Can agricultural water conservation and efficiency provide the water needed for Colorado's future?

Colorado Agricultural Water Alliance

an association of agricultural organizations committed to the preservation of irrigated agriculture through the wise use of Colorado's water resources.

Produced by Colorado Agricultural Water Alliance

Made possible by a grant from the Colorado Water Conservation Board.

Adapted from *Meeting Colorado's Future Water Supply Needs: Opportunities and Challenges Associated with Potential Agricultural Water Conservation Measures*, in consultation with Todd Doherty, Rick Brown, Reagan Waskom, and Kelly DiNatale.

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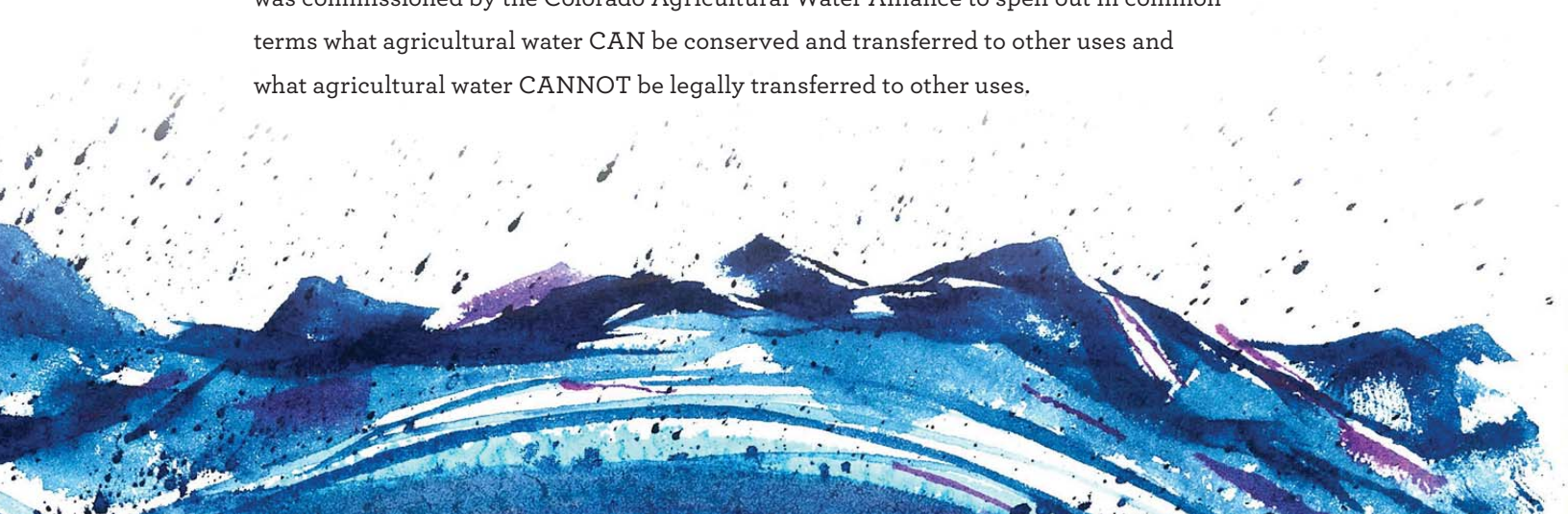
Can Colorado find the additional water it needs through agricultural water conservation?

Studies project that Colorado will be at least 20% short of the water it needs by the year 2030. Anticipated population growth, the effects of climate change, water requirements for energy production (even renewable energy) will increase demand, while most of the water available in the state has already been spoken for.

There is a perception that if only farmers would do a better job of conserving water, by lining canals or switching to more efficient irrigation such as center pivot or drip systems, we would have plenty of water to meet the anticipated gap.

The reality is that while there are opportunities for agricultural water conservation, opportunities for producing significant amounts of transferrable water for municipal uses are constrained by certain legal, physical, and economic factors. This brochure was commissioned by the Colorado Agricultural Water Alliance to spell out in common terms what agricultural water CAN be conserved and transferred to other uses and what agricultural water CANNOT be legally transferred to other uses.



Of all the water available in Colorado...
About 75% is diverted for Agriculture

What happens to this water?
A Crop Consumptive Use
B Return Flow

A

Crop Consumptive Use is made up of...

- **Water retained by plant**
- **Plant Evapotranspiration**
- **Soil Surface Evaporation**

Crop consumptive use is the only water that Colorado water law allows the farmer to transfer.

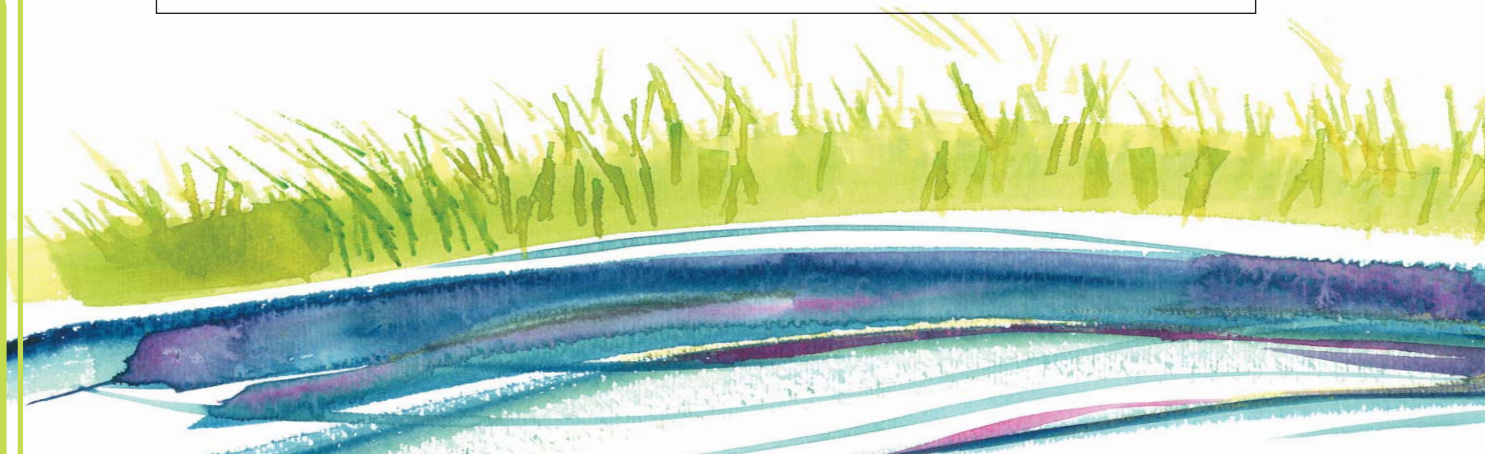
B

Return Flow is made up of...

- **Ditch Losses**
- **Percolation below crop's root zone**
- **Tailwater**

Where does Return Flow Go?

- Supports Riparian Habitat → Including Native and Invasive Phreatophytes
- Slow Percolation into Deep Bedrock Aquifer → To be Pumped by Well Users **or** used by Downstream Surface Water Users **or** to be lost to Evaporative "Upflux" **or** to meet Interstate Compact Demands
- Seeps into the Shallow (Alluvial) Aquifer
- Flows Back into River or Stream → To satisfy Downstream Surface Water Rights **and** to meet Interstate Compact Demands



Water Diverted for Agriculture in Colorado falls into two categories: Crop Consumptive Use and Return Flow

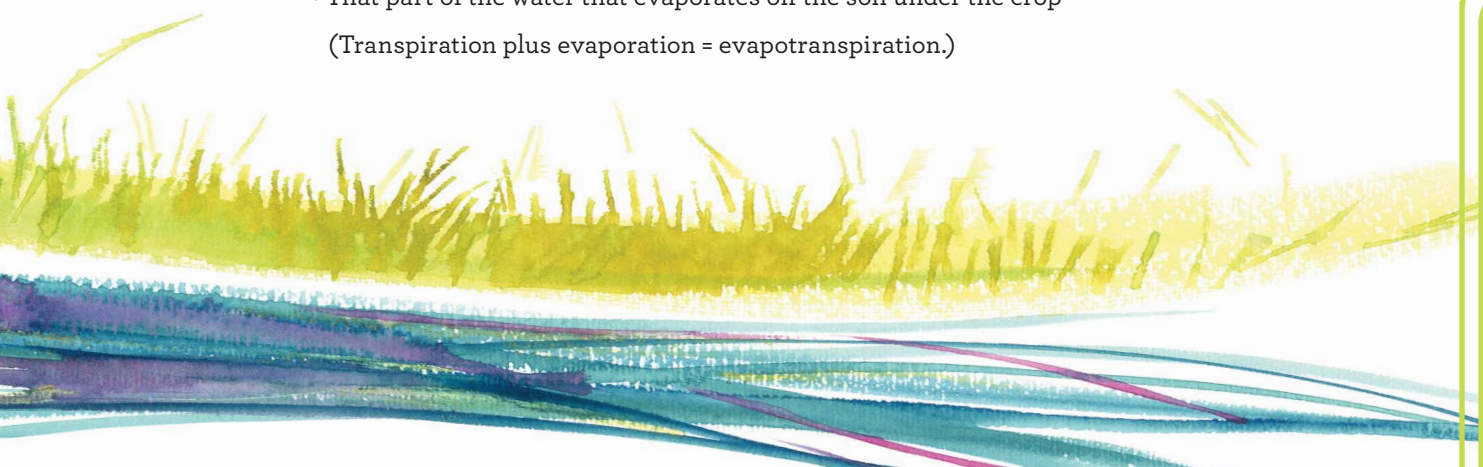
Colorado water law provides that the measure of an agricultural water right is the historical "crop consumptive use." That's the only water a farmer can theoretically transfer out of agriculture for other consumptive uses. Water that falls under the category of "return flow" is not the farmer's to transfer to other consumptive uses, even though it is part of the water he is allowed to divert onto his farm. To understand what water can and cannot be legally transferred from farms for other uses, such as quenching the thirst of urban neighbors, we have to understand these two categories.

What is crop consumptive use water?

Crop consumptive use is legally defined to include:

- That part of the water which is incorporated into the crop
- That part of the water which transpires through the leaves of the crop
- That part of the water that evaporates off the soil under the crop

(Transpiration plus evaporation = evapotranspiration.)



What is "return flow?"

The rest of the water diverted from rivers and elsewhere for agriculture is called "return flow." It includes:

- Water that seeps into ditches as it makes its way onto the farm or after it gets to the farm
- Water that runs off the end of the field after the crops are irrigated.

Can't return flow water be conserved and transferred for other uses?

Not really.

Return flow water returns to the hydrologic system and is usually relied upon by other water rights holders. If the initial farmer tried to conserve return flow to grow more crops, or to transfer it to the cities, he would be in violation of Colorado water law. Any city purchasing and transferring an agricultural water right would have to ensure that historical return flows are maintained in volume, timing and location.

Besides, return flow water provides benefits.

- It travels down into the soil below the root zone to carry away salts which could harm the crop.
- It seeps down into the aquifers to provide groundwater for farmers who pump it into wells to irrigate their crops, and for rural households to drink and water their landscapes.
- It returns to the river so other farmers downstream can divert it as "surface water" to grow crops, and to provide instream flows for fish.
- It creates habitat for plants and animals we value—birds and mammals, cotton woods and cattails.
- It flows downstream and can help Colorado meet our interstate compact obligations.

But return flow may create some problems.

- It sustains habitat for plants we do NOT value—plants which are invasive and crowd out the native plants we do value—and the birds and animals who depend on the native plants for habitat.
- It may pick up nutrients, sediments, and chemicals as it flows from farm to farm—which can deteriorate water quality.

Phreatophyte *is the word we use for the water loving plants that grow in and beside ditches and where tailwater flows. Whether they are natives or invasives, they consume water that would otherwise be used by the crop or return to the river for other uses. Eradicating non-beneficial phreatophytes can provide "salvaged water" but Colorado water law requires that salvaged water must be returned to the stream system. Farmers are not allowed to transfer it or use it to grow more crops.*

What if a farmer wants to conserve return flow for transfer to other uses?

If a farmer wants to change his water right in use, location, or timing, he must go to court and prove he will not harm other users. If his proposed change might affect other users who depend on the return flow, they would object. The court would most likely require continuation of historic river flows.

Why don't we change the law?

The law protects all those who over the years have attained rights to use Colorado's water. To be fair, any changes must protect those users. However, we *have* been changing the law in ways that do not hurt other water users.

- The Colorado Water Conservation Board can now accept or even purchase water rights from farmers to stay in the stream for fish—called "in stream flow rights."
- Water rights can now be claimed for "recreation in channel diversion" purposes—to provide water for kayaking, for instance.

If crop consumptive use is the only water a farmer can transfer for other purposes, how can it be done?

By selling the water rights.

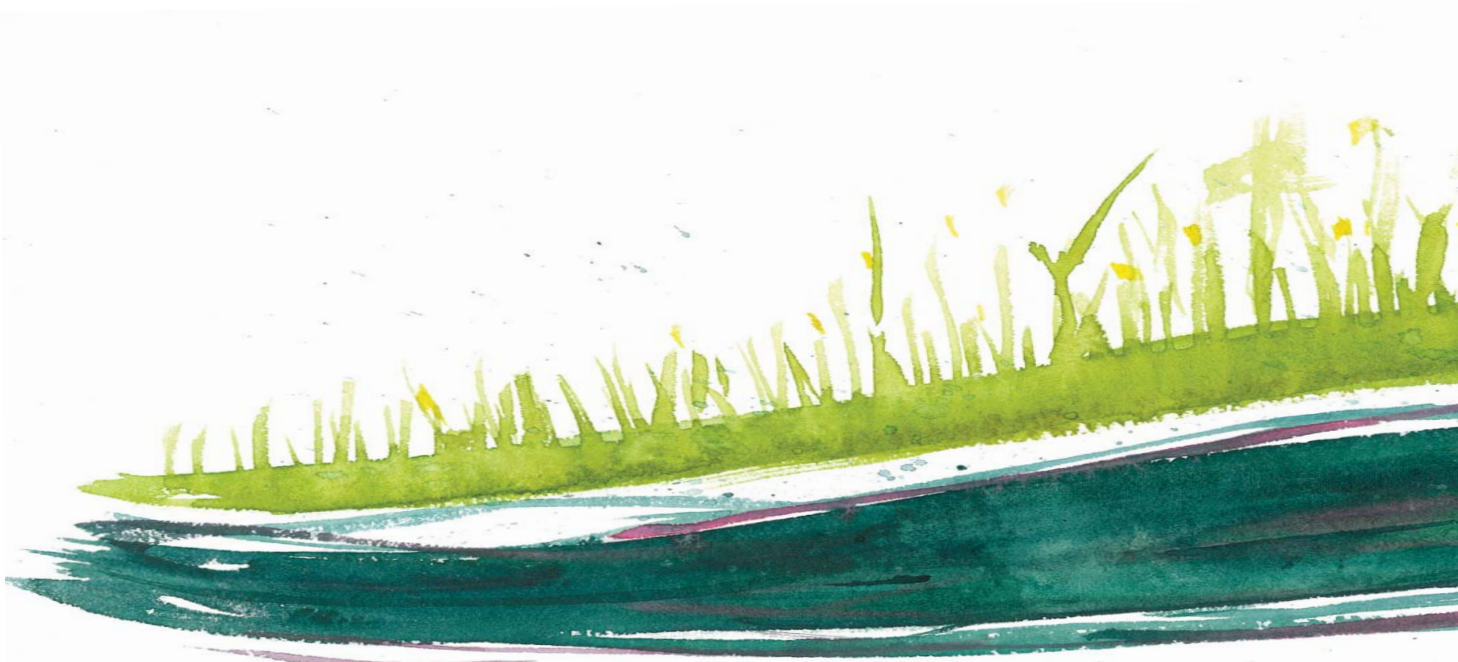
The farmer might stop farming. She might sell her farm and/or her water rights to be transferred off the farm for other uses. Or she might keep her farm, sell her water rights, and start growing crops that do not require irrigation.

By leasing the water rights.

Farmers and cities are beginning to experiment with the concept of transferring consumptive use water through leasing. The farmer might stay in farming, but from time to time lease water for use elsewhere (for example, during times of drought when he couldn't make much of a crop anyway.) He might enter into a rotational fallow agreement which allows him to keep farming most of his land but lease the water that was being used for crops on a portion of his land—say 25%.

By changing crops or cropping patterns.

The farmer might change to crops which take less water, then sell or lease the conserved crop consumptive use water. In addition, the farmer might consistently give the crop less water than it likes—called deficit irrigation. The crop yield would be less, but the water not used by the crop could theoretically be sold or leased for other uses, offsetting the loss in yield. In this case, water could become a secondary crop in itself!



But these alternative methods of transferring water from agriculture without permanent dry up of agricultural land have not been fully tested in court.

The challenge with using methods such as rotational fallowing and deficit irrigation to free up crop consumptive use for transfer to other uses is proving that these practices can be decreed in water court and administered to the satisfaction of the state engineer and other water users. One example of the legislature addressing this issue is a bill passed a few years ago that allows a farmer to lease water to cities during drought in three out of 10 years, without having to get a change of use decree in water court.

Can't a farmer conserve crop consumptive use water for transfer by changing to more efficient irrigation methods?

Not really.

The farmer's water right is based on irrigating a certain amount of land. If by using a more efficient irrigation system, he uses less water, he is not entitled to transfer that water, or use it to expand acreage beyond the land included in his original water right. The exception is that the water that evaporates under the crop is minimized with drip irrigation (but not with other kinds of improved irrigation efficiencies, like center pivots.) That small portion of the water that evaporates off the soil surface under the crop, since it is part of the legal definition of "crop consumptive use," can be conserved and potentially transferred.

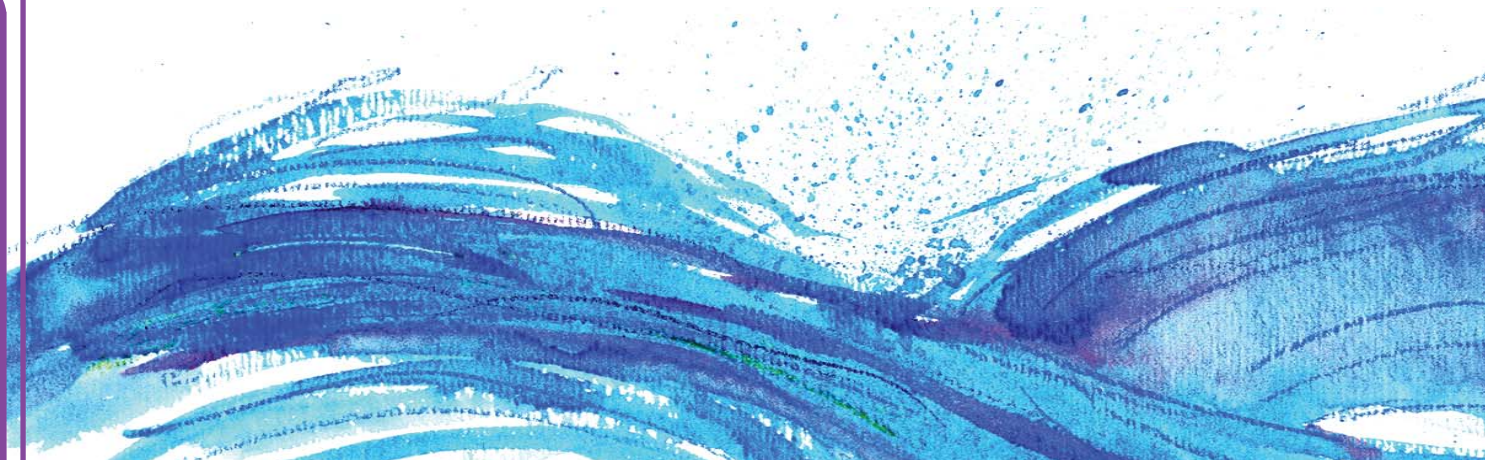
Why use more efficient irrigation methods then?

Many farmers have switched to more efficient irrigation methods at considerable capital and operating cost. (Federal and state grants and loans may cover some but not all of the capital costs.) Why have they upgraded if they can't benefit from the water they save?

- More efficient irrigation methods like center pivot sprinklers and drip irrigation do a better job of delivering the water to the crop, so the crop may be more evenly irrigated, increasing yield. (For farmers who did not have a full water supply using previous irrigation methods, more efficient irrigation might actually increase rather than decrease consumptive use.)
- More efficient irrigation methods typically require less labor.
- More efficient irrigation methods leach less water through the soil, so a farmer may be able to save money on fertilizer and herbicides.

Salvaged Water, Saved Water, and Conserved Crop Consumptive Use Water

Imprecise terminology has lead to confusion about agricultural water conservation. *Salvaged Water* results from measures such as removing phreatophytes — it's not transferrable. *Saved Water* results from more efficient diversion and irrigation methods — it's not transferrable. *Conserved crop consumptive use water* is water previously consumed by crops that has been removed from an irrigated cropping system. It is theoretically transferrable under Colorado water law but has not yet been fully tested by courts. Statutory definitions of these terms should be provided by the legislature to clear up misconceptions.



If a farmer can only transfer crop consumptive use water, is that enough to quench the thirst of growing cities?

It depends.

A. ***Probably not*** — if farmers use methods of conserving crop consumptive use like changing crops and deficit irrigating. How much transferrable water could be made available for other uses by these methods is unknown.

B. ***Probably so*** — if lots of farmers were to sell the water off their lands and either quit farming or change to dry land farming. (But if that happens, what about the economies of rural communities? What about wildlife habitat and the benefits from a green countryside if the land is permanently left fallow?)

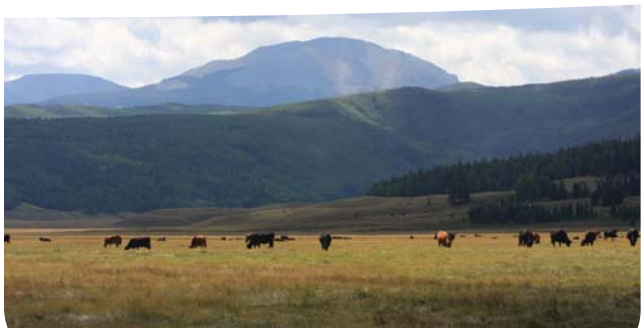
C. ***Maybe*** — if farmers use rotational fallowing leases and drought year leases to add a new crop —"water" — to their crop mix. (Under these circumstances, farmers continue to own the water rights and enjoy the benefits of their appreciation in value over the years. Rural communities' economies are affected less than when agricultural lands are dried up.)

A few future considerations

- The effects of implementing agricultural water conservation measures should be considered on both a basin-wide scale and a farm scale. On-farm implementation of conservation measures must be evaluated in the context of interstate compacts and basin hydrology.
- Incentives for farmers to control phreatophytes, given the restriction on transferring water salvaged in this manner, should be developed.
- The cost of agricultural water conservation measures should be borne by the beneficiaries of the conserved water. It isn't fair for agricultural producers to bear the cost of benefits we all enjoy, such as improved stream flow and water quality.

So what's the future for agricultural water conservation?

Farmers are as concerned as the rest of us about having enough water for our state's future. They know our state's economy and the quality of life of all Coloradoans depends on having enough water not just for food, but for thirsty cities, the environment, and for recreational uses which promote tourism. We need to understand the potential AND the challenges of agricultural water conservation to meet Colorado's growing need for water. It's complex, but it's not impossible. The first step is for all of us to understand that agricultural water conservation is not the simple answer some believe it to be.



How can I learn more?

This brochure has been made available by the Colorado Agricultural Water Alliance in an effort to clear up confusion about agricultural water conservation on the part of the public, legislators, stakeholder groups, and farmers. It is based on a paper titled *Meeting Colorado's Future Water Supply Needs—Opportunities and Challenges Associated with Potential Agricultural Water Conservation Methods*. For a more complete discussion of the issue, you may download the paper from: http://www.cwi.colostate.edu. This brochure may be downloaded from there as well.