

2016 Ag Water Right Holder Survey Results Summary

August, 2016



Dolores Archeological Program Records, Dolores, Colorado



ADVANCING THE LEGACY

Ag Water NetWORK
Colorado Cattlemen's Association / Partners for Western Conservation
8833 Ralston Road, Arvada, Colorado, 80002.

*Partial Funding for the CCA / PWC Ag Water Network is provided by the
Walton Family Foundation.*

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I. Background

The Colorado Cattlemen's Association (CCA) and Partners for Western Conservation (PWC) initiated the Ag Water Network in late 2015 with the objective of helping to 'keep ag water connected with ag land.' The Ag Water Network is partially funded by a Walton Family Foundation grant.

The state water plan, released in November, 2015, estimated Colorado's population could swell to 10 million people by 2050, nearly doubling our current population of 5.4 million. The plan projects that the demand for water driven by the increasing population could result in a municipal and industrial water supply gap of 560,000 acre-feet. Statewide, this could result in the loss of 700,000 irrigated acres by 2050 through the purchase and transfer of water rights from irrigated agriculture to urban areas. Such large-scale dry-up of irrigated agriculture would have permanent adverse economic, environmental and food security impacts.

The water plan acknowledges the economic, environmental and cultural value of Colorado's agriculture industry. To minimize 'buy and dry' of irrigated farmland, the plan emphasizes water conservation, increased storage, and alternative agricultural transfer methods (ag water leases) as the primary means for closing the projected water supply-demand gap.

Rotational fallowing, deficit irrigation, and planting lower consumptive use crops are the main practices being used and/or tested for "creating" consumptive use water that would otherwise have been used by crops. Consumptive use (CU) water is water retained by the growing plant plus the amount lost through evapotranspiration.

The consumptive use (CU) water can be leased to municipal, industrial, recreational, environmental or agricultural interests provided the lease complies with state water law. All alternative ag transfers, or "ag water sharing" agreements must be voluntary, temporary and compensated. A variety of state laws have been passed over the last decade to ensure that a participating landowner's water right(s) are not negatively impacted as long as the terms of the lease agreement comply with state law. Ag water leasing represents a sustainable approach that enables irrigated land to stay in production, albeit at a reduced output level, while helping supply water for other uses.

Ag water leasing is a new concept to most Colorado ag producers. The purpose of the ag water survey was to assess the level of knowledge of ag water right holders throughout the state regarding water leasing terms and concepts, and determine ag water right holder perspectives, concerns and interest related to leasing.

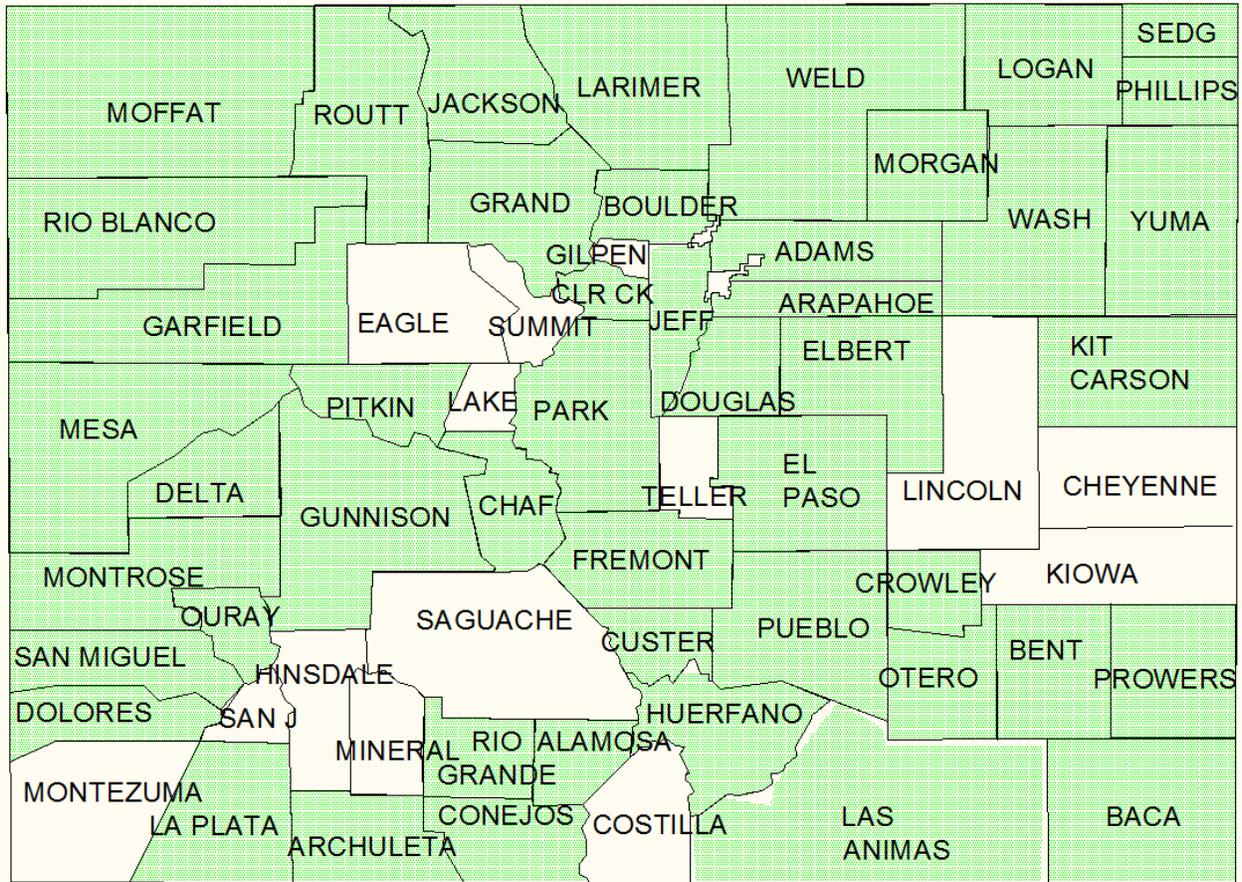
The survey was initiated February 26th, 2016 and closed on July 15, 2016, and received more than 300 responses. The first question - "do you own or lease ag water rights?" - was answered "no" by 51 respondents, leaving 266 respondents that said they own or lease agricultural water rights. The survey contained 25 background and water-related questions as well as a section at the conclusion which allowed respondents to leave comments or ask questions. All 25 survey questions are listed in the Appendix. The results of the survey are explained and shown graphically in the following text and figures. A footnote at the bottom of each figure indicates the number of respondents that answered the question (for example, n = 266), and the number that did not respond to the question (for example, nr = 0).

II. Survey Responses

A. Survey Respondent Operation Characteristics

Responses were received from 48 counties around the state, which represents three-fourths of the counties in Colorado. Green-shading on Figure 1 (below) indicates that at least one survey response was received from an ag water right holder in the county.

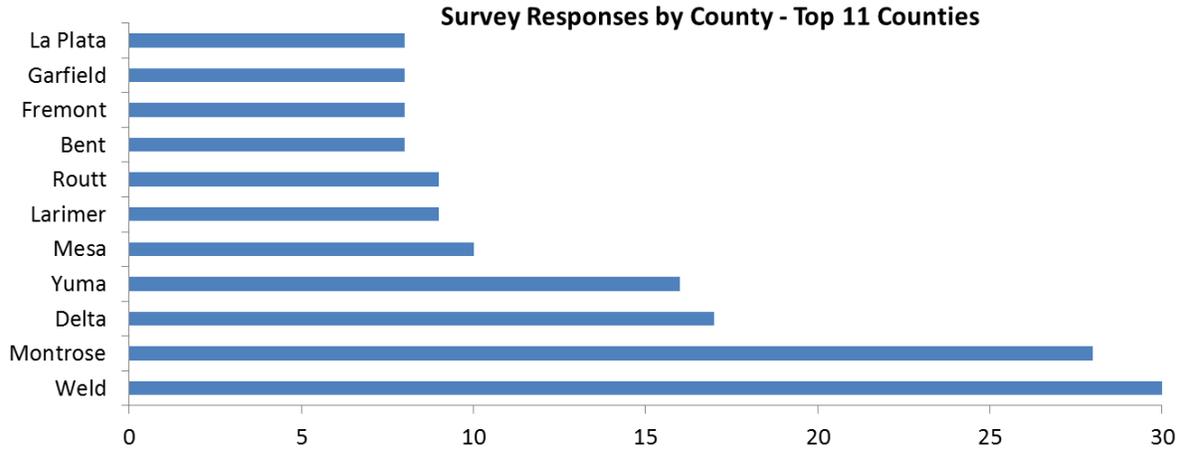
Figure 1. Map of Responding Counties



n = 266, nr = 0

The figure below displays the survey response rate among the top 11 counties (La Plata and Garfield Counties were tied for 10th place). The greatest number of responses came from counties in the northeast and western parts of Colorado. One southeastern county (Bent) and one southwestern county (La Plata) were also within the top group. When combined, the responses received from the top 11 counties represent 57 percent of all survey responses.

Figure 2. Top 11 Responding Counties



Irrigation water rights come in several forms. As shown in the table below, the majority of survey respondents derive their water from surface water sources, and several utilize multiple types of water rights. For example, one ag water right holder indicated that he uses a combination of mutual ditch company shares and decreed surface rights, as well as tributary and non-tributary groundwater (wells). Approximately one-third of respondents reported using groundwater. Few irrigators reported that they directly lease water from a government agency, such as a county or the Bureau of Reclamation.

Figure 3. Types of Irrigation Water Rights Owned or Leased

Ditch company shares	Decreed surface water right(s)	Tributary groundwater (well) right	Non-trib. GW right	Private Irrig. Co.	Gov't agency (ex. BoR)	Don't know
62%	51%	29%	19%	13%	7%	0%

n = 266, nr = 0

There are several ways that a field can be irrigated, as shown by the variety of responses indicated in Figure 4 (next page). Smaller scale irrigators more typically use less expensive irrigation methods. About 90 percent of respondents that irrigate less than 300 acres indicated they use flood, siphon tube or gated pipe, though some also use other methods, including sprinklers. About 72 percent of respondents with more than 300 acres under irrigation indicated they utilize some type of sprinkler system, such as pivot, side roll, stationary or rolling big gun, and/or subsurface drip irrigation (SDI).

Figure 4. Irrigation Methods Used

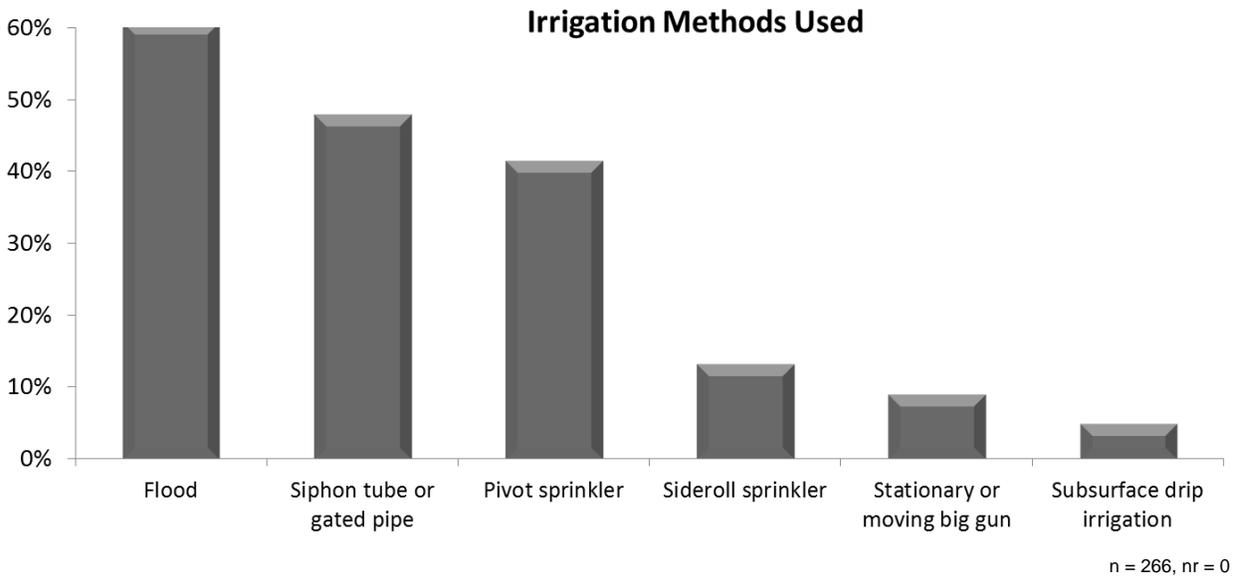
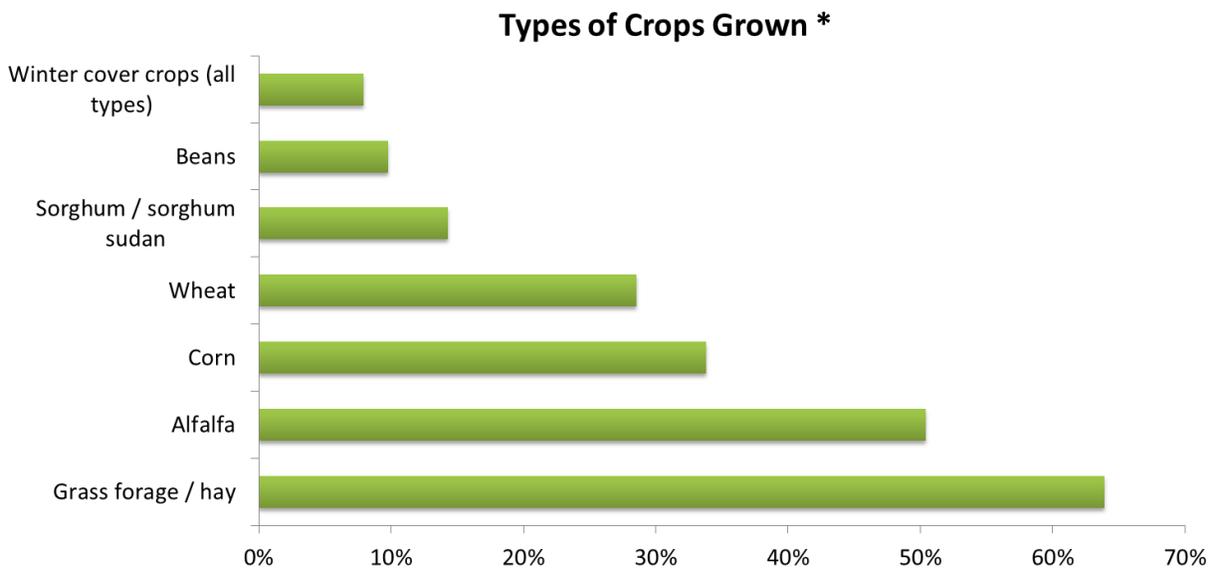


Figure 5 (below) illustrates the plethora of crops grown in Colorado. Among survey respondents the most commonly produced crops are grass / forage hay, alfalfa, corn, wheat, and sorghum or sorghum-sudan. Other crops mentioned include onions, oats, soybeans, sunflowers, triticale, winter peas, popcorn and quinoa.

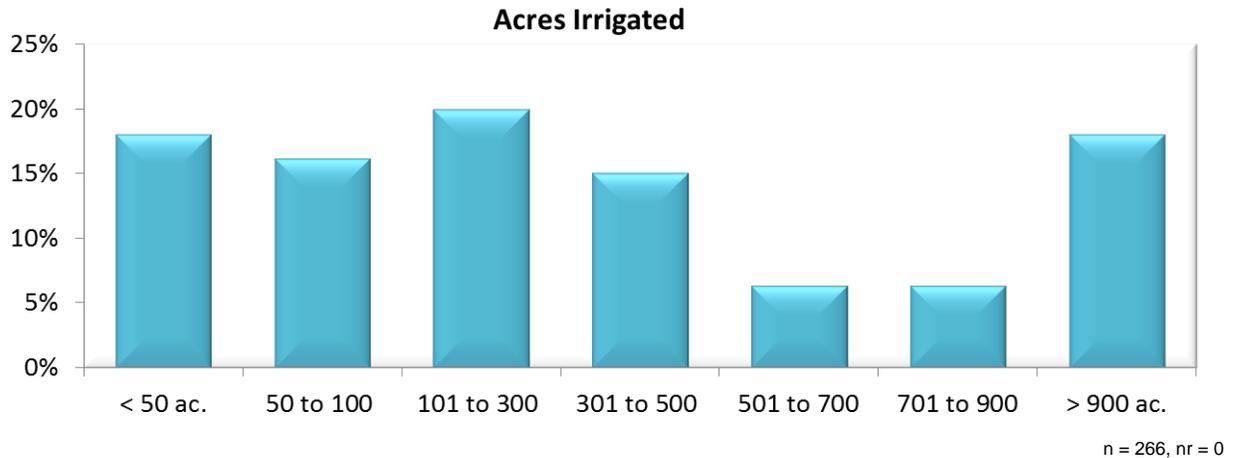
Figure 5. Crops Grown



* Other crops included truck crops, barley, beets, potatoes, fruit crops, other specialty crops. n = 266, nr = 0

Survey respondents represented a wide variety of operational sizes; from modest to large, with many in-between. The greatest number of respondents irrigate between 101 and 300 acres. Small operations (less than 50 acres under irrigation) and large operations (more than 900 acres) were about evenly represented.

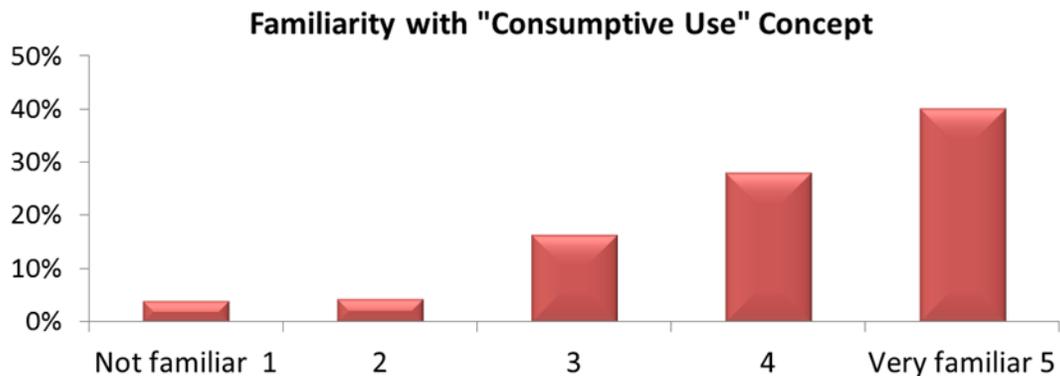
Figure 6. Acres Irrigated



B. Lease Terms and Methods

Figure 7 (below) displays how survey respondents ranked their familiarity with the concept of "consumptive use." The true measure of a water right is its actual historical, beneficial consumptive use (CU). In the case of an irrigation right, this is the documented annual crop evapotranspiration (ET) that can be shown to have been met by the water right, for a representative period of years (CSU Water Institute, 2016). Determination of the historic CU of a water right may include a review of the crops grown and corresponding yields, acres irrigated, amount of water diverted, transit losses, return flows, and precipitation.

Figure 7. 'Consumptive Use' Familiarity



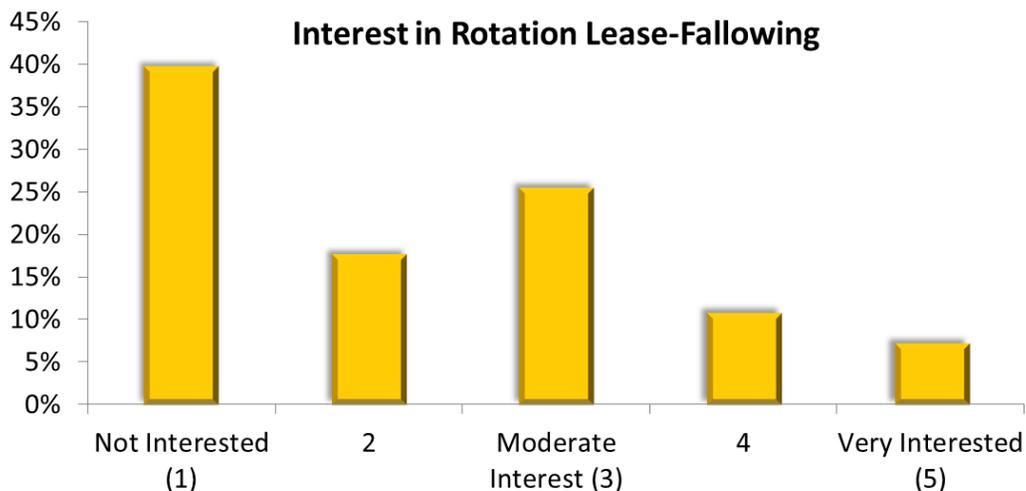
n = 249, nr = 17

Consumptive use is important to agricultural water leasing because the maximum amount of water that can be leased by an ag water right holder is the established historic consumptive use amount.

A variety of ag water leasing mechanisms have been advanced by the state legislature over the past few decades. House Bill 13-1248 and Senate Bill 15-198 enable ag water right holders participating in an approved state pilot program to temporarily lease up to 30 percent of their consumptive use water annually to other users. No field can be fallowed for more than three years out of ten, and water leasing activities must not injure other water right holders. Water rights participating in the program do not have to go through water court proceedings for a change of use, and the fallowing of a field is not counted against its historic consumptive use volume.

The recently passed Colorado Ag Water Protection Act (CAWPA) allows landowners to change up to half of their consumptive use water to the newly created Agriculture Water Protection (AWP) water right. Once adjudicated through water court, an AWP water right can be leased on an annual basis for several different uses, including agricultural, municipal, industrial, recreational and environmental. The remaining 50 percent of the original irrigation water right must remain on the land to be used for irrigation.

Figure 8. Interest in Rotational Fallowing for Ag Water Leasing



n = 249, nr = 17

Legislation initiated in 2003 enabled interruptible water supply agreements (IWSA), which allow water users to transfer a water right's historical consumptive use to another water user on a temporary basis, without permanently changing the water right. For one ten-year period, the state engineer is authorized to approve IWSAs that allow a temporary change in point of diversion, location of use, and the type of use of a water right, without the need for adjudication. A water right owner with an IWSA can also request re-authorization for up to two additional ten-year periods if the current IWSA has not been utilized. An Interruptible water supply agreement cannot be exercised for more than 3 years in a 10-year period, and is subject to the priority system like any water right. The State Engineer cannot renew an IWSA that transfers water

across the Continental Divide. There are also notification requirements for IWSA applicants to make sure that potentially affected water users have the ability to comment on the IWSA.

Leasing ag water for maintenance of in-stream flows is enabled through the Colorado Water Conservation Board's (CWCB) in-stream flow program (ISF). The ISF program was created to help preserve or improve the natural environment, with emphasis on maintaining minimum flows in critical stream and river reaches. Water rights can be leased, sold, or donated to the CWCB. The CWCB can lease agricultural water rights on a temporary basis. By law, only the Colorado water conservation board is entitled to hold instream flow water rights. Instream flow water rights are decreed for a specific rate of flow through a specific reach of stream.

Rotational fallowing represents the simplest method of 'creating' consumptive use water for leasing. Instead of growing a crop, a field is fallowed and the consumptive use water associated with the field is instead leased for another use, such as municipal or environmental purposes. One potential downside of rotational fallowing is the impact fallowing may have on soil quality and health. Additionally, a cover crop may be required to help control weeds and soil erosion. Like all lease arrangements, the lease must not injure other water rights.

Figure 9. Ranking of Ag Water Lease Arrangement Preferences

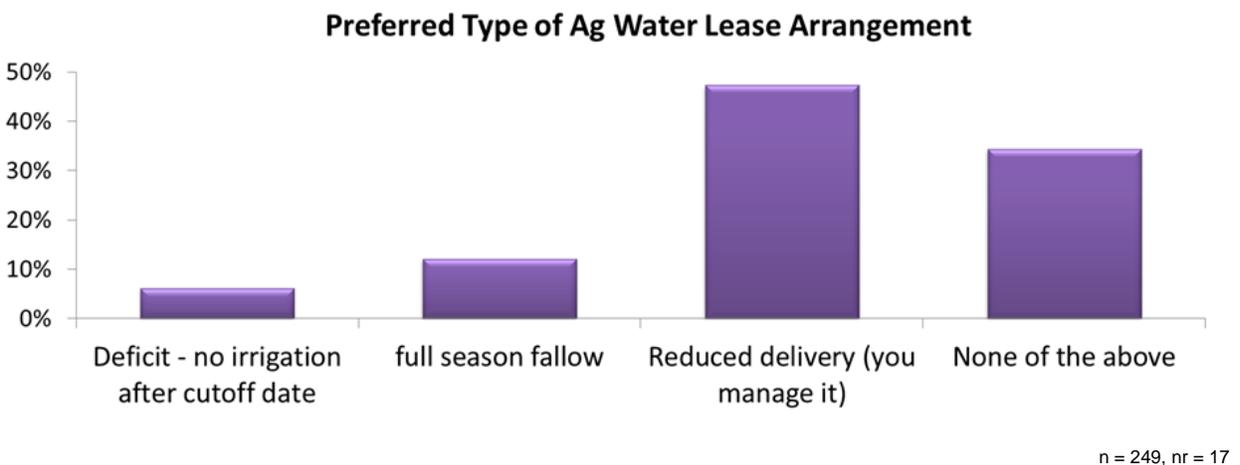
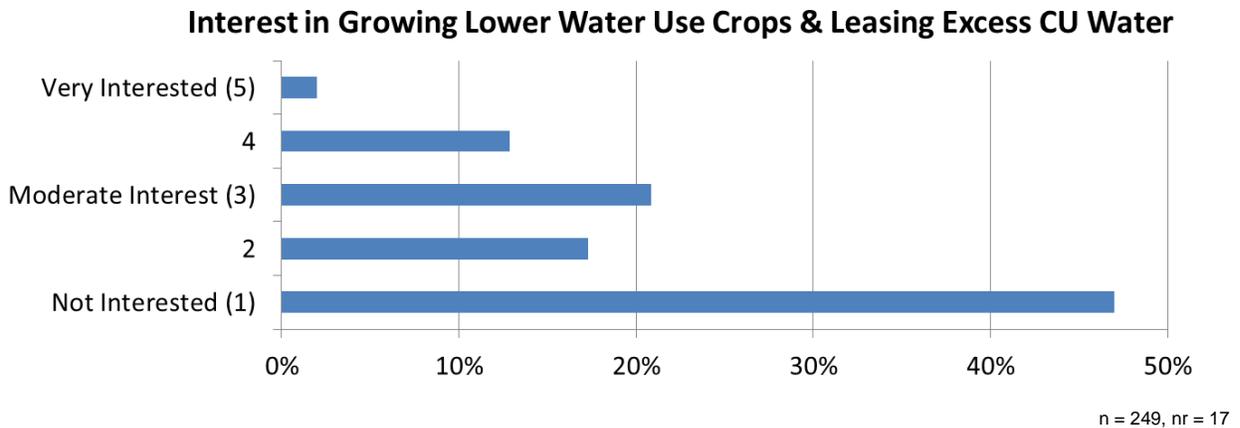


Figure 9 (above) displays the results from a question in which respondents voiced their preference about different types of ag water lease arrangements, including full season fallowing (no water on the fallowed field), deficit irrigation with a specific water cutoff date, or a reduced delivery volume where the operator decides how to manage it. The majority favored the reduced delivery option, and little interest was expressed for fallowing or deficit irrigation.

Deficit or partial irrigation refers to the practice of under-watering a crop for all or part of the growing season to create consumptive use water for leasing while still growing a crop, albeit with a lower yield. Deficit irrigation may include watering a crop up to a specific cutoff date and then ceasing irrigation, or watering at a prescribed, sub-maximum rate throughout the entire season ceases. Crops that can tolerate significant drought stress, such as alfalfa, may be well-suited for deficit irrigation. CSU research has found that alfalfa plants, for example, use more water as it gets hotter but the increased water use (transpiration) doesn't translate to an equivalent increase in biomass production. In other words, as the temperature increases, more water must be used by the plant for cooling. Alfalfa growth near the beginning and end of

summer tends to have superior water use efficiency (WUE) than growth during the hottest time of the summer (CSU Extension, 2016). Water use efficiency (WUE) is the ratio of biomass produced to the rate of transpiration. Irrigation water could potentially be applied early and later in the growing season, enabling two cuttings, but leased during the hottest period of the summer. This scenario could potentially produce a higher overall monetary return on the water by leasing it during the highest municipal demand months.

Figure 10. Lower Consumptive Use Crop Interest



Growing crops that use less water than the established historic consumptive use is another method of creating CU water for leasing. An example is the substitution of field peas for corn. Respondents were asked to rank their interest in growing 'less thirsty' crops on a scale of 1 to 5, with 5 representing a high level of interest. As shown in Figure 10 (above), survey takers indicated varying levels of interest in this option, with the majority expressing little or no interest.

Ag Water Fact: "What Use it or Lose it Really Means"

"A water right can be determined to be abandoned due to non-use for a long period of time (ten years or more), but only if the non-use is due to an actual intent of the owner of the water right to permanently forego the beneficial use of this water. This is the real basis for the term "use it or lose it."

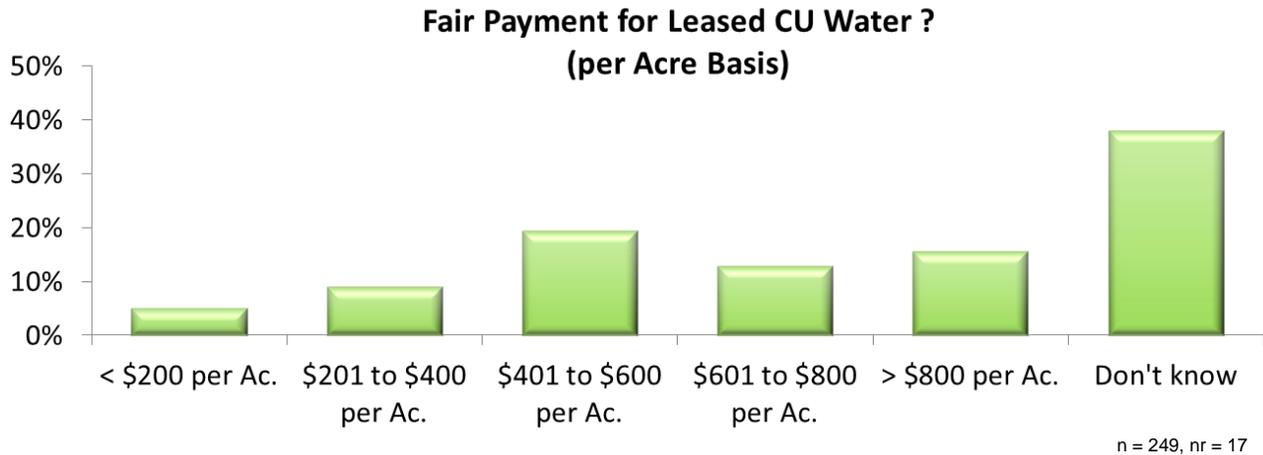
Source: Special Report No. 25, Colorado Water Institute. February, 2016.

C. Leased Water Compensation Preferences

Agreement on an equitable price for leased water is one of the keys to making any ag water lease arrangement work. Survey takers were asked in separate questions to indicate what a fair payment would be for leased CU water based on a price per acre and based on a price per acre-foot. The answers to both questions are displayed in the following charts. Based on a

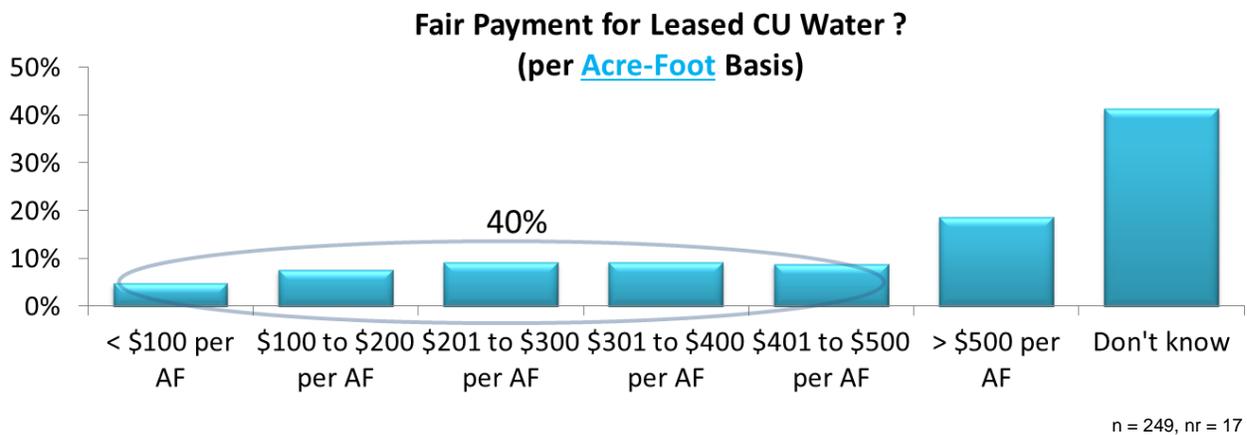
price per acre, 14 percent thought an amount below \$401 per acre would be adequate compensation for leasing the associated water.

Figure 11. Fair Payment for Leased Water based on a Price per Acre



On a per acre-foot price basis, 40 percent expressed interest below \$501 per acre-foot and about 19% indicated a price above \$501 per acre-foot would be needed. In both charts, the large number of "don't know" responses appears to primarily reflect a disinterest in leasing. This same approximate number of respondents (~35% +/-) indicated throughout the survey that leasing their ag water was not appealing to them.

Figure 12. Fair Payment for Leased Water based on a Price per Acre-Foot



The state water plan puts forth a goal of 50,000 acre-feet of CU irrigation water to be leased to the municipal and industrial (M & I) sectors annually to help close the demand-supply gap. In addition to the M & I sectors, recreational and environmental interests also desire to lease agricultural water for sustaining stream flows, supporting aquatic life, and other uses.

Cities and industries can typically afford to pay a superior price for water because their costs can largely be passed through to rate-payers. This advantage could reduce the ability of recreational and environmental interests to compete in an open market for leased ag water. However, as Figure 13 (below) indicates, many ag water right holders consider the ultimate use of leased ag water to be important. This suggests that the intended use of leased water may influence the price that some ag water lessors are willing to accept.

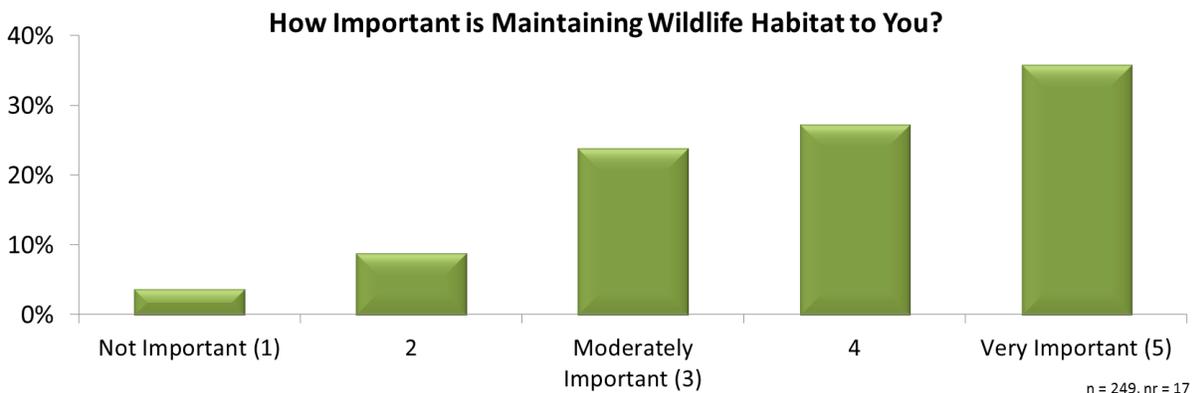
D. Leased Water Use Preferences

Figure 13. Use of Leased Water



When irrigated lands are dried up, even for a season, it can impact wildlife habitat. Fields, earthen irrigation ditches and storage ponds can 'leak' a significant volume of water during and after the irrigation season. Besides supplying water to downgradient irrigators, this leaked water supplements stream flows and sustains many small seeps and springs around the state which creates watering areas and seasonal wetlands. Colorado water law requires that no injury can occur to other water right holders as a result of ag water leasing, and this requirement will also help to reduce impacts to wildlife habitat. As displayed in Figure 14 (below), ag water right holders generally have a high level of concern about sustaining wildlife habitat.

Figure 14. Wildlife Habitat Importance

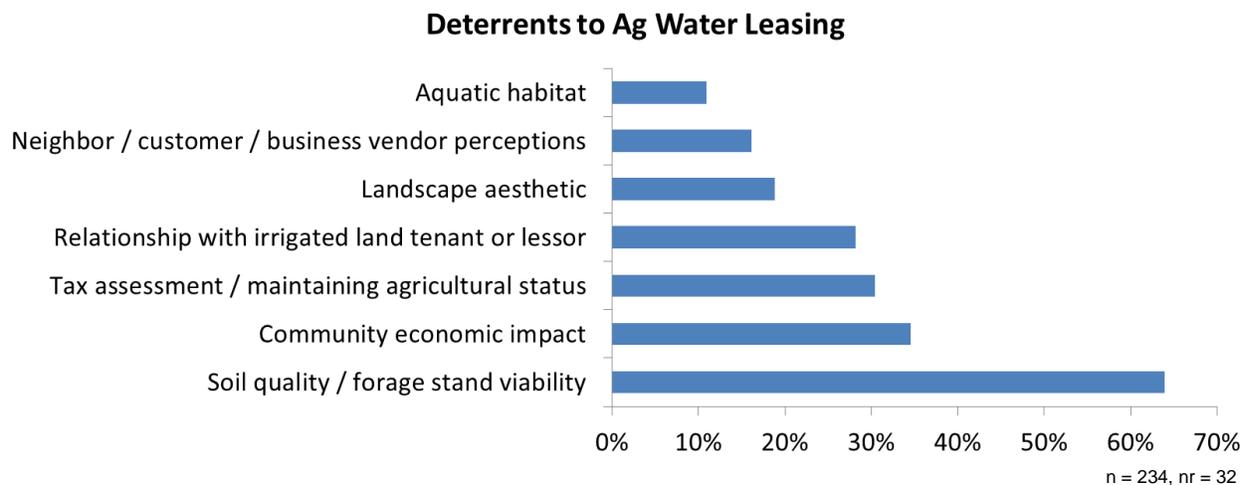


E. Perceived Deterrents and Advantages of Ag Water Leasing

When CU water is created for leasing through deficit irrigation, rotational fallowing, reduced delivery, or planting lower CU crops, it means reduced crop yield or no crop yield for a season. Figure 15 (below) shows the responses to the question "which of the potential effects of seasonal ag water leasing would you consider to be a significant deterrent to leasing ag water?"

A majority of ag water right holders expressed concern over impacts to soil quality and perennial forage stand viability. One respondent said "we have experienced multiple years of water shortages where some land has not been watered for several years and rainfall has been much below normal. Trying to bring these acres back into production has been very expensive, much more so than any research projects show." The respondent further commented that problems associated with hydrophobic soils, lack of soil tilth, and cracks in the soil surface were exacerbated by flood irrigation when trying to get a crop started. The commenter concluded that one year of leasing would be acceptable, but multiple years would be very detrimental to soils. The degree to which fields are impacted by fallowing is partially dependent upon pre-existing conditions, such as the soil type, depth and organic matter level. Precipitation, temperatures and other weather variables will also influence the level of impact to fallowed soils.

Figure 15. Potential Deterrents to Ag Water Leasing



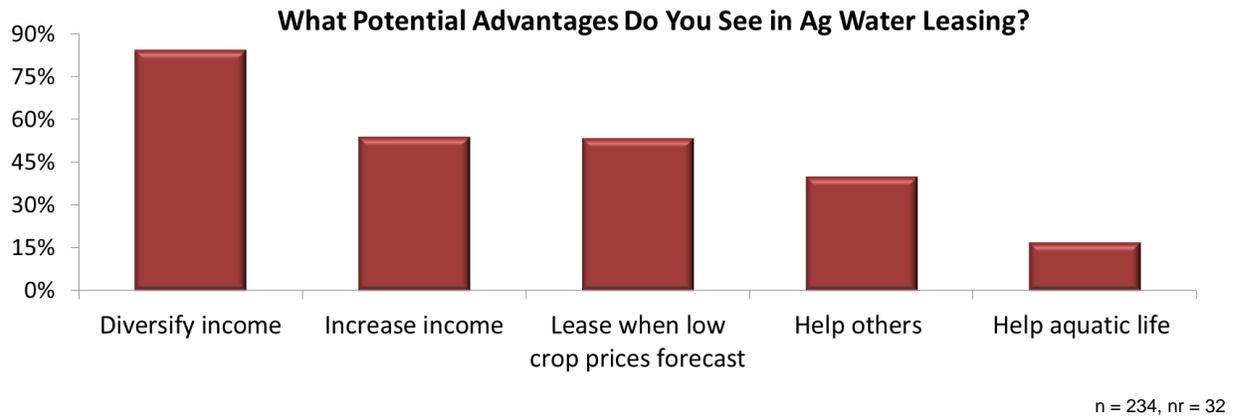
Ag Water Fact: Diverting Excess Water

"Consumptive use is based on an analysis of the crop demand and diversions, so diverting excess water may not yield additional consumptive use. Excess diversions will either be discounted as wasteful in the historical consumptive use analysis, or made a part of the return flow obligations of the applicant. Meeting return flow obligations is often difficult for applicants and increasing this obligation is not necessarily positive from an applicant's perspective."

Source: Special Report No. 25, Colorado Water Institute, February, 2016.

Figure 16 (below) displays the perceived advantages of ag water leasing. Diversification of income was widely cited as the most appealing element of leasing, followed by the potential to increase income and possibly lease water when low crop prices are expected.

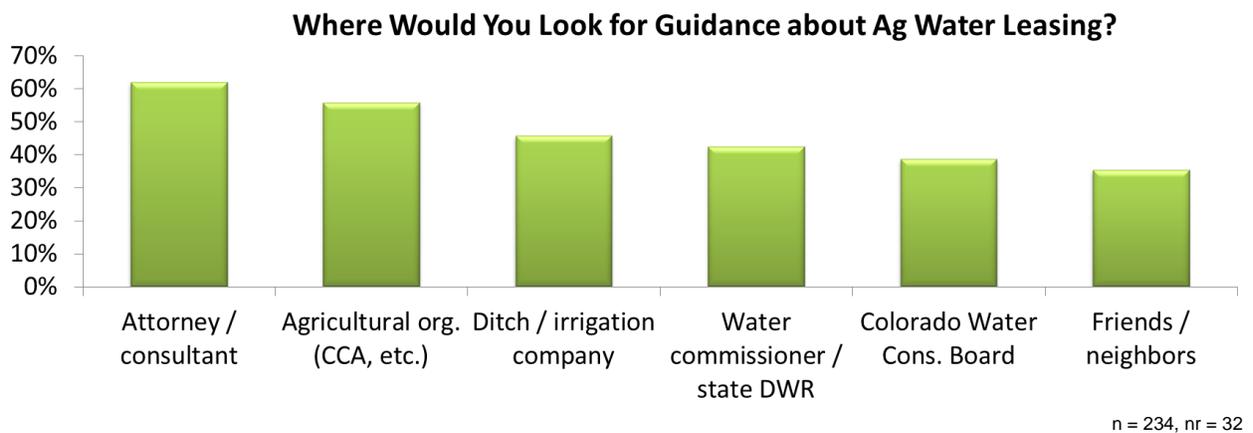
Figure 16. Potential Advantages of Ag Water Leasing



F. Ag Water Leasing Guidance and Administration Preferences

Water leasing is relatively new to most Colorado ag water right holders. As producers consider potential lease agreements, expert guidance will be needed to assist in determining the amount of consumptive use water available for leasing, developing and negotiating lease terms, and coordinating logistics. Survey respondents indicated that they would look to several different sources for guidance about ag water leasing, with attorneys and agricultural organizations topping the list.

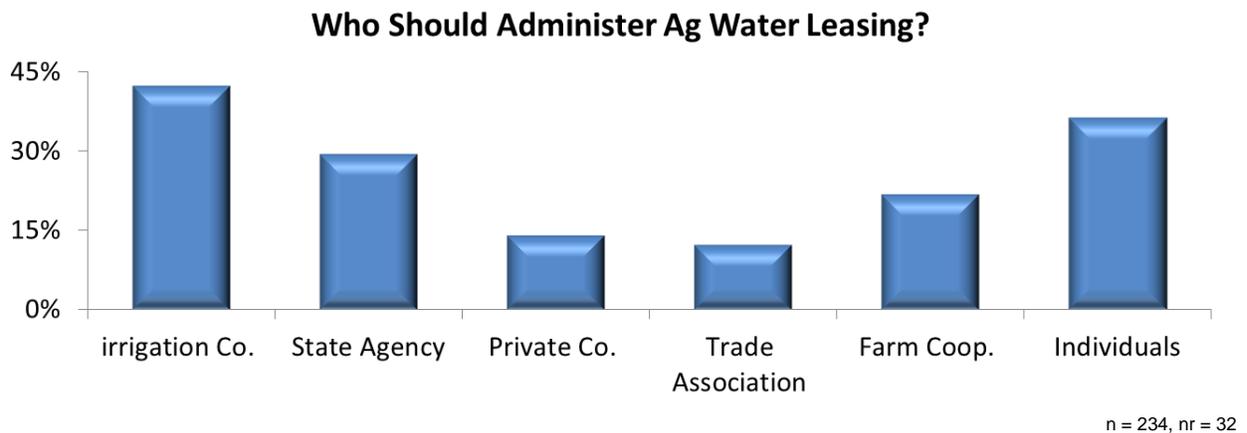
Figure 17. Sources of Guidance about Ag Water Leasing



Following the question indicated above, the survey asked respondents what entity or entities are most appropriate for administering ag water leasing arrangements. To this question, survey respondents favored irrigation companies and themselves over the other alternatives.

All ag water leases will require some type of state oversight to ensure that other water right holders are not injured by the lease arrangement, and that leases comply with state laws and interstate compact agreements. The Catlin Canal lease pilot project, which is administered by the Lower Arkansas Valley Conservancy District and overseen by the Colorado Water Conservation Board, is an example of how some lease arrangements are likely to function. A report summarizing the first year of the Catlin Canal Company Rotational land following - municipal leasing pilot project is available at the Division of Water Resources (DWR) website: <http://dwrweblink.state.co.us/dwrweblink/ElectronicFile.aspx?docid=2860293&&dbid=0>.

Figure 18. Administration of Ag Water Leases



Conservation versus Efficiency: What is the Difference?

In Colorado's system of water administration, conservation is the effort to reduce the amount of water consumed or taken out of the hydrologic cycle.

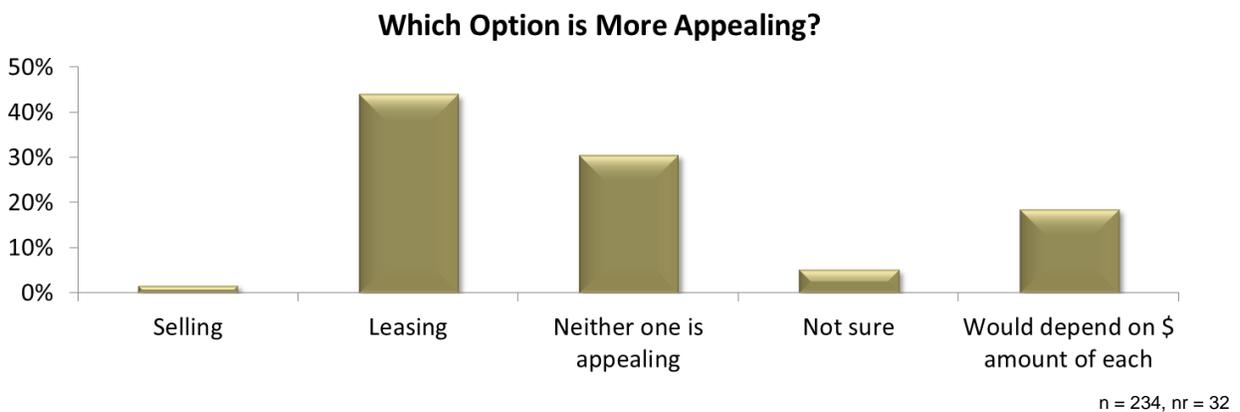
Efficiency is the ratio of the amount of water consumed by a specific beneficial use to the amount of water that must be diverted to achieve the beneficial use.

Source: Special Report No. 25, Colorado Water Institute, February, 2016.

G. Likelihood and Interest in Leasing Ag Water

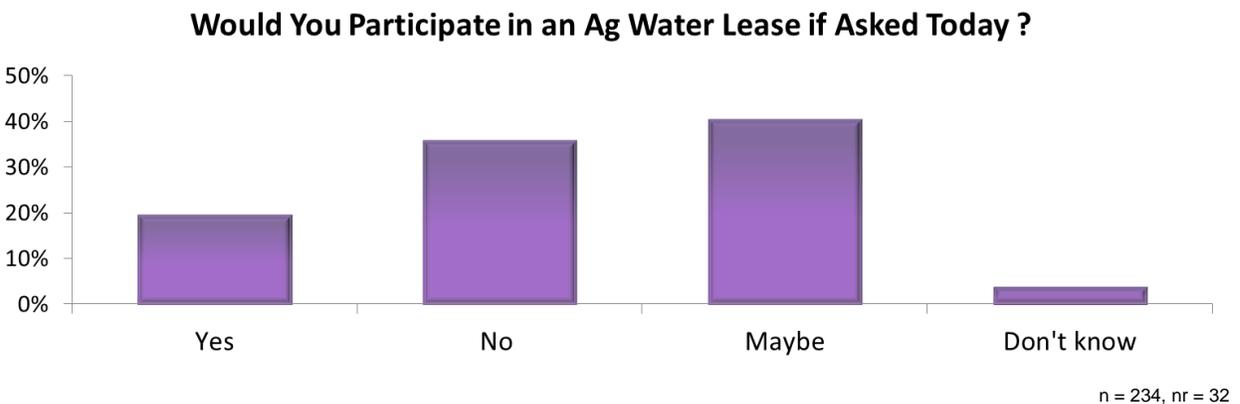
In response to the question of which option holds more appeal - selling or leasing ag water - most survey respondents indicate a strong preference for leasing. Less than two percent favored selling their water, given the choice. Approximately 31 percent - or about one third - of survey takers said that neither option was appealing. Anecdotally, some individuals who answered "neither" indicated in follow-up conversations that they preferred using all of their available water for growing crops and forage. Finally, 19 percent of survey respondents said the appeal of selling versus leasing depended on the financial terms associated with each option.

Figure 19. Selling Water Rights vs. Leasing



As shown in Figure 20 (below), about one-fifth percent of survey respondents would enter into a lease agreement today if the terms were favorable. Another 41 percent answered "maybe" and slightly more than one-third of respondents said "no." Overall, nearly two-thirds of the water right holders that answered the question indicate some level of interest in leasing.

Figure 20. Likelihood of Participating in an Ag Water Lease



III. Respondent Comments

More than 50 comments and questions were received from survey respondents. A sampling of the comments are shown below:

"Across the state, there are many differences in water rights and the interdependence of their use. What may be tail water for one, is the water right of another."

"Would not want any of the ag water going for golf course use. Parks OK."

"Changing the amount of water delivered or applied or changing a point of diversion has an impact on the entire river system (return flows) and can adversely effect the water rights of downstream owners of these rights."

"My fear would be of losing the water or the determination that I can operate on less water (and then losing it anyway)."

"Biggest fear is the propensity of water lawyers and legislative authority in dictating the terms. [We need] "information sources other than private company or individual with a known reputation to help spread the word."

"I think leasing is a good idea especially for large consumptive users. It is not practical for small producers. More information on risks /benefits should be made available by authoritative sources."

"It's better if government builds water storage than buying up agriculture water."

"I really do not believe in drying up farms by removing the water for city. The world needs to be fed especially with an increase in population. Farm ground is disappearing that cannot be undone. One [of] the effects of choices today will be reflected upon as horrible if farming and farms are not supported then being stripped of the most valuable resource it needs to succeed."

"It could just be a slippery slope that results in ag water rights permanently being taken away to provide for the never ending front range growth."

"I have seen very little has been published regarding this topic. My first thought is this is the camel's nose under the tent, next thing you know, Ag producers don't have any water."

"Understand that we're reducing agriculture production hence less food for an ever increasing population and smaller economic contribution."

"This is a tough year economically to grow crops. The idea that we could potentially be compensated to use less water is appealing. However, if and when prices turn around that will become less appealing. What is always scary is the idea that we could ultimately lose our water.. And ultimately, our way of life."

"One of the pillars of the water plan is storage. I am president of a ditch and reservoir company. We have spent 10 years trying to get permitted to expand an existing reservoir to store an absolute decree of 1,000 AF of mostly pre-1921 water. We cannot get through the Federal Permitting Process. The State no longer owns this water, .the Federal government does.by and through the tyranny of the Clean Water Act, the WOTUS encroachment by the Corps of

Engineers, and the EPA grip on water because they fund a lot of the infrastructure programs. Until such time as political persons at the congressional and governor level take on the FEDS...Storage is going nowhere."

"How would you get it from way out here (near KS border) to where it is needed around the front range?"

"The bottom line is: We have got to control human population growth."

The Ag Water Network is partially funded by a grant from the Walton Family Foundation (<http://www.waltonfamilyfoundation.org>), "focusing on oceans and rivers and the communities that depend on them." Contact Phil Brink, Ag Water Network Project Coordinator at (720) 887-9944 or Terry Fankhauser, CCA EVP at (303) 431-6422.

IV. References

2 CCR 402-15; Rules and Regulations for Submittal and Evaluation of Interruptible Water Supply Agreements submitted pursuant to 37-92, 309 C.R.S. (IWSA Rules); <http://water.state.co.us/DWRIPub/Documents/IWSARules.PDF>

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V. Appendix

Survey Questions:

- 1: Do you own or lease irrigated agricultural land? If no, you do not need to complete this survey.
- 2: In which county / counties do you own or lease irrigated ag land?
- 3: Please indicate the type(s) of irrigation water rights that you own / lease (check all that apply)
- 4: Please indicate the source(s) of your irrigation water? (Check all that apply)
5. Please indicate the irrigation method(s) that you use? (Please check all that apply)
6. Please indicate how many acres you irrigate.
7. Please indicate which crops are grown on your irrigated farm land (check all that apply)
8. "Consumptive use" is the amount of water used by the crop plus the amount lost through evapo-transpiration. How would you rate your familiarity with the concept of "consumptive use?"
9. Rotational Fallowing means not irrigating all or a portion of a field for an entire growing season. A cover crop may be required to help control weeds and soil erosion. The water that would have otherwise been used by the crop is leased for the season and the producer is compensated for the water. Please rank your interest in rotational fallowing:
10. Deficit Irrigation refers to the practice of under-watering a crop for all or part of the growing season to create consumptive use water for leasing while still growing a crop, albeit with a lower yield. Please rank your interest in deficit irrigation:
11. What type of ag water lease arrangement would you favor - full season fallowing (no water on fallowed field), split-season with a specific water cutoff date, or a reduced delivery volume where you, the operator, decide how to manage it?
12. Growing crops that use less water than the historic consumptive use is another method of creating water for leasing. An example is substituting sorghum for corn. Please rank your interest in planting lower consumptive use crops and leasing the excess consumptive use water:
13. If you were to participate in an ag water leasing arrangement, what would be a fair price for the consumptive use water you lease, based on a price per acre?
14. Similar to the last question, what would be a fair price for the consumptive use water you lease, based on a price per acre-foot of water?
15. If you leased ag water, would your interest in participating depend on how the water was used (for example: municipal, industrial or environmental)?
16. Where would you look for guidance if you were interested in participating in ag water leasing? (please check all that apply)

17. "Buy and Dry" is the term used to describe the practice where a city or other water interest purchases irrigated agricultural property and removes the water from the land to use for other purposes. Given the choice between selling your water rights or keeping them and leasing a portion of the consumptive use water each year for an annual payment, which would be more appealing to you?

18. Ag water leasing arrangements have been established between irrigation companies and industry where the irrigation company guarantees it will deliver water if needed, up to a maximum amount per year. The irrigators involved agree to have their annual water allocation reduced by some maximum amount that is previously agreed upon. In return, the participating irrigators receive an annual base payment plus an additional payment if water is actually delivered. How interested would you be in participating in an ag water leasing arrangement of this kind?

19. What entity or entities do you see as being the most appropriate for administering ag water leasing arrangements?

20. What length of time is best for an ag water lease arrangement?

21. When irrigated lands are dried up, it can impact wildlife habitat. How important is maintaining wildlife habitat to you?

22. When consumptive use water is created for leasing through deficit irrigation or rotational fallowing, it means reduced crop yield or no crop yield for a season. Which of the potential effects of seasonal ag water leasing would you consider to be a significant deterrent to ag water leasing?

23. Do you feel that participating in an agricultural water leasing program would make your water rights more or less vulnerable to reduction or abandonment?

24. What potential advantages do you see in ag water leasing (check all that apply)

25. If you were asked today if you would be interested in participating in a compensated, voluntary, temporary agricultural water lease agreement, what would you likely say?