Our Food Supply at Risk
White Paper on the Importance of Alfalfa Production in the American West

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Alfalfa is often the target of journalists and some critics of irrigated agriculture who frequently rely upon simplistic explanations to heap scorn upon growing a forage crop in the West, particularly in times of drought. The attack on alfalfa has intensified in the wake of U.S. Bureau of Reclamation Commissioner Camille Touton's June 14, 2022 appearance before a Senate committee, where she called on water users across the Colorado River Basin to take actions to prevent Lake Powell and Lake Mead from falling to critically low elevations that would threaten water deliveries and power production.

When the states failed to meet the mid-August deadline set by Commissioner Touton for them to propose 15% to 30% cuts to their water use, critics of irrigated agriculture ramped up their focus on the perceived easy "fix" to the complicated challenges facing the Colorado River: stop growing crops that they believe use lots of water….like alfalfa.

The "shot across the bow" against alfalfa production was fired by the witness who testified immediately after Commissioner Touton at the June 14th Senate hearing. The general manager of the Southern Nevada Water Authority (SNWA), whose member agencies serve more than 2.2 million residents in Southern Nevada, summarized the impressive urban efforts to reduce per-capita water use and further suggested that farmers reconsider growing crops like alfalfa. The solution, he said, is working toward "a degree of demand management previously considered unattainable."

He also noted that SNWA is planning to serve a population that will swell to 3.8 million by 2072.

In August, SNWA followed up with a strongly worded letter to the Biden administration, demanding action on several fronts, including creating "beneficial use criteria for Lower Basin water users, eliminating wasteful and antiquated water use practices and uses of water no longer appropriate for this Basin's limited resources".

In the following weeks, a steady stream of media coverage, including a 1,600-word essay in *High Country News*, have carried a similar message: Growing less hay is the only way to keep the Colorado River's water system from collapsing.

Some journalists love going after crops that use lots of water. Almond growers in California's Central Valley were subjected to a merciless multi-year "one almond uses one gallon of water" campaign during the last "unprecedented" drought that hit the Golden State in the last decade. Guess what? Years later, Central Valley farmers still grow them because consumers around the globe love almonds and consume them in mass quantities for their great taste and dense nutritional punch.

Simplistic examinations of alfalfa in terms of water demand vs. supply must be enhanced and balanced with discussion of productivity, economic return, food production, and the environment to be truly productive. A former Imperial Irrigation District (IID) board member once said that the definition of a low-value crop is one that's grown with the water someone else wants.

On behalf of the California Farm Water Coalition and the Family Farm Alliance, we offer this brief bit of continuing education to help you understand the rest of the story about alfalfa production in the Colorado River Basin and other parts of the American West.

Alfalfa 101: The Rest of the Story

The alfalfa sales pitch is a good one, because there's such a good story behind it.

That's not just a load of hay you see rumbling by on Western highways during summer months. Those hay bales form the foundation of rural agriculture in many Western rural communities. Alfalfa is not only a food source for livestock, it also has important environmental attributes.

Importantly, alfalfa actually has a key role to play in the water-uncertain future of the West due to its high flexibility during times of insufficient or excess water.

Why Do We Grow Alfalfa Today?

Most people understand that Western farmers grow alfalfa as livestock feed for the beef industry. Many people also overlook the fact that alfalfa is the major food source for dairy cows. Dairy cows provide dairy products, another important part of a balanced diet.

Alfalfa hay is essentially dried alfalfa. It is normally cut at a relatively mature stage of growth and left to dry out completely. As a result, the moisture content of hay is very low, but during the drying process some nutrients can be lost.

Alfalfa haylage is alfalfa that has been cut earlier and at a younger stage of growth than hay and left to wilt for a shorter period of time in the field before being baled and wrapped in several layers of plastic or chopped and ensiled.

The difference between haylage and hay is that, while the conservation of hay relies on the removal of moisture, the conservation of haylage relies on the exclusion of oxygen which prevents mold growth.

Tables 1 and 2 (below) summarizes hay and haylage in terms of production and value, respectively, for Western states. Not shown is Wisconsin, the number one producer of alfalfa in the country at over 6.9 billion tons (or 16.4 % of the national total) of dry alfalfa hay and haylage. In terms of dollars, the Badger State generated over $1.2 billion in 2021, or 10.4 % of all the nation's alfalfa production value. (*Source: USDA National Agricultural Statistics Service Information*).

Table 1. HAY & HAYLAGE, ALFALA -PRODUCTION (Measured in $)

State	Value	% of Reported U.S. Dollars	U.S. RANKING
US TOTAL	**11,594,140,000**		
WESTERN STATES			
IDAHO	947,188,000	8.17%	2
CALIFORNIA	835,582,000	7.21%	3
COLORADO	698,880,000	6.03%	4
NEBRASKA	593,931,000	5.12%	6
MONTANA	563,890,000	4.86%	7
ARIZONA	468,015,000	4.04%	9
KANSAS	454,359,000	3.92%	11
UTAH	418,803,000	3.61%	12
WASHINGTON	414,854,000	3.58%	13
SOUTH DAKOTA	342,056,000	2.95%	16
OREGON	329,120,000	2.84%	17
WYOMING	269,780,000	2.33%	18
NEVADA	204,561,000	1.76%	21
NEW MEXICO	147,500,000	1.27%	23
NORTH DAKOTA	139,104,000	1.20%	24
TEXAS	121,220,000	1.05%	25
OKLAHOMA	104,904,000	0.90%	27
TOTAL FOR WESTERN STATES	**7,053,747,000**	**60.84%**	

Table 2. HAY & HAYLAGE, ALFALFA - PRODUCTION, MEASURED IN TONS, DRY BASIS			
		% of Reported	U.S.
State	Value	U.S. Tonnage	Ranking
US TOTAL	**42,011,000**		
WESTERN STATES			
IDAHO	4,598,000	10.94%	2
CALIFORNIA	3,998,000	9.52%	3
NEBRASKA	3,783,000	9.00%	4
KANSAS	2,567,000	6.11%	7
SOUTH DAKOTA	2,024,000	4.82%	9
WASHINGTON	1,903,000	4.53%	10
TEXAS	580,000	1.38%	16
TOTAL FOR WESTERN STATES	**19,453,000**	**46.30%**	

As you can see from this table, nearly 61% of all the alfalfa production value in the nation derives from Reclamation states. Behind Wisconsin, Idaho is the number two producer of alfalfa in the country. Idaho hay is known for its high-protein content, and is marketable for dairy and horse operations around the world. Idaho's high elevations and arid climate create ideal drying conditions. Major alfalfa seed companies have facilities in Idaho and develop superior genetics tailored to Idaho's climate.

California - the third ranking producer of alfalfa in the country – also happens to be the No. 1 dairy state in the nation. California dairies generate 41.8 billion pounds of milk (18.5% of U.S. 2021 total output) from 1.7 million dairy cows. Of that total milk production, 46 percent is used to generate 2.5 billion pounds of cheese. California also leads the nation in the production of butter (534 million pounds), ice cream (528 million pounds), and yogurt (442 million pounds).

Alfalfa is considered to be the "secret ingredient" for the dairy industry; it is essential for higher milk production. Given its protein, calcium and fiber content, alfalfa is universally considered one of the highest-quality forages available for livestock.

Alfalfa also allows dairy producers to blend other crop by-products into their daily feed mix. – things like almond hulls, grape pomace and rice straw -that would otherwise not be utilized. Modern feeding practices now balance multiple feed sources to meet the nutritional needs of dairy cows. As the demand has risen for milk and other dairy products, such as yogurt, cheese, and ice cream, the amount of alfalfa required to meet those needs has remained relatively steady.

Western farmers also grow alfalfa as a seed crop to sell to other farmers around the world. When alfalfa is grown for seed, it flowers. Those alfalfa flowers attract bees and bees produce honey.

How sweet it is! More honey is made from alfalfa than any other crop.

Recent Trends

California for many years was the number one producer of alfalfa in the United States. In 2020, California harvested alfalfa hay acreage was at the lowest point in more than 100 years. Fifty years ago, 1.2 million acres of alfalfa were harvested in California, according to USDA data. Last year, only 475,000 acres were harvested.

There has been a dramatic reduction in the state's alfalfa acreage in recent years due to the ongoing drought in the Central Valley and the change in San Joaquin Valley cropping, where alfalfa and other forage crops have often been replaced by nut trees. The 2022 water shortage in the Central Valley resulted in 695,000 idle acres of farmland, with more acreage impacted. Alfalfa and dairy farms have also relocated from some areas of southern California due to recent urban development, according to anecdotal reports.

Farmland in general is being lost to development at alarming rates throughout California, but particularly in the Southland. The American Farmland Trust (AFT) reported in "Farms Under Threat 2040: Choosing an Abundant Future" that if recent trends continue, 797,400 acres of California's farmland and ranchland in 2040 will be paved over, fragmented, or converted to uses that jeopardize agriculture. Two-thirds of the conversion will occur on California's best land, and the top two hardest-hit counties will be Riverside and San Bernardino in Southern California. Fresno County, the nation's leading agricultural county by gross value, is in third place, and the 17th fastest in the nation in terms of farmland lost to other uses.

Central Arizona Project irrigators - due to operating guidelines on the Colorado River - expect that about 100,000 acres of farmland will be fallowed in 2023. Most of these lands (approximately 40,000 acres) currently produce cotton, but a significant portion – roughly 20,000 acres, according to CAP producers - will be alfalfa fields.

Benefits of Alfalfa

Alfalfa fields are the beginning of a food chain for a host of wildlife. The fields attract insects, which attract songbirds. Alfalfa fields also entice gophers, ground squirrels, and other rodents who make their homes there because alfalfa fields are not plowed under each year. All this activity draws the attention of nature's hunters and predators such as hawks, raptors and foxes looking for prey. Studies have shown several endangered and threatened species use alfalfa habitats. Alfalfa fields are host to beneficial insects that help control harmful pests.

Large wild mammals like deer and elk are drawn to alfalfa for the same reasons dairy cows do. Although they can be annoying to farmers and ranchers at times, deer and elk herds are common sights in rural alfalfa fields in many parts of the West.

Alfalfa promotes healthy soil. It has an extensive root structure that creates channels in the soil and secretes organic acids, which contribute to an improved crumbly soil structure called tilth. Both of these benefits help other types of crops planted later in the same field.

By growing alfalfa as a rotation crop, farmers reduce the need for chemical fertilizers in subsequent crops. Alfalfa is an excellent source of nitrogen, which is an important soil nutrient. Being a legume, alfalfa extracts and "fixes" nitrogen into the soil from the air. For many Western farmers and ranchers, it is the only economic legume crop that can be produced, which makes it a very valuable part of a crop rotation. Not only does alfalfa break pest cycles, it also builds up the soil nutrient levels. This keeps soil sustainable and makes it suitable for organic crop production after the alfalfa is harvested.

Alfalfa roots also protect the soil from erosion in several ways. Since alfalfa fields are not plowed as often as fields growing other crops, the extensive roots hold the soil in place, and the plants provide a canopy that prevents rain from loosening the soil.

Water Makes Alfalfa Grow

Although the sum-total water demand for a fully-watered alfalfa crop is high, this is mostly a function of its high yield and season-long growth pattern. Alfalfa is considered an efficient water user when compared to yield. The entire above-ground plant is harvested and used. Alfalfa fields use between 30 inches (2.5 acre-feet) and 80 inches (6.7 acre-feet) of water per year depending upon climate, soil type, and topography.

This wide range in consumptive use is also due to the number of cuttings (harvest operations) that a single field of alfalfa can generate in a year. In many parts of the West, alfalfa producers are lucky to generate six cuttings per year. In the Intermountain West, only three to four cuttings are made per year due to the cooler weather and shorter growing season. However, in the agricultural areas of California's Imperial Valley and around Yuma, Arizona - where the weather permits year-round agricultural production - farmers can get 9-10 cuttings per year.

The tremendous yield in these areas as compared to national alfalfa yield is reflected in Table 3.

TABLE 3: Alfalfa Hay Yield for Colorado River Basin States

Average Alfalfa Hay Yield (Tons / Acre)

	2016	2017	2018	2019	2020	2021	2022
ARIZONA	8.6	8.4	8.3	8.3	8.5	8.3	8.2
CALIFORNIA	7	6.8	6.9	7.1	7.2	7.4	7.1
NEVADA	4.4	4.3	4.7	4.9	4.4	5.1	4.9
Lower CO River Basin*	6.9	6.7	6.9	7.0	7.0	7.2	7.0
COLORADO	3.5	3.7	3.4	3.7	3.4	4	2.9
NEW MEXICO	4.6	5	4.7	4.9	5.3	5	5.3
UTAH	4.2	4.2	3.7	4.3	3.8	3.7	4
WYOMING	2.7	2.8	2.7	2.7	3.1	2.8	3.2
Upper CO River Basin*	3.6	3.7	3.4	3.6	3.5	3.7	3.4
Colorado River Basin*	4.9	4.8	4.6	4.8	4.6	4.9	4.7
National Average	3.4	3.3	3.2	3.3	3.3	3.2	3.2

% of National Average

Lower CO River*	202%	205%	216%	212%	215%	222%	222%
Upper CO River*	104%	113%	106%	111%	108%	114%	109%

*- Calculated from Production/Acreage NASS Data

In 2022, Arizona's and California's average per acre yield on alfalfa hay & haylage was 8.2 tons/acre and 7.1 tons per acre, respectively, compared to the national average of 3.2 tons/acre, which is extremely consistent with the national tonnage per acre median for the preceding 13-year time frame.

Farmers irrigate alfalfa fields using energy-efficient gravity (or surface) irrigation or sprinkler irrigation. Alfalfa producers manage their irrigation more efficiently by using tools like computer models and soil sensors, which help them determine when to irrigate and how much. An added benefit of surface or gravity irrigation is water can percolate into the soil, replenishing underground aquifers.

Demonizing Alfalfa and Western Irrigated Agriculture

Some in academic circles and the media like to play the role of social engineer and suggest that alfalfa production be abandoned in favor of "higher value" crops, or ones that use less water.

In recent years, some journalists have also advanced the message that the field crops grown in California's Imperial Valley are exported to Asia, implying that precious water is being shipped overseas through these crops to foreign countries.

According to Jay Lund of the U.C. Davis Center for Watershed Sciences, the concept of virtual water is misleading in the overall discussion of global trade and the water needed to support economic activities throughout the world.

"Talk of virtual water distracts from serious discussion of economic, environmental and hydrological objectives and processes important for real water and environmental systems to function. Virtual water discussions are all the more counterproductive coming in the midst of a very real and serious drought."

Still – alfalfa producers continue to be subjected to public criticism in media outlets, as well as by anti-animal agriculture extremists, who know that the more expensive forage and alfalfa become, the more difficult it is for beef producers to stay in business.

"$880 million – the value of hay shipped overseas last year from Colorado River Basin states, most of which went to China, Japan and Saudi Arabia," a *High Country News* opinion piece recently claimed.

The National Geographic reported in 2014 that 12% of Colorado River Basin hay is exported. Which implies that 88% of Basin hay was sold for domestic use, for a jaw-dropping $2.147 billion. In the Imperial Valley, between 20% - 30% of the hay that is produced is exported to other countries. The remaining 70% - 80% of the hay that's grown in the Imperial Valley is for domestic use for dairies and livestock all over the United States, especially in California.

Recent state level hay export data is made available from USDA Foreign Agricultural Service (FAS). This data indicates that Colorado, New Mexico and Wyoming are not significant exporters of hay. Export values for the first six months of 2022 are up for the U.S. at large (up 11%), as well as the states of California (up 11%) and Arizona (up 41%). This is the result of higher per unit prices – export volumes are down 1% for both the U.S. at large and California. Export values for the first six months of 2022 are down in both value and volume for Utah (-44% and -50%, respectively) and Nevada (-46% and -52%, respectively).

It should be noted that exports occur less from inland regions – like Colorado, Idaho, Utah and Wyoming – because of the proximity of states like Arizona, California and Nevada to outbound ports.

<u>Understand the Limitation of the Export Data</u>

It's important to note that the FAS state-level export data is fraught with asterisks. This is because sales of commodities to and from international trade partners are recorded at the national border,

so the exact amount of a product produced by a state and then exported is difficult to track with absolute accuracy. Although a state's actual agricultural export value cannot be measured directly, ERS estimates state exports of total and selected commodities based on U.S. farm cash receipts data. State shares of U.S. farm receipts are updated annually in calculating state-level international export values. This means that sometimes a state may be assigned exports based on their production that may not have actually come from their state.

The moral of the story - perhaps - is that available FAS data doesn't always give us a perfect picture and so everyone needs to be careful when they talk about it.

So What if Alfalfa is Exported?

America's five biggest export products by value in 2021 were refined petroleum oils, crude oil, petroleum gases, cars and electronic integrated circuits.

It takes a lot of water to run a plant that manufactures electronic integrated circuits. Roughly 10 gallons of water are needed to make a single computer chip. That may not sound like much, but multiply it by the millions of chips made each year, and the result is a large and rapidly growing demand for water. A shift to increased domestic manufacturing of computer chips creates a new demand that formerly did not exist. Unless new water supplies are developed that satisfy increased industrial demand, existing supplies will be stretched even more, leading to shortages for current users, higher prices, or both.

Taiwan Semiconductor Manufacturing Company (TSMC), headquartered in Taiwan and which makes chips for Apple Inc. and other customers, announced plans last year to invest $3.5 billion in its second U.S. manufacturing site on the northern outskirts of Phoenix, Arizona. Intel Corp., the only major U.S. producer of microchips, announced plans in March 2021 to build two chip factories in Arizona at a cost of $20 billion. The company has had another facility in Arizona since 1980. In addition to the potable water needed for a workforce of several thousands, companies like Intel also needs large volumes of water for their cooling towers. Intel's plant in Chandler, Arizona uses billions of gallons of water each year in its manufacturing process. In the fourth quarter of 2020, Intel used about 1.8 billion gallons of water. The company treats and discharges about 80 % of that water back to the city for further treatment and reuse. As part of Intel's recent plans to expand its plant in Chandler, the company's water treatment and recycling facility, W.A.T.R. (Wastewater and Treatment Recovery), allows Intel to treat 9 million gallons of water each day that it can then reuse.

U.S. semiconductor manufacturing has long been established in Arizona, and the state has more than 200 production facilities in addition to Intel and the new TSMC plant.

It's difficult to determine exactly how much Colorado River water is going to support chip manufacturing in the Southwest, but the volume is not insignificant. What is disturbing is that no one seems to be decrying the "export" of Colorado River water to other countries via these

products. Regardless of whether cars, computer chips, or alfalfa is sold to another country, water is required to produce all of them. The economic benefits associated with the production of these items is enormously important to the American workers who create them. It also matters to their communities, which benefit from the economic "ripple effect" of these production activities.

Moreover, the focus on "exporting water" in crops sold abroad is fundamentally incomplete because it does not account for the multitude of imported products used by U.S. residents. If water from Western states goes out embedded in goods produced in those states and sold overseas, then water from other countries necessarily also comes in embedded in goods produced in those countries and sold to Western U.S. consumers.

By ignoring the "water in" side of the import/export equation, those who advance the common narrative around "exporting water" in farm products not only disregard the economic advantages and quality of life benefits associated with international trade, but fail to make their underlying point that Western U.S. states are losing water to foreign countries through the sale of agricultural products.

Alfalfa Farmers and Agricultural Water Managers Are Proactive

The agricultural production meccas that are being attacked for what local producers grow seldom get the recognition they deserve for the vision shown by their forebearers and proactive management actions they have taken in Colorado River water resources management. The early irrigation districts on the Lower Colorado River – decades before the Colorado River Storage Project and Hoover and Glen Canyon Dams were constructed - first established the present perfected water rights and infrastructure on the River which allowed water to be stored to support year-round agricultural production. The significance of IID's present perfected right is that in times of shortage, present perfected rights must be satisfied first.

The 2003 Quantification Settlement Agreement (QSA) for the Colorado River authorized the nation's largest agricultural-to-urban water transfers, which were necessary for California to reduce its Colorado River diversions to within the state's 4.4 million acre-feet entitlement. IID is implementing efficiency-based water conservation programs that improve its water delivery system and provides funding for on-farm conservation measures to create approximately a half million acre-feet a year of conservation. Under the QSA and related agreements, IID agreed to transfer this conserved water, over 15% of its annual share of Colorado River water, for 45 years to the San Diego County Water Authority, the Coachella Valley Water District and Metropolitan Water District of Southern California.

Also, through an on-farm partnership, IID and farmers are conserving water and ensuring that water is put to beneficial use in each field. This promotes the use of sprinklers, drip, pump-backs, land leveling, and other methods of improved water use and management efficiency. The on-farm program encourages significant economic development in the region, with $86 million budgeted for 2019 and 2020. Being that the IID system is a terminal system, any savings to enable more accurate deliveries and reduce spills allow a larger quantity of water to be available to its users and

to meet conservation obligations. These programs enable water security for the region and economic development in a farming sector that is struggling with rising labor costs and foreign competition.

Agricultural water use efficiency has also improved over time on the Arizona side of the Colorado River on the Yuma and Gila Projects, which were authorized to provide irrigation diversion and water delivery systems. Agricultural production in the Yuma area has shifted from perennial and summer-centric crop production systems (alfalfa, citrus, cotton) to winter-centric, multi-crop systems focused on the production of high-value agricultural crops. Use of irrigation water during the hot, summer months has declined precipitously over the past 30 years, reflecting the decline in perennial and full season crop production.

Irrigation water diverted to farms decreased 15% between 1990 and 2015 and nearly 18 % between 1975 and 2015. Factors contributing to this reduction in water use include a reduction in irrigable acres driven by urbanization, expanded use of multi-crop production systems that require less water and significant improvements in crop and irrigation management and infrastructure.

Urbanization during this time period reduced the number of irrigable acres by approximately 3%, which cannot by itself drive a 15 % reduction in water use. This becomes evident when the gross farm water delivery data are divided by the number of irrigable acres. When viewed in this manner, farm water deliveries on a per acre basis have declined by approximately 0.8 AF per acres since 1990.

The other important factor driving the reduction in water use is improved irrigation management. Improvements in on-farm irrigation infrastructure, including construction of concrete lined irrigation ditches and high flow turnouts, shortened irrigation runs, and sprinkler irrigation systems have improved on-farm irrigation efficiencies, resulting in a reduction in water use. Most Yuma growers use highly efficient level furrow or level basin surface irrigation systems with average application efficiencies in the 80-85 percent range.

The development of the Yuma vegetable industry is also responsible for the reduction in water use through its impact on crop production seasons and the industry's unending search for improved production practices.

Alfalfa Production as a Water Management Tool

Alfalfa has a variety of roles to play in a water-uncertain future due to its high flexibility during times of both insufficient and excess water. Eliminating its production doesn't have to be one of them.

Putnam et al. explain this in detail in a paper that was included in the proceedings of the 2021 Western Alfalfa & Forage Symposium, parts of which are reiterated here.

Alfalfa has several important biological features that make it an important component to consider as farmers adjust to a water uncertain future. Its deep roots can tap into residual moisture. Those roots can survive summer dry-downs and regrow when re-watered. Farmers in California's San Joaquin Valley have implemented summer dry-down as a practice to temporarily free up water supplies for other crops in the region. By temporarily ceasing to irrigate alfalfa, that water can be used by other farmers when it is needed most during water short years.

Because it is harvested in several cuttings, alfalfa can provide partial economic yields when irrigation ceases. Alfalfa fields can also be flooded in winter to recharge aquifers in many parts of the West.

Buildup of soil salinity is an unwanted consequence of drought. Contrary to some published accounts, alfalfa is actually highly tolerant of salinity. This would enable alfalfa to be grown utilizing degraded water, such as treated municipal wastewater, drainage water, and the like, which provides another avenue to extend water supplies.

Alfalfa has proved to be highly flexible and resilient in surviving droughts while sustaining productivity, even when as little as half the water requirement is applied. Deficit irrigation is the application of water below full crop evapotranspiration requirements during stress-tolerant growth stages. The practice has been shown to conserve water while maintaining yield in several crops grown in the Colorado River Basin, including alfalfa. It is one of the most cost-effective and most easily applied methods available, yet remains counter-intuitive to many, including some farmers. Perhaps the critics of alfalfa farming would consider assisting with developing policy that educates both decision makers and farmers and incentivizes the practice, which could reduce future water demand.

Under highly variable water supplies, alfalfa cropping systems offer tremendous flexibility due to its ability to be deficit irrigated and recover from droughts to yield normally. Alfalfa should be considered an important element of future irrigated cropping systems designed for highly variable water supplies in the Colorado River and elsewhere in the West.

Final Thoughts

Finding solutions to complex problems, like the Colorado River's dwindling supplies, requires working together, not divisive attacks. Fallowing productive farmland should be a last resort when it comes to America's food supply and the foundational inputs it needs.

The problem is, there currently isn't enough water in the Colorado River to meet its current demands, thanks to the ongoing drought in the Western United States and uncontrolled growth of urban areas. The situation is bad enough that the Bureau of Reclamation, which oversees water operations on the river, is seeking 2 million to 4 million acre-feet of water reductions and additional conservation by users in the river's seven basin states. That is a significant amount and will put a strain on everyone, but we can make it less painful by working together.

Growers across the West are stepping up, at their own expense, to provide solutions for the viability of their basins and the communities those basins serve. In many cases, that means senior water rights holders are voluntarily making water supplies available to junior water users, preventing cuts otherwise required. There are other collaborative efforts underway to fund on-farm conservation projects that are helping reduce demand.

Urban, agricultural, and environmental water users would all benefit from such efforts in the short and long term.

What is not helping is the relentless finger-pointing by non-agricultural water agencies and critics of agriculture, saying that farmers aren't doing enough. Critics of irrigated agriculture continue to shame farmers for growing crops, such as alfalfa, saying they should fallow their fields or switch to crops that use less water, which fixes nothing.

Farmers only grow crops that other people buy. Current vegetable and value-added farm products are subject to the same supply and demand of American manufacturers. Planting a crop simply because it uses less water ends up being a complete loss for the farmer and society if nobody is willing to buy it.

The Western agricultural system was built on local supply of feed and food. Shifting alfalfa production to other states adds additional food miles, greenhouse gas emissions from transportation, and would require far more acres to approach the yields that Colorado River Basin states are uniquely suited to produce as shown in Table 3, ultimately leading to higher costs and/or emptier shelves at the grocery store. Locally grown food for humans, dairy and animal proteins results in lower costs to producers and consumers.

Worse is the impact on communities that depend on agriculture for their economic well-being. California's Imperial Valley has no suitable groundwater or alternative water supply other than the Colorado River. With the largest irrigated district in the United States, it is an agricultural region that doesn't have an alternate economic base that can absorb additional unemployment, business closures, and the loss of tax revenue that come with fallowing.

Agricultural regions, such as the central valleys of California and Arizona, are facing a future of dwindling and unsustainable groundwater supplies as they look to replace potential shortages from sources like the Colorado River. Entire communities are at risk of closing, bankrupting their populations.

IID General Manager Enrique Martinez said it best in a recent interview with the *Desert Sun*: "You've got to . . . keep listening to the farmers, because ultimately, you don't want to get to the point of creating a food crisis to solve a water crisis."

REFERENCES

Coronel, Joyce, 2021. "Chandler-Intel pact preserves city's water resources as drought lingers". *Wrangler News*. May 27, 2021.

Entsminger, J. Statement of General Manager, Southern Nevada Water Authority, Governor's Representative, State of Nevada to U.S. Senate Committee of Energy and Natural Resources, June 14.

Family Farm Alliance, 2019. Testimony of Margi Hoffmann on behalf of Farmers Conservation Alliance and The Family Farm Alliance Before the U.S. Senate Energy and Natural Resources Committee, Subcommittee on Water and Power Hearing to Examine the Use of Technology and Innovation to Increase Water Security and Enable Economic Development in the West. October 30.

Family Farm Alliance, 2015. "An Ambitious Plan to Restore the Salton Sea". *Family Farm Water Review*. September, 2015.

Idaho State Department of Agriculture, 2022. "Crops Grown in Idaho". https://agri.idaho.gov/main/about/about-idaho-agriculture/idaho-crops/

Jervey, Ben. 2014. "Exporting the Colorado River to Asia, Through Hay". *National Geographic*. January 2014.

Lund, J. 2015. "California Drought: Virtual Water vs Real Water". Blog posted July 5, 2015 by University of California at Davis Center for Watershed Sciences.

Miller, C. 2020. "Imperial County Alfalfa – Critical for California, Essential for the World". *The Desert Review*. June 12, 2015 Updated April 17, 2020.

Orloff, S. and Putnam, D. 2010. "Adjusting Alfalfa Cutting Schedules for Economic Conditions". In Proceedings, 2010 California Alfalfa & Forage Symposium and Corn/Cereal Silage Mini-Symposium, Visalia, CA, 1-2 December, 2010. University of California Cooperative Extension, Plant Sciences Department, University of California, Davis, CA 95616.

Putnam, D.H., Gull, Amair, Baili, Khaled. 2021. "The Importance of Alfalfa in a Water-Uncertain Future". Umair Gull, Khaled Bali Published IN Proceedings, 2021 Western Alfalfa & Forage Symposium, Reno, NV 16-18 November, 2021. (http://alfalfa.ucdavis.edu).

Reiley, L. 2022. "The summer drought's hefty toll on American crops". *Washington Post.* September 5, 2022.

Sain, Ken. 2021. "Unique water plant enabling Intel's massive expansion". Gilbert (AZ) *Daily Sun*. October 11, 2021.

Helms, C. Robert, 1996. "Can computer chip makers reduce environmental impact?". Stanford University News Service. June 5, 1996.

Southern Nevada Water Authority, 2022. Letter to Debra Haaland (Secretary of the Interior), Tanya Trujillo (Assistant Interior Secretary for Water and Science) and Camille Calimlim Touton (Commissioner, Bureau of Reclamation). August 15, 2022.

Thompson, J. 2022. "The Colorado River's alfalfa problem". Published in *High Country News*. September 1.

U.S. Bureau of Reclamation. 2012. "Colorado River basin water supply and demand study". Study report. Washington D.C.: Department of the Interior.

USDA Economic Research Service (ERS) and Foreign Agricultural Service (FAS)

Workman, Daniel, 2022. "United States Top Exports", https://www.worldstopexports.com/united-states-top-10-exports/ April 22, 2022.

Yuma County Agriculture Water Coalition, 2015. "A Case Study in Efficiency – Agriculture and Water Use in the Yuma, Arizona Area. February, 2015.