after COVID." Another added, "the way some of these programs are structured, the juice isn't worth the squeeze, so to speak. But if there's a more efficient way to deliver money on the ground, there'd be several people here [that would be] interested [in participating]."

Focus group participants thought that state grant programs administered through local committees, such as Colorado's Habitat Protection Program (HPP) and others administered by the Colorado Water Conservation Board, were much better models for delivering programs on the ground. Improving the ease of enrollment in programs like EQIP, or modeling approaches on programs like Colorado's HPP, will be critical for broad engagement of agricultural users in future conservation efforts.

Figure 8. Program awareness and participation.



PATH FORWARD

As states and federal agencies continue to implement efforts to address water shortages in the Basin, developing strategies that effectively engage agricultural water users will be critical. We asked about several strategies under consideration in the Basin, such as forms of demand management or system conservation[2] practices piloted under the

2 Demand management and system conservation are similar concepts that involve temporary, voluntary, and compensated measures to reduce water consumption. They differ in that water conserved under demand management is stored and available to meet state or subbasin obligations under the Colorado River Compact while water conserved under system conservation becomes "system water" and is not credited to a state or subbasin for Compact compliance purposes.

Photo by Max Lewis

System Conservation Pilot Program (SCPP), as well as several water transfer programs, to understand the interest and support for such efforts. As a whole, there was low interest in most of the demand management or system conservation practices we asked about and general opposition to water transfers under most circumstances.

In addition to asking what practices respondents had already engaged in (Figure 6 above and Figure A2 in Appendix B), we also asked about practices they would willing to adopt, moving forward, as part of a formal demand management or system conservation program. We asked about these 8 practices: split season irrigation, earlier harvest than normal then turn off water, no irrigation on some fields for the whole year, no irrigation of the same fields for multiple years, forego the use of any stored water, investments that reduce water use by enhancing delivery systems, everyone a tributary or irrigation district agrees to implement some version of the specified management practices, and everyone on tributary or irrigation district agrees to reduce water use by a certain amount with no specification of management practices.

Respondents in the Lower Basin were more likely to adopt all of the 8 practices as part of a formal demand management or system conservation program than respondents in the Upper Basin. Of the practices we asked about, "investments that reduce water use by enhancing delivery systems" overwhelmingly garnered the most interest from water users in both parts of the Basin relative to other practices (24% very likely and 32% somewhat likely to adopt in the Upper Basin; 29% very likely and 32% somewhat likely in the Lower Basin). This was also the only practice that more than 7% of respondents in the Upper Basin said they would very likely adopt as part of a demand management program (Figure 9).

In both parts of the Basin, the two practices with the next highest likelihood of adoption were collective efforts of all water users on a tributary or irrigation district to: agree to reduce water use by a certain amount, and implement a specified management practice (Figure 9). The greater interest in these collective practices was explained by focus group participants who emphasized that collective decision making is often essential in managing a shared ditch system. Consequently, many irrigators are accustomed to coordinating with their neighbors on irrigation practices through their informal networks. The practices with the next highest likelihood of adoption were fallowing fields for a whole season followed by split season irrigation. Although these results do not reflect broad likelihood of adoption among agricultural water users, even 10% to 20% adoption rates could have an impact as part of a portfolio of strategies to address water shortages across the Basin.

If a demand management program were established, respondents across the Basin overwhelmingly preferred to have a local agency manage the program (74%), followed by a state agency (15%). Only 2% preferred a federal agency to manage such a program (Figure 10), echoing previous results around preferences for local-level water management approaches.

Figure 9. Likelihood of adopting specific practices as part of a demand management program.

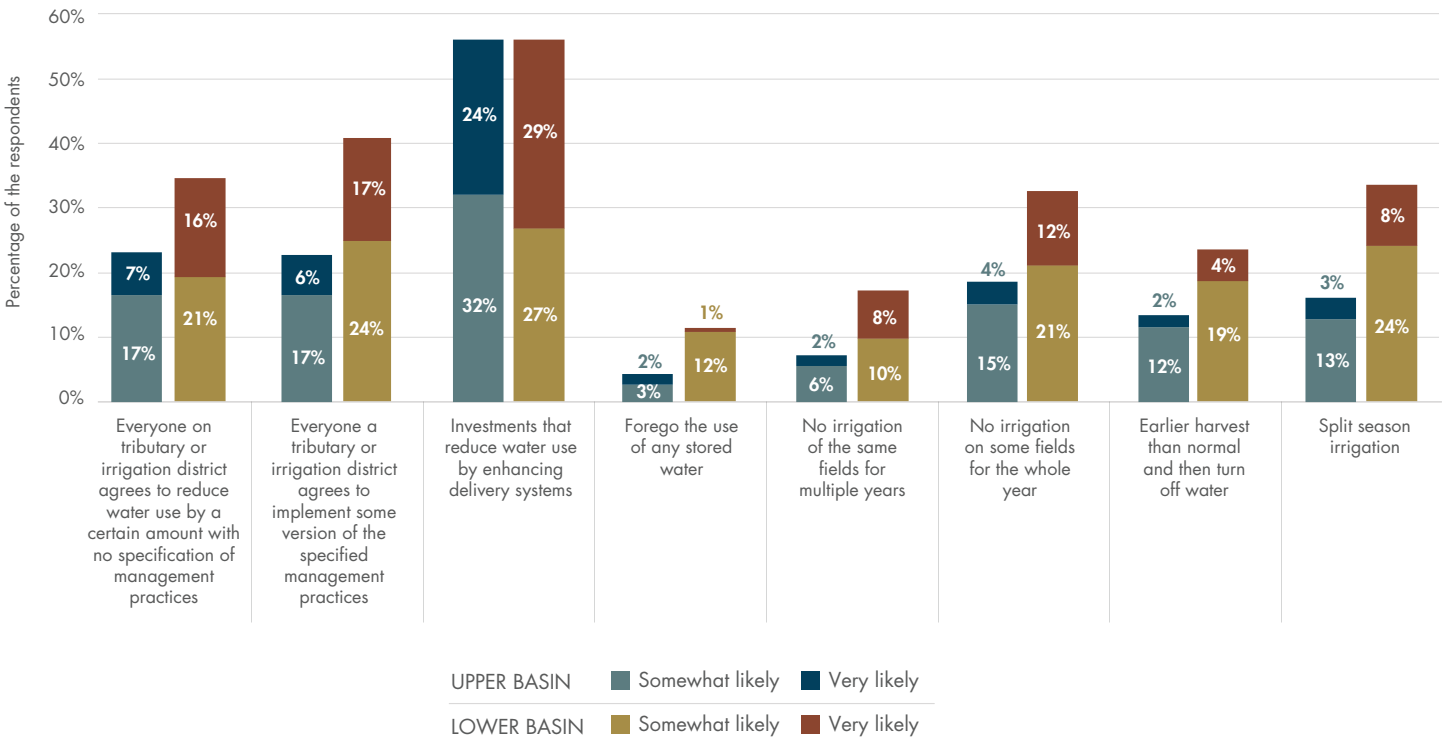
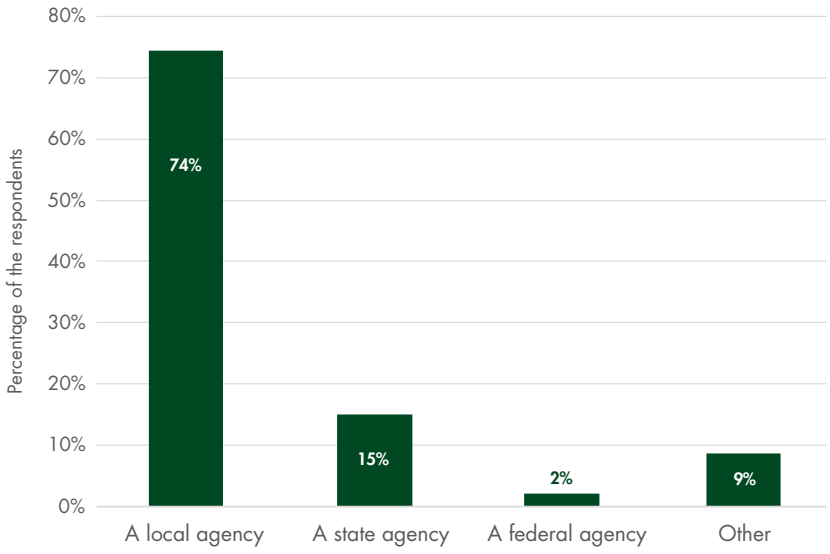
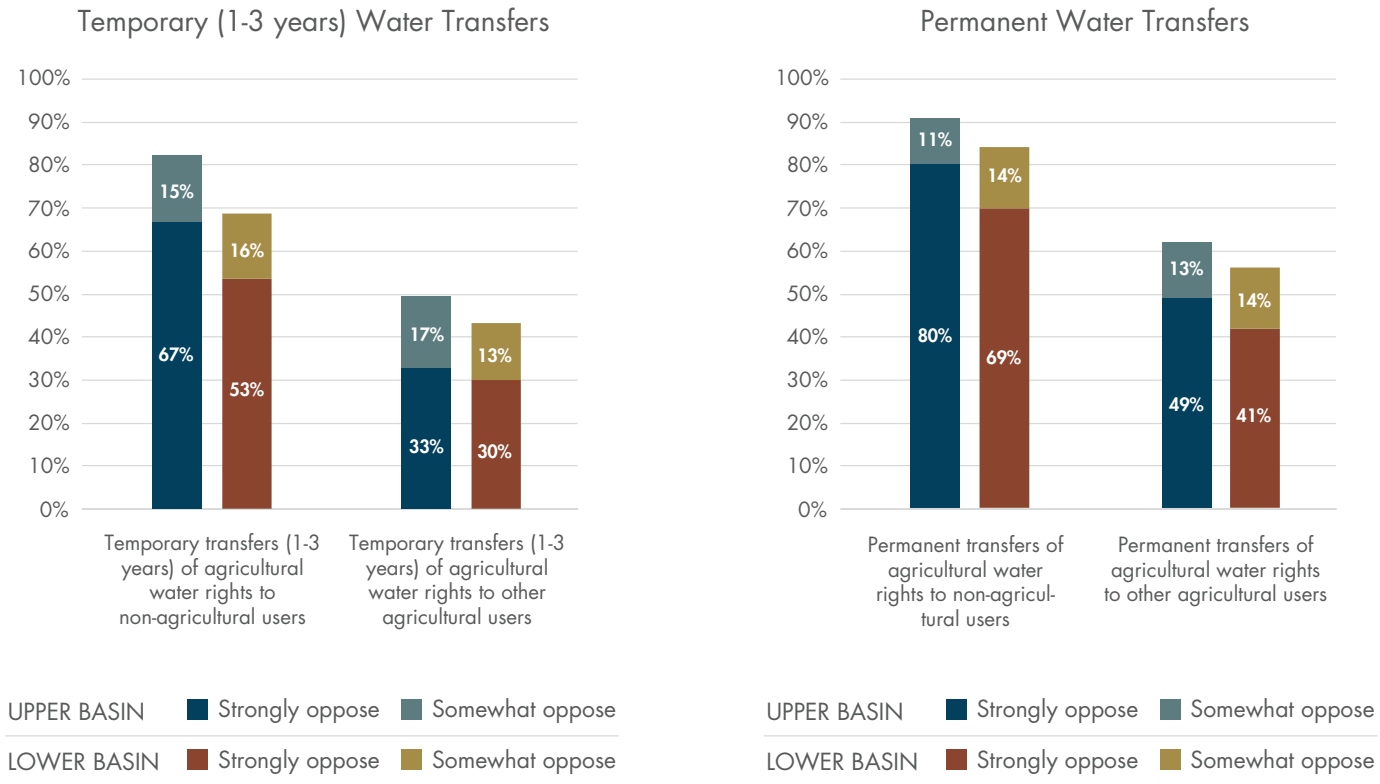


Figure 10. Preferences for administration of a demand management program (across both Basins).



Respondents in both parts of the Basin opposed most water transfers, whether permanent or temporary, as a solution to water shortages. Respondents were particularly opposed to any water transfers from agricultural users to non-agricultural users and especially to permanent transfers relative to temporary (1-3 years) transfers (Figure 11). Support for all four forms of water transfers was higher in the Lower Basin than the Upper Basin. While overall support for water transfers was generally low, 29% in the Upper Basin and 35% in the Lower Basin supported temporary transfers to other agricultural users and 9% (Upper Basin) and 19% (Lower Basin) supported temporary transfers to non-agricultural users (Figure A3 in Appendix B). Even though a minority of respondents supported water transfers, providing additional flexibility for willing water users through water transfers, when combined with other approaches, could help address water shortages.

Figure 11. Level of opposition to water transfers.



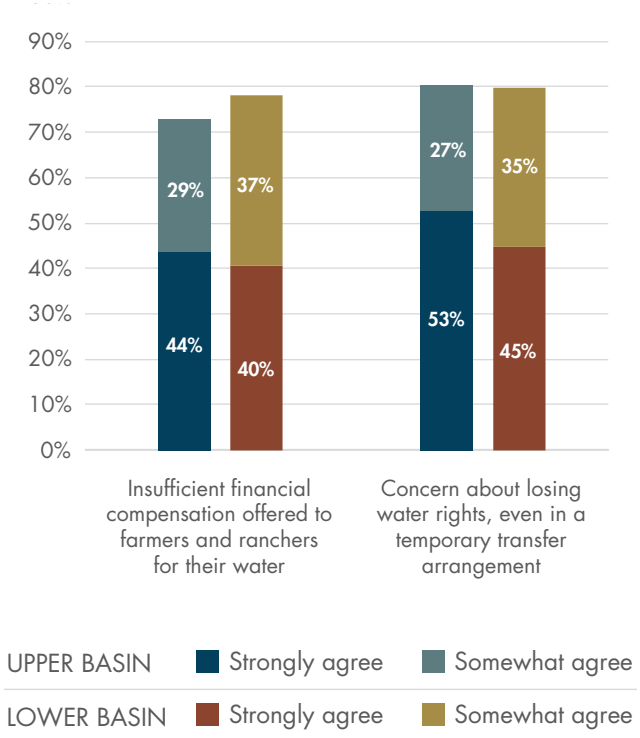
Following the questions about support or opposition to water transfers, we asked respondents about 8 potential barriers to engaging water transfers (state regulations, policies, or laws; federal regulations, policies, or laws; high administrative, legal, engineering, and other costs; length and complexity of administrative process; lack of information regarding the advantages of water transfers; concern about losing water rights, even in a temporary transfer arrangement; insufficient financial compensation offered to farmers and ranchers for their water), which can help identify reasons for high levels of opposition. Of the potential barriers we asked about, "Concern about losing water rights even in a temporary transfer agreement" was the barrier respondents most strongly agreed was significant (Figure 12; also see Figure A4 in Appendix B for other potential barriers). This concern was also expressed in interviews and the focus group where water users shared that they were reluctant to take any action that might

jeopardize their water rights. Water users raised issues around abandonment and forfeiture[3] for participating in water transfers and demand management practices and were skeptical of assurances that participation in these types of programs would not place their rights in jeopardy. As a participant in the focus group explained, "If we go and put in all of these water conservation programs where we are actually consuming less water, is the state going to come in and say 'you purposefully just devalued your asset in water because now you're using less of it'… Are we actually digging our own grave by participating?" In other words, by participating in formal water conservation programs, agricultural water users are demonstrating that their operations can get by with using less and give the government reason to restrict water use in the future.

Respondents also strongly agreed that insufficient financial compensation was another barrier to water transfers (Figure 12). Participants in interviews and the focus group shared that most water users have a price at which they would be willing to sell or lease their water. They also expressed, however, that this price was high for most farmers and ranchers given how critical the resource is to their operations. The costs associated with negative secondary impacts from temporarily removing water from irrigated land, such as the growth of weeds or declines in soil health, may also figure into agricultural water users' desired prices for leased water. Several interview and focus group participants referenced the amount of compensation being paid through pilot programs in the Upper Basin and felt that it was not close to a competitive rate for most irrigators.

Focus group participants discussed ways to better determine prices for such programs and thought that establishing a predetermined rate did not make sense. Instead, they preferred using reverse auctions or similar types of mechanisms that allow agricultural water users to determine a price that worked for the specifics of their operation. Although there was general agreement that more water users would be willing to consider water transfers or demand management practices if the compensation was sufficient, some participants cited concerns about the potential negative ripple effects these types of programs might have on agricultural communities, as has been experienced in communities where a high degree of "buy-and-dry" has taken place.

Figure 12. Level of agreement with factors being barriers to water transfers.

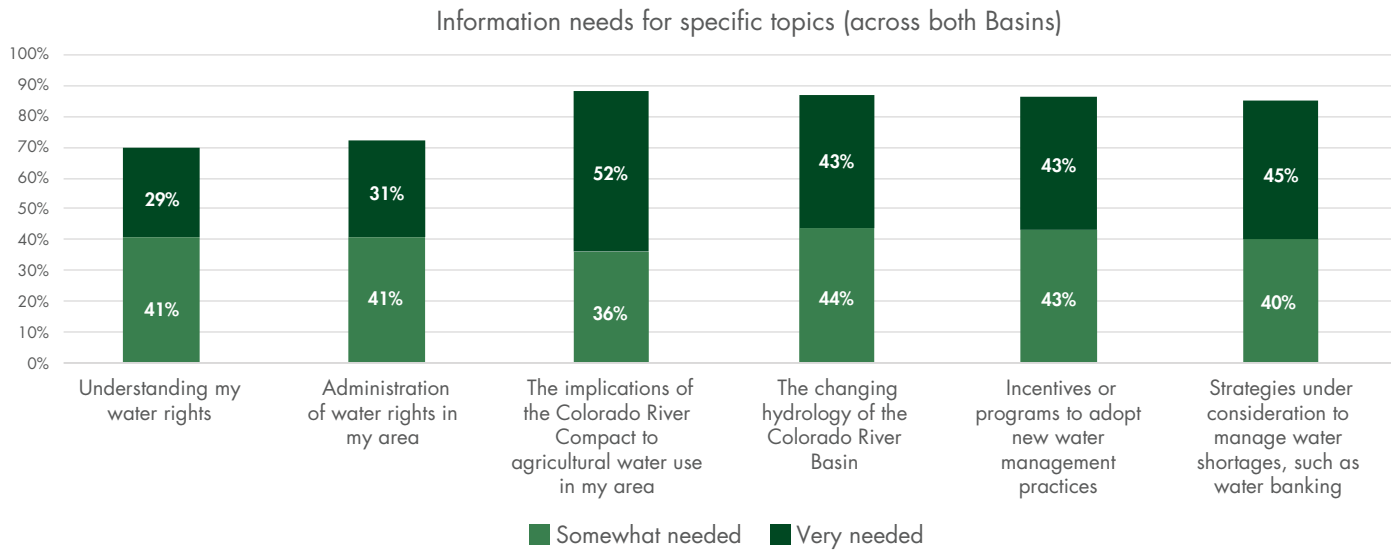


We also asked survey respondents about potential information and irrigation infrastructure needs to gain further insight into what may help the agricultural sector manage the impacts of water shortages. Respondents expressed that the topic that they need the most information about is the implications of the Colorado River Compact for agricultural water use in their area. Respondents also strongly expressed a need for more information about strategies under consideration to manage water shortages. Overall, respondents expressed a need for additional information on a number of topics (Figure 13). Improvement of headgates, laterals, or other structures was the most reported infrastructure need (43% Upper Basin, 35% Lower Basin) followed by a desire to upgrade to a more

3 Abandonment and forfeiture relate to the "use it or lose it" principle in the prior appropriation doctrine common in most western states. If a water right is not put to a beneficial use, either intentionally or unintentionally, during a defined time period set by each state (e.g., a consecutive 5 year period in Wyoming), the state may determine the right to be abandoned and must be forfeited by the right holder.

efficient system (36% Upper Basin, 32% Lower Basin; Figure A5 in Appendix B). Roughly a quarter of respondents in each part of the Basin reported that they did not have any of the infrastructure needs we asked about.

Figure 13. Information needs for specific topics.



Conclusions

Photo by Elizabeth Koebele

The current state of the Colorado River Basin raises significant concerns for its agricultural producers. Their greatest concerns are potential water policy changes and water use constraints—particularly for themselves and other farmers and ranchers. In some parts of the Basin, such as along the Central Arizona Project, farmers have already experienced significant cuts to their water deliveries. In other parts, producers are bracing for changes in water management that may accompany the projected increases in drought and streamflow variability.

The high percentage of agricultural water users that have already adopted one or more conservation practices or adaptation strategies suggests hope for voluntary efforts. We see a willingness among producers to experiment with new approaches to water management on their properties and act as partners in managing water under shortage conditions. However, many agricultural water users are highly risk-averse and reluctant to take actions that may jeopardize their water rights, which are often their most valuable asset. This includes participating in a program that would reduce consumptive use even if provided assurance that such actions will not be used to pursue abandonment or forfeiture claims. Overcoming this barrier will be important for new water conservation programs given the long-standing presence of the "use it or lose it" tenet in

Photo by Drew Bennett

western water law. In short, for many producers, the perceived risk of endangering their water rights far outweighs the benefits of water conservation, even if conservation is compensated.

Agricultural water users also perceive a disconnect between policies at the state and federal level and management at the local level, with an overwhelming preference for local administration of programs and attention to local context in water management. This perception has created a trust gap that may create a barrier to gaining buy-in for new water management strategies, even if they are supported by significant funding from state and federal government agencies. To be successful in gaining the support and participation of agricultural water users, state and federal agencies must build trust by working at the local level and being responsive to local contexts. One strategy is to partner with local non-governmental organizations that have established relationships in agricultural communities to distribute information about new programs and provide support for water users who engage in them (Szeptycki et al. 2018). Related research suggests that trust can come from providing a spectrum of social interaction opportunities among water users and other stakeholders, including managers and decisionmakers (Burbach et al. 2022). On one end of this spectrum, managers and decisionmakers provide information to water users about programs and potential benefits in one-way fashion. Education campaigns and related outreach may be necessary; however, such approaches are insufficient for building trust. The other end of this spectrum highlights opportunities for two-way social interaction through dialogue, listening, and shared learning, which research suggests can transform relationships, build trust, and enable a shared vision for the problem and solution (Innes and Booher 1999; Reed et al. 2018). While recent federal legislation provides unprecedented resources to address water shortages, simply providing additional funding will likely be inadequate given agricultural water users' perceptions of federal programs and proposed demand management strategies highlighted in this report.

Additionally, conservation and water management program administrators at all levels should work directly with users to understand and mitigate the burdens placed on those who desire to participate in formal conservation incentive programs, such as EQIP. Expanding program participation beyond current levels will likely require program delivery to be nimble and sensitive to local contexts. This, again, can be enhanced through two-way social interaction with water users. While most of the demand management or system conservation practices and forms of water transfers considered in the survey did not garner broad support, some strategies, such as funding for infrastructure and efficiency improvements, may be more popular among agricultural water users. These actions do not necessarily impact systemwide water availability if rights holders use conserved water to expand irrigation, for example – an outcome that is possible without appropriate provisions to shepherd conserved water. While effective water management strategies also do not require participation from a majority of water users, a sufficient number of participants are needed to address shortages; thus, understanding incentives for participation across space and time is critical for increasing agricultural water user engagement. This further suggests an opportunity for decisionmakers and policymakers to engage locally trusted leaders among water users to together identify the right time and right place for critical water management practices.

The future of agriculture in the Basin is intricately tied to policy and management decisions at multiple levels that will unfold over the next several years. Current policy processes – whether they are concerned with emergency conservation in the near-term or longer-term changes to Basin-wide water management policies – provide an opportunity to proactively engage agricultural water users. This engagement can facilitate the adaptation of operations to mitigate the impacts of water shortages and sustain agricultural livelihoods. The findings in this report provide insight into the strategies preferred by producers and those that are more likely to face resistance. We hope these insights are useful in guiding the development of solutions that are both attractive to agricultural water users and help to address the systemic water challenges in the Basin.

Acknowledgements

First and foremost, we are grateful to the many agricultural water users across the Basin for their participation in this study. Whether it was taking time to fill out a survey, speak with us for an interview, or participate in the focus group, we recognize producers' many time constraints and appreciate them making space in their busy schedules to share their views. We thank Regrid's "Data with Purpose" program for their support in providing county land parcel data for the Basin that was essential in developing the sample. We thank Michael Dorssom, Brian Harnisch, and the WYSAC team for their support in administering the survey. The Walton Family Foundation provided financial support for the project through a grant to the Western Landowners Alliance.

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Appendices

APPENDIX A. RESEARCH APPROACH

GIS Data and Sample Creation

We relied on two primary data sources to generate a list of agricultural water users in the Basin. The first was land ownership data sourced from Regrid, a company specialized in collecting and distributing county-level parcel data. The second was irrigated lands data, which included US Geological Survey data depicting agricultural lands in the Upper Basin[4], and the 2017 Landsat-based Irrigation Dataset (LANID) for the United States[5] (Xie & Lark, 2021).

County-level parcel data was aggregated to the state level, resulting in statewide parcel ownership datasets for each state in the Basin (excluding Nevada, which has a small number of agricultural properties that use surface water in the Basin). The two irrigated lands datasets were merged into a single polygon layer and clipped to the Basin boundary, which was defined as the hydrologic boundary of the Basin plus the out-of-basin but highly relevant Coachella and Imperial Valleys of southern California.

With the statewide parcel ownership and irrigated lands datasets prepared, a simple overlay was used to pinpoint all parcels that intersected irrigated land. The number of irrigated acres within each of these parcels was calculated, with parcels containing ten or fewer acres being omitted. This list of parcels served as the basis for the stratified random sample of agricultural water users as described in the introduction.

Limitations of research approach

Although we followed common methods for scientific surveys, our research approach has limitations. One challenge was developing a robust and comprehensive sample of agricultural water users throughout the Basin. Since there is not a comprehensive list of water users to develop a sampling frame, we relied on county assessors' records of property ownership to develop the sample. Property owners, however, may not operate the agricultural operation and make decisions about water use in some cases. Although our cover letter asked the receipt to pass the survey along to the individuals responsible for making water management decisions, these may not have been done for many non-owner operators managing properties included in our sample.

Nonresponse bias is another potential limitation of survey-based research. Nonresponse bias occurs when individuals with different characteristics or perspectives participate at much lower rates than other groups that participate in the survey. This can result in researchers reaching conclusions that do not reflect the true characteristics or perspectives of the target population.

This project surveyed agricultural water users across the Basin and included questions with broad relevancy to water management. There are a great diversity of agricultural operations and water management approaches across the Basin, and our effort to survey all agricultural water users limited considerations of local context. Our results may not capture localized conditions or be reflective of nuances across the Basin's broad geography.

4 Available at https://water.usgs.gov/GIS/metadata/usgswrd/XML/sir2014_5039_UCRBAgriculture.xml#stdorder

5 Available at https://zenodo.org/record/5548555#.YvVdN3bMLIU

Interviews

We conducted semi-structured interviews with 12 agricultural water users and other water experts in the Basin. We conducted interviews with agricultural water users in Arizona, California, Colorado, Utah, Wyoming and water experts with specific expertise in Arizona, California, Colorado, and Utah and one expert with extensive experience across the Basin. Interviews lasted between 30 minutes and 1.5 hours. The interviews focused on current concerns in the Basin and possible solutions to addressing water shortages. We relied on our networks to identify potential individuals to participate in an interview and to suggest others to interview.

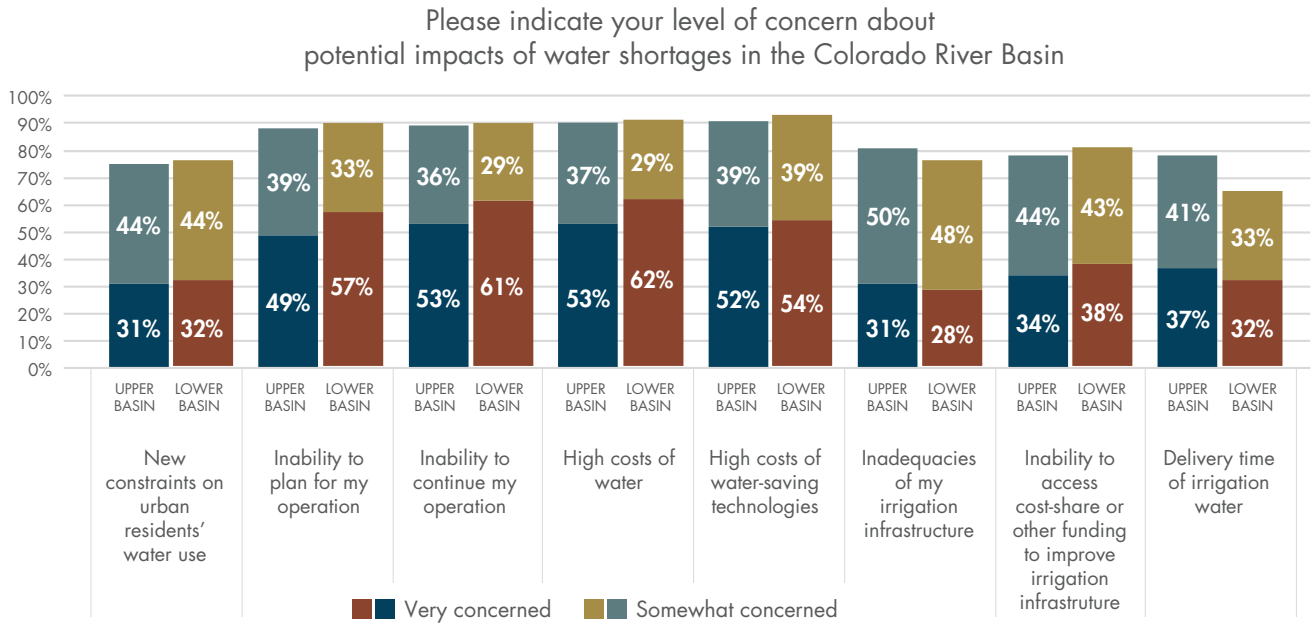
Focus group

We conducted a focus group with 10 agricultural water users in Kremmling, Colorado on April 17th, 2023. We partnered with the Colorado Headwaters Land Trust to help recruit focus group participants from the North Park, Colorado area. The focus group lasted 2 hours and was facilitated by report authors D. Bennett, W. Eaton, and M. Collins. During the focus group, the facilitation team presented selected survey results from Colorado to prime the conversation and asked participants to help interpret the findings. We recorded and transcribed the conversation to assist with analysis but no names were included in the transcript.

APPENDIX B. ADDITIONAL FINDINGS

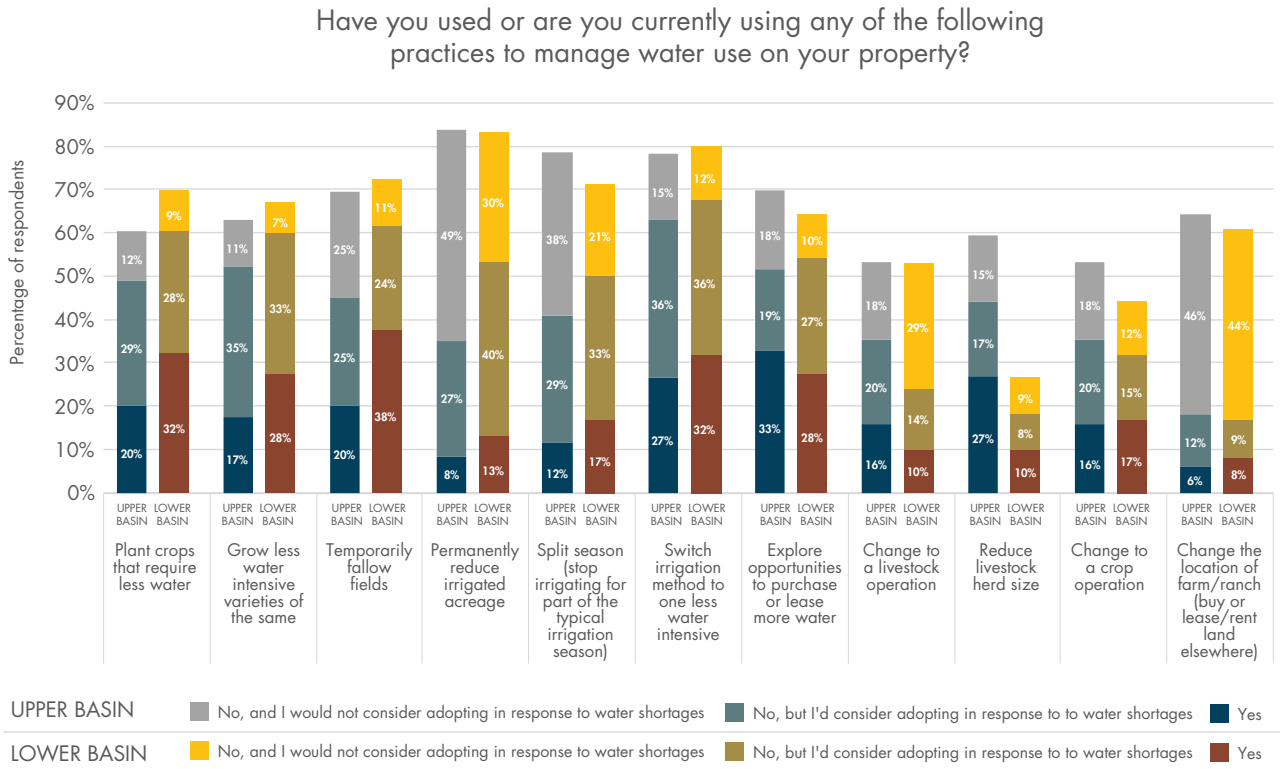
Concerns about water management

Figure A1. Concerns about potential impacts of water shortages in the Colorado River Basin.



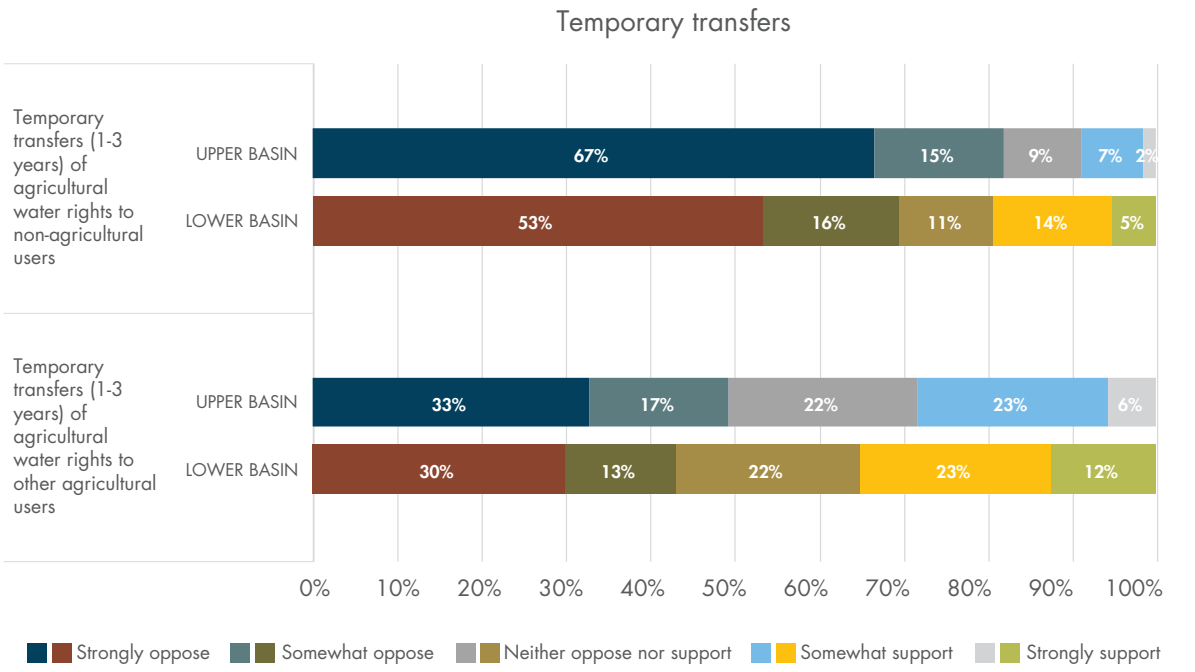
Water Conservation Practices

Figure A2. Current and previous water conservation practice and adaptation strategy adoption.



Path forward

Figure A3. Opposition and support for water transfers.



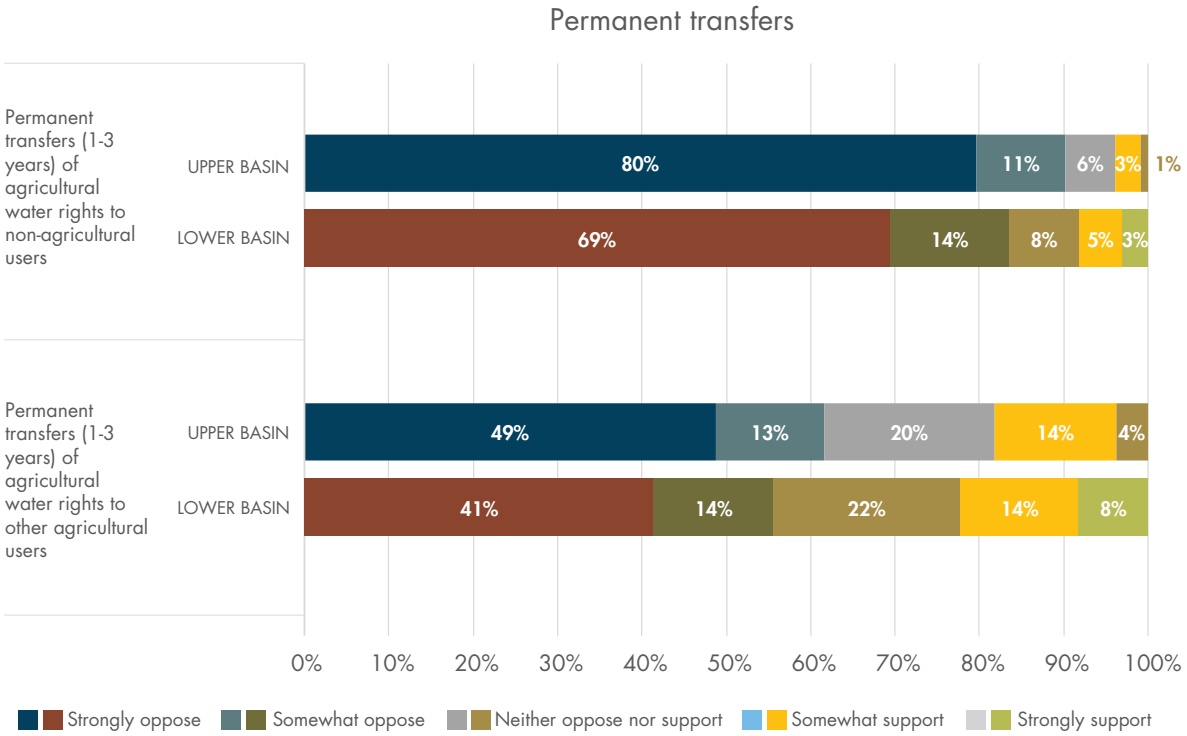


Figure A4. Additional barriers to water transfers (across both Basins)

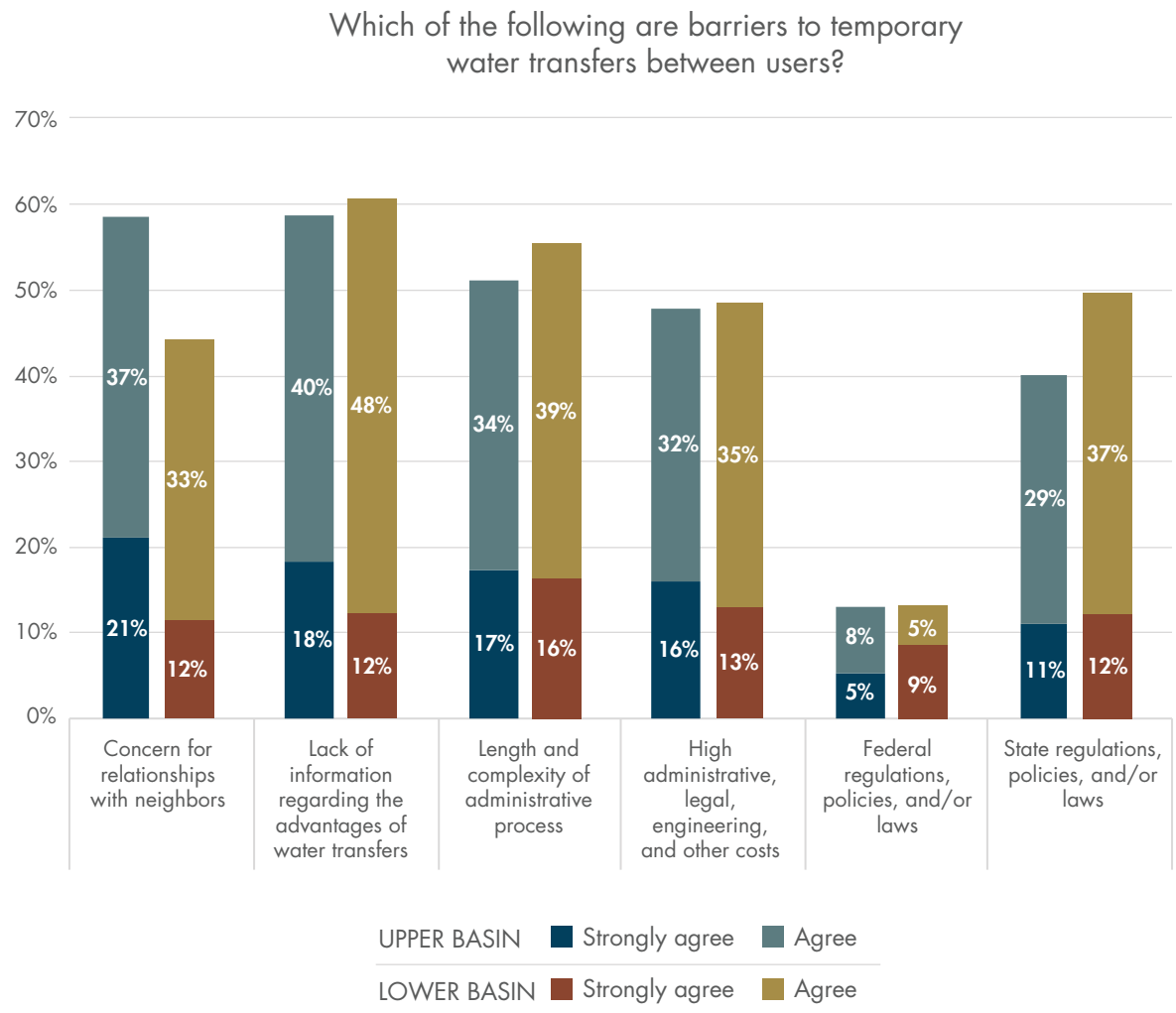
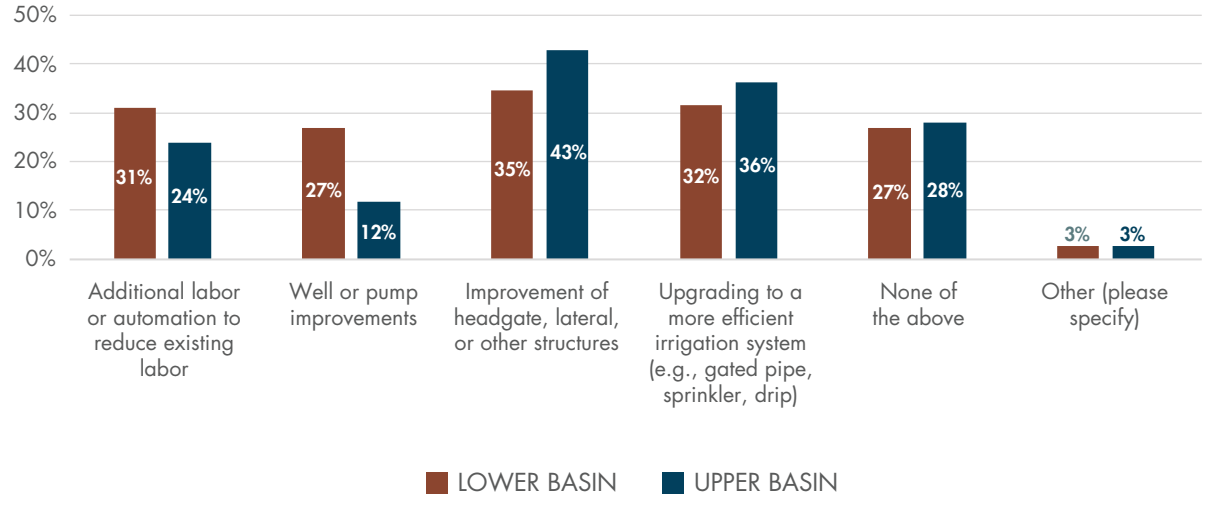


Figure A5. Irrigation system needs (across both Basins)



APPENDIX C. SURVEY QUESTIONNAIRE

Survey of Agricultural Water Users in the Colorado River Basin

University of Wyoming

Thank you for taking the time to complete this survey. Your participation in this survey is voluntary. Your completion and submission of this survey indicates that you give your consent to participate in this study. Fill in bubbles completely using either pencil or pen (blue or black ink), but please do NOT use a felt-tip marker.

Mark Answers Like This ⇨ ● ▮
NOT Like This ⇨ ⊗ ☑

The University of Wyoming, in partnership with the Western Landowners Alliance, is conducting this survey to understand agricultural water users' perspectives on water shortages in the Colorado River Basin. These perspectives are essential to inform policy and the development of programs to address water shortages.

You are being asked to participate in this survey because your irrigated property is in the Colorado River Basin. *We ask that this survey be completed by the person who makes most of the decisions about irrigation and water management on your property and is at least 18 years old*. If you have more than one property that uses irrigation water from the Colorado River Basin, please consider all irrigated properties when answering the questions.

We have included a secure return envelope to protect your privacy. **Your answers will be confidential, disassociated from your name, and only reported in aggregate where individual answers cannot be identified.** We anticipate the survey will take about 15 minutes to complete. Thank you for your participation in the study.

Has the property used water for agricultural purposes in the past 5 years?

○ Yes ○ No —— —— —— —— —— —— —— If no, please stop and return the survey in the enclosed envelope.

If yes, please complete the survey.

1. In which state(s) do you irrigate? (*mark all that apply*)

☐ Arizona ☐ California ☐ Colorado ☐ New Mexico ☐ Utah ☐ Wyoming

2. Approximately how many acres do you irrigate in a typical year? (*answer using a number*) ☐☐☐☐ acres

3. What type(s) of irrigation water rights does your operation own or lease? (*mark all that apply*)

☐ Decreed surface water rights ☐ Non-tributary groundwater ☐ Government agency

☐ Mutual ditch company shares ☐ Private irrigation company ☐ Other (please specify) _____

☐ Tributary groundwater ☐ Water conservancy district ☐ Unsure

4. If your operation uses groundwater for irrigation, approximately what percentage of the total volume of water comes from groundwater sources? (*answer using a number*)

☐☐☐ %

5. For Upper Colorado River Basin users (CO, UT, WY, or San Juan County NM), do the water rights that provide the majority of the irrigation water have a priority date earlier than 1922, the date of the Colorado River Compact?

○ Yes

○ No

○ Not sure

○ I am in the Lower Colorado River Basin (AZ, CA, or a NM county other than San Juan County)

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6. Which irrigation methods do you currently use? (*mark all that apply*)

- ☐ Surface flood
- ☐ Controlled flood (between borders or within basins)
- ☐ Furrow irrigation
- ☐ Center pivot sprinkler
- ☐ Solid set and permanent systems
- ☐ Side roll sprinkler or other mechanical move systems
- ☐ Drip, trickle, or micro irrigation, including sub-surface drip
- ☐ Subirrigation (water seepage, or use of a drainage system to maintain aquifer table at a predetermined depth)
- ☐ Other (please specify) _____

7. Does your irrigation system need any of the following? (*mark all that apply*)

- ☐ Additional labor or automation to reduce existing labor
- ☐ Well or pump improvements
- ☐ Improvement of headgate, lateral, or other structures
- ☐ Upgrading to a more efficient irrigation system (e.g., gated pipe, sprinkler, drip)
- ☐ None of the above
- ☐ Other (please specify) _____

8. Please indicate your level of concern about potential impacts of water shortages in the Colorado River Basin:

	Not at all concerned	Somewhat concerned	Very concerned
a. changes in water management policy	○	○	○
b. new constraints on my water use	○	○	○
c. new constraints on other farmers' or ranchers' water use	○	○	○
d. new constraints on urban residents' water use	○	○	○
e. inability to plan for my operation	○	○	○
f. inability to continue my operation	○	○	○
g. high costs of water	○	○	○
h. high costs of water-saving technologies	○	○	○
i. inadequacies of my irrigation infrastructure	○	○	○
j. inability to access cost-share or other funding to improve irrigation infrastructure	○	○	○
k. delivery time of irrigation water	○	○	○

9. Due to water shortages in the Colorado River Basin, do you need additional information on the following topics?

	Not needed	Somewhat needed	Very needed
a. Understanding my water rights	○	○	○
b. Administration of water rights in my area	○	○	○
c. The implications of the Colorado River Compact to agricultural water use in my area	○	○	○
d. The changing hydrology of the Colorado River Basin	○	○	○
e. Incentives or programs to adopt new water management practices	○	○	○
f. Strategies under consideration to manage water shortages, such as water banking	○	○	○

10. Please indicate your level of agreement or disagreement with each of the statements below about water management in your area.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
a. Water rights are well defined in my state	○	○	○	○	○
b. The benefits of using water resources for my farm operation outweigh the costs of developing, managing, and using those water resources	○	○	○	○	○
c. I am able to influence the rules that are put in place to manage water resources within my state	○	○	○	○	○
d. Overall, I think there are adequate systems in place to monitor people's use of water	○	○	○	○	○
e. Penalties enforced for failing to abide by water use regulations are sufficient	○	○	○	○	○
f. There are adequate mechanisms in place to resolve local water conflicts	○	○	○	○	○
g. Local management plays a large role in how water is managed in my state	○	○	○	○	○
h. State and local water management activities are well integrated	○	○	○	○	○
i. There is excellent leadership in my state when it comes to making decisions about how water is managed	○	○	○	○	○
j. Sufficient data and information exist for state and local agencies to successfully manage water resources	○	○	○	○	○
k. My state's water management system is flexible, able to account for local concerns and changing hydrologic conditions	○	○	○	○	○
l. There is a high level of trust between water users and water management agencies in my state	○	○	○	○	○
m. There is adequate funding for state and local agencies to manage water resources	○	○	○	○	○
n. I am treated the same as other water users in my state	○	○	○	○	○
o. Water management in my state is proactive	○	○	○	○	○
p. My state's planning process is adequate for dealing with water supply issues	○	○	○	○	○

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11. Have you used or are you currently using any of the following practices to manage water use on your property? (If the practice does not apply to the property, select Not Applicable.)

a. Plant crops that require less water

- ○ Yes
- ○ No, but I'd consider adopting in response to water shortages
- ○ No, and I would not consider adopting in response to water shortages
- ○ Not Applicable

b. Grow less water intensive varieties of the same crops

- ○ Yes
- ○ No, but I'd consider adopting in response to water shortages
- ○ No, and I would not consider adopting in response to water shortages
- ○ Not Applicable

c. Temporarily fallow fields

- ○ Yes
- ○ No, but I'd consider adopting in response to water shortages
- ○ No, and I would not consider adopting in response to water shortages
- ○ Not Applicable

d. Permanently reduce irrigated acreage

- ○ Yes
- ○ No, but I'd consider adopting in response to water shortages
- ○ No, and I would not consider adopting in response to water shortages
- ○ Not Applicable

e. Split season (stop irrigating for part of the typical irrigation season)

- ○ Yes
- ○ No, but I'd consider adopting in response to water shortages
- ○ No, and I would not consider adopting in response to water shortages
- ○ Not Applicable

f. Switch irrigation method to one less water intensive

- ○ Yes
- ○ No, but I'd consider adopting in response to water shortages
- ○ No, and I would not consider adopting in response to water shortages
- ○ Not Applicable

g. Explore opportunities to purchase or lease more water

- ○ Yes
- ○ No, but I'd consider adopting in response to water shortages
- ○ No, and I would not consider adopting in response to water shortages
- ○ Not Applicable

h. Change to a livestock operation

- ○ Yes
- ○ No, but I'd consider adopting in response to water shortages
- ○ No, and I would not consider adopting in response to water shortages
- ○ Not Applicable

11. continued...Have you used or are you currently using any of the following practices to manage water use on your property? (If the practice does not apply to the property, select Not Applicable.)

i. Reduce livestock herd size

- ○ Yes
- ○ No, but I'd consider adopting in response to water shortages
- ○ No, and I would not consider adopting in response to water shortages
- ○ Not Applicable

j. Change to a crop operation

- ○ Yes
- ○ No, but I'd consider adopting in response to water shortages
- ○ No, and I would not consider adopting in response to water shortages
- ○ Not Applicable

k. Change the location of farm/ranch (buy or lease/ rent land elsewhere)

- ○ Yes
- ○ No, but I'd consider adopting in response to water shortages
- ○ No, and I would not consider adopting in response to water shortages
- ○ Not Applicable

l. Other (*please specify*) _____

_____

_____

12. If you have adopted any of the practices listed in question 11, what was your reasoning for doing so? (*mark all that apply*)

- ☐ In response to water shortages on my property
- ☐ In anticipation of water shortages on my property
- ☐ To help my community address water shortages
- ☐ In response to curtailment of water or mandatory reductions
- ☐ To receive financial support from a federal, state, or private program
- ☐ To support the health of the surrounding river ecosystem
- ☐ Other (please specify) _____

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13. What is your awareness of and participation in the water conservation programs listed below?

a. NRCS's Environmental Quality Incentives Program (EQIP) to improve irrigation efficiency or irrigation management plans

- ○ I currently participate in the program or have in the past
- ○ I am aware of this program and have interest in participating in the future
- ○ I am aware of this program and have no plans to participate
- ○ I am not aware of this program and have not participated

b. NRCS's PL-566 program

- ○ I currently participate in the program or have in the past
- ○ I am aware of this program and have interest in participating in the future
- ○ I am aware of this program and have no plans to participate
- ○ I am not aware of this program and have not participated

c. WaterSmart Initiative through the NRCS and the Bureau of Reclamation

- ○ I currently participate in the program or have in the past
- ○ I am aware of this program and have interest in participating in the future
- ○ I am aware of this program and have no plans to participate
- ○ I am not aware of this program and have not participated

d. Colorado River System Conservation Pilot Program (SCPP; also known as the Pilot System Conservation Program)

- ○ I currently participate in the program or have in the past
- ○ I am aware of this program and have interest in participating in the future
- ○ I am aware of this program and have no plans to participate
- ○ I am not aware of this program and have not participated

e. A water leasing or water banking program for other consumptive uses

- ○ I currently participate in the program or have in the past
- ○ I am aware of this program and have interest in participating in the future
- ○ I am aware of this program and have no plans to participate
- ○ I am not aware of this program and have not participated

f. A water leasing or water banking program for instream flows or another environmental use

- ○ I currently participate in the program or have in the past
- ○ I am aware of this program and have interest in participating in the future
- ○ I am aware of this program and have no plans to participate
- ○ I am not aware of this program and have not participated

14. Given historic dry conditions in the Colorado River Basin, some water users have pursued permanent or temporary transfers of water to address shortages. What is the extent to which you oppose or support the following options for transferring water rights?

	Strongly oppose	Somewhat oppose	Neither oppose nor support	Somewhat support	Strongly support
a. **Permanent** transfers of agricultural water rights to other **agricultural** users	○	○	○	○	○
b. **Temporary** transfers (1-3 years) of agricultural water rights to other **agricultural** users	○	○	○	○	○
c. **Permanent** transfers of agricultural water rights to **non-agricultural** users	○	○	○	○	○
d. **Temporary** transfers (1-3 years) of agricultural water rights to **non-agricultural** users	○	○	○	○	○

15. Please share any comments you have regarding water rights transfers:

_____

_____

16. To what extent do you agree that the following are <u>barriers</u> to temporary water transfers between water users?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
a. State regulations, policies, and/or laws	○	○	○	○	○
b. Federal regulations, policies, and/or laws	○	○	○	○	○
c. High administrative, legal, engineering, and other costs	○	○	○	○	○
d. Length and complexity of administrative process	○	○	○	○	○
e. Lack of information regarding the advantages of water transfers	○	○	○	○	○
f. Concern about losing water rights, even in a temporary transfer arrangement	○	○	○	○	○
g. Insufficient financial compensation offered to farmers and ranchers for their water	○	○	○	○	○
h. Concern for relationships with neighbors	○	○	○	○	○
i. Other (*please specify*) _____	○	○	○	○	○

17. Do you see other barriers to temporary water transfers that we did not ask about?

_____

_____

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18. Do you have ideas on how agricultural water users can help address water shortages that we did not address?

_____

_____

_____

States in the Colorado River Basin are considering demand management programs to achieve temporary, voluntary, and compensated reductions in the consumptive use of water without jeopardizing water rights to abandonment.

19. How likely are you to adopt the following practices as part of a demand management program?

	Very unlikely	Somewhat unlikely	Unsure	Somewhat likely	Very likely	N/A
a. Split season (stop irrigating for part of the typical irrigation season)	○	○	○	○	○	○
b. Earlier harvest than normal (and then turn off water)	○	○	○	○	○	○
c. No irrigation of some fields (i.e., fallowing) for the whole year	○	○	○	○	○	○
d. No irrigation of the same fields for multiple years	○	○	○	○	○	○
e. Forego the use of any stored water	○	○	○	○	○	○
f. Investments that reduce water use by enhancing delivery systems	○	○	○	○	○	○
g. Everyone on a tributary (or irrigation district) agrees to implement some version of specified management practices (e.g., rotational fallowing)	○	○	○	○	○	○
h. Everyone on a tributary (or irrigation district) agrees to reduce their water use by a certain amount (no specification of management practices)	○	○	○	○	○	○
i. Other (specify): _____	○	○	○	○	○	○

20. If a demand management program was established, what, if any, concerns would you have?

_____

_____

_____

21. If a demand management program was established, who would you prefer to manage that program in your area? (*mark all that apply*)

☐ A local agency

☐ A state agency

☐ A federal agency

☐ Other (please specify) _____

22. The groups listed below are involved with water management in the Colorado River Basin. For each group, please rate (a) how familiar you are with the group, (b) how much you trust the group, (c) how competent you feel the group is, and (d) how similar the group's goals are to your own.

Your local Conservation District (e.g., Soil and Water Conservation District)	Not at all familiar	O	O	O	O	O Very familiar
	Not at all trustworthy	O	O	O	O	O Very trustworthy
	Completely incompetent	O	O	O	O	O Completely competent
	Very different goals from me	O	O	O	O	O Very similar goals from me
Your state Department / Division of Water Resources (or if your operation is in Wyoming, the State Engineer's Office)	Not at all familiar	O	O	O	O	O Very familiar
	Not at all trustworthy	O	O	O	O	O Very trustworthy
	Completely incompetent	O	O	O	O	O Completely competent
	Very different goals from me	O	O	O	O	O Very similar goals from me
USDA's Natural Resource Conservation Service (NRCS)	Not at all familiar	O	O	O	O	O Very familiar
	Not at all trustworthy	O	O	O	O	O Very trustworthy
	Completely incompetent	O	O	O	O	O Completely competent
	Very different goals from me	O	O	O	O	O Very similar goals from me
U.S. Bureau of Reclamation	Not at all familiar	O	O	O	O	O Very familiar
	Not at all trustworthy	O	O	O	O	O Very trustworthy
	Completely incompetent	O	O	O	O	O Completely competent
	Very different goals from me	O	O	O	O	O Very similar goals from me
U.S. Fish and Wildlife Service	Not at all familiar	O	O	O	O	O Very familiar
	Not at all trustworthy	O	O	O	O	O Very trustworthy
	Completely incompetent	O	O	O	O	O Completely competent
	Very different goals from me	O	O	O	O	O Very similar goals from me
Your state Game and Fish Commission	Not at all familiar	O	O	O	O	O Very familiar
	Not at all trustworthy	O	O	O	O	O Very trustworthy
	Completely incompetent	O	O	O	O	O Completely competent
	Very different goals from me	O	O	O	O	O Very similar goals from me

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Water users in the Colorado River Basin are making efforts to conserve water as the Colorado River's flows have declined by more than 20% over the last century.

23. By what percentage do you think agriculture should collectively reduce its water consumption to help address water shortages in the Colorado River Basin? (*answer using a number from 1-100*)

☐☐☐ %

In this section, we would like to learn a little bit about you. We would like to remind you that all of your answers to this survey are strictly confidential and will be used for statistical purposes only.

24. Which of the following best describes you?

- ○ Landowner who operates the irrigated property
- ○ Landowner who leases out the irrigated property
- ○ Manager hired by the landowner to manage the irrigated property
- ○ Lessee of the property
- ○ Other (please specify) _____

25 Do you reside on the irrigated property?

- ○ Yes, full-time
- ○ Yes, part-time
- ○ No

26. For which activities is the irrigated property used? (*mark all that apply*)

- ☐ Ranching
- ☐ Hay/Crop production
- ☐ Guest/Dude ranch
- ☐ Recreation (hunting, fishing, snowmobiling)
- ☐ Other (please specify) _____

27. Which activity is the primary source of revenue on the property? (*select only one option*)

- ○ Ranching
- ○ Hay/Crop production
- ○ Guest/Dude ranch
- ○ Recreation (hunting, fishing, snowmobiling)
- ○ Other (please specify) _____

28. How long has the current landowner (or their family) owned the irrigated property?

- ○ Less than 5 years
- ○ 5 to 15 years
- ○ 15 to 30 years
- ○ More than 30 years

29. Approximately what percentage of your income comes from agriculture? (*answer using a number*)

			%

30. Which of the following generated most (more than 50%) of your farm income in the past 3 years? (*select only one option*)

- ○ Livestock
- ○ Alfalfa, grass hay, or pasture
- ○ Row crops (beans, corn, cotton, wheat, other small grains)
- ○ Perennial crops (fruit, nuts)
- ○ No single source generated more than 50% of my farm income

31. What is your race?

- ○ White / Caucasion
- ○ Black / African American
- ○ Asian American
- ○ Latinx / Hispanic
- ○ Native American / Indigenous
- ○ Other (please specify)_____
- ○ Prefer not to say

32. What is your gender?

- ○ Male
- ○ Female
- ○ Prefer to self-describe:_____

33. What is your birth year?

34. Do you have any additional comments or information that you would like to share about any of the topics addressed in this survey?

_____

_____

_____

_____

_____

_____

_____

_____

_____

Visit www.uwyo.edu/crb-survey for an interactive dashboard displaying comprehensive survey results

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Western Landowners Alliance