INNOVATIONS in AGRICULTURAL STEWARDSHIP

Stories of Conservation and Drought Resilience in the Arid West

A compilation of case studies from

National Young Farmers Coalition

Family Farm Alliance

The **National Young Farmers Coalition (NYFC)** represents, mobilizes, and engages young farmers to ensure their success. We are a national network of farmers, ranchers, and consumers who support practices and policies that will sustain young, independent, and prosperous farmers now and in the future. Visit youngfarmers.org or contact kate@youngfarmers.org for more information.

The **Family Farm Alliance (FFA)** is a powerful advocate for family farmers, ranchers, irrigation districts, and allied industries in seventeen Western states. The Alliance is focused on one mission: to ensure the availability of reliable, affordable irrigation water supplies to Western farmers and ranchers. Visit familyfarmalliance.org or contact dankeppen@charter.net for more information.

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Photo courtesy Singing Frogs Farm

LETTER TO THE READER

In the arid West we are entering a new normal. Drought and climate variability are colliding with population growth, spiking the demand for food and fresh water. Across the Colorado River Basin, a geography that supplies water to over 35 million people in seven U.S. states from Wyoming to California, and two states in Mexico, new efforts are underway to close the gap between supply and demand. While everyone is feeling the sting, farmers and ranchers are all too often caught in the middle.

The last 14 years have seen prolonged drought in the western U.S., but 2015 has set new historical records. California offers a prime example. Like most western states, California relies primarily on snowmelt for its drinking water, irrigation, and water for the environment. On April 1st of this year, the state's snowpack was a mere 5% of normal.[1]

The southern portion of the state relies on melt from the Colorado River system, which is experiencing far below average snowpack, as well. In an urgent response, Governor Jerry Brown ordered mandatory water cutbacks in towns and cities statewide. Meanwhile, many farmers are already receiving little to no surface water allocation due to the miniscule supply and regulatory constraints, even after many regions have invested billions of dollars in efficiency improvements.

This sense of urgency has spurred renewed efforts to find solutions across western states. However, too often agriculture is viewed as the default "reservoir" that other sectors can access to satisfy growing demands for water. A report released by the Bureau of Reclamation in 2012 identifies a 3.2 million acre-foot gap between water supply and demand in the Colorado River Basin by 2060.[2]

Suggestions to meet this gap indicate taking 6-15% of existing irrigated agriculture out of production. Such efforts are already underway: Thirsty cities continue to buy water from farmers at tough-to-beat prices while the almond unfairly bears the brunt of the latest round of negative PR targeting water-demanding crops. If we continue down this path we risk serious implications for our farmers, ranchers, and food supply.

Without a doubt, agriculture has a significant role to play in water conservation. But all too often discussions of what to do about water scarcity take place off the farm, without input from those who have a direct connection to our food supply and far away from the landscapes that will be most affected. In order to develop **smart policy, it is critical to understand the solutions farmers and ranchers—young and seasoned alike—are utilizing to build drought resilience, steward water, and grow good food for all of us.**

The National Young Farmers Coalition and the Family Farm Alliance have teamed up to elevate the voices of farmers and ranchers doing just this. Following are five case studies profiling producers across the Colorado River Basin and beyond who—with curiosity, creativity, and seasons of trial and error—are conserving resources while enhancing productivity. Some are integrating efficient irrigation technology with soil health to increase both productivity and water savings. Others are navigating conservation within constraints outside of their control, such as the operations of the ditches which deliver water to farms.

To paint a deeper picture of the complexities and nuances of agricultural water conservation in the West, we worked with the engineering firm Applegate Group to create a water balance for three of the case studies. These water balances utilize a technical, objective approach to assess the producers' water rights, current conservation efforts, and barriers or opportunities for future conservation. They underscore the reality that conservation practices are different on every operation and unique from farm to farm.

Of all the producers whose stories are told here, what binds them together is their ability to manage for the economic, ecological, and social health of their operations, communities, and environments. They represent a growing movement of agriculturalists who are stepping up to the plate—and have been for years, despite the lack of attention—to farm with "whole systems" in mind. These farmers see that healthy soil is integral to healthy crops; that efficiency is an investment in future food and water security; that ecological services contribute to the bottom line; and that farmers sharing knowledge with one another is critical to innovation and adaptation.

As the pressures of climate variability and drought increase, farmers and ranchers are at the forefront of our national adaptation strategy. Producers are coming together to help one another, but they also need support from consumers, policy makers, scientists, and service providers. Our hope is these case studies will provide policy makers and other stakeholders with a more nuanced understanding of the diversity and complexity of western agricultural water conservation and an appreciation of what continuing to take agricultural lands out of production might mean.

Now is the time to engage farmers and ranchers as allies in finding innovative solutions that support the health of our land, water, and Western communities.

Sincerely,

Kate Greenberg
National Young Farmers Coalition

Dan Keppen
Family Farm Alliance

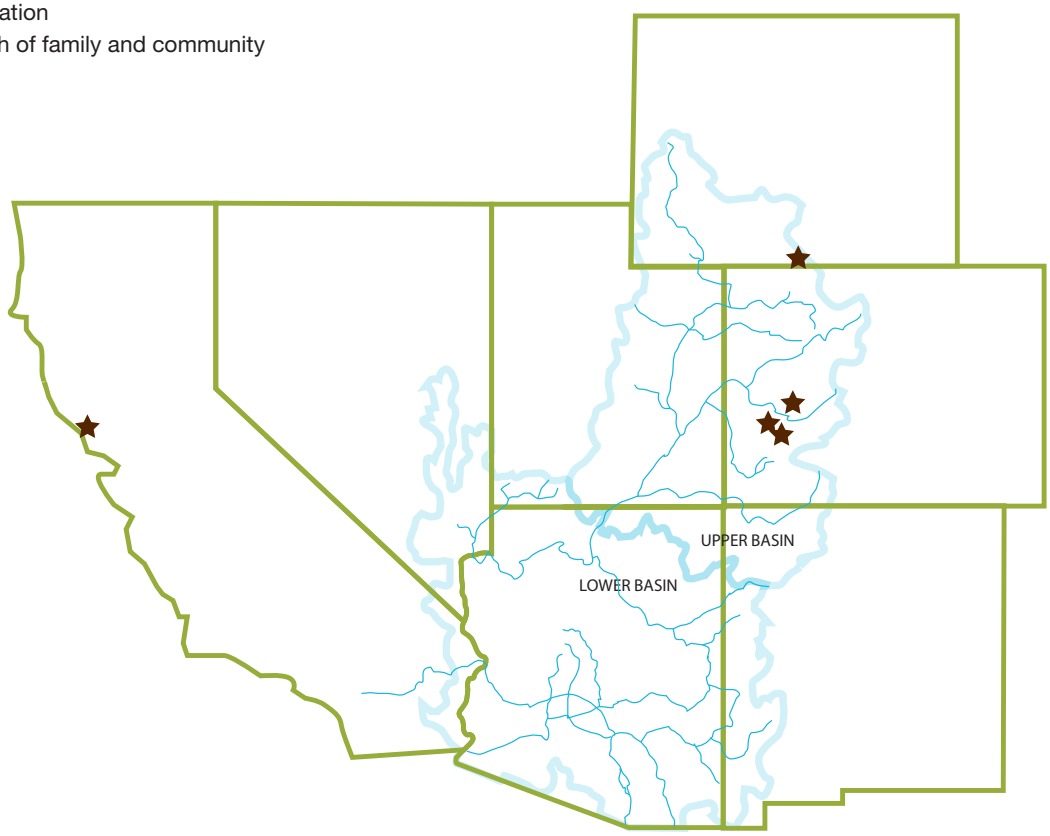
1 http://www.water.ca.gov/news/newsreleases/2015/040115snowsurvey.pdf

2 http://www.usbr.gov/lc/region/programs/crbstudy/FactSheet_June2013.pdf

EXECUTIVE SUMMARY

Through the process of researching and compiling the following stories, a number of common themes emerged. These themes point toward more conservation-oriented, resilient agriculture evolving in the arid West. These ideas are not new but have not yet been implemented at a scale equivalent to their potential. The solutions illuminated here must be amplified across all sectors invested in western water.

- **Farmers are investing in irrigation efficiency and conservation**
- **Efficiency improvements may be cost-prohibitive for some producers**
- **Many farmers and ranchers manage their water for multiple values including:**
  - food production
  - ecosystem services
  - biodiversity and wildlife habitat
  - recreation
  - health of family and community
- **Soil health is critical to drought resilience, productivity, and water conservation. This includes such methods as:**
  - cover cropping
  - rotational grazing
  - no-till
  - mulching
- **Soil health is an investment with long-term benefits; it connects producers across operation types, regions, and philosophy; it enhances other forms of water-use efficiency**
- **Farmers and ranchers are our first line of innovation for climate change adaptation and drought resilience**



The Colorado River Basin is a seven-state geography governed by complex interstate and international water law. The river travels some 1,450 miles from the Rocky Mountains to the Gulf of California. It supports over 35 million people; 15% of U.S. produce; and recreation, industry, wildlife, and the environment.

Pat & Sharon O'Toole

LADDER RANCH

A 135-year-old ranch built through holistic management

CONSERVATION AS FOUNDING PRINCIPLE

The Little Snake River Valley runs along the border between Colorado and Wyoming and helps form the headwaters of the Colorado River. This is a portion of the same water that eventually fills millions of taps in cities like Los Angeles and Phoenix. But first, it is stewarded on the Ladder Ranch, home to Pat and Sharon O'Toole, their children, and grandchildren.

The O'Tooles husband the same landscape that Sharon's great-grandparents settled on in 1881. Today, Ladder Ranch raises cattle, commercial sheep, horses, and working dogs. The O'Tooles have also created a ranch recreation business, which caters to fishermen, birders, hunters, and cyclers, as well as visitors interested in ranch life.

Sharon's family has long practiced what is known as holistic management—a way of integrating the whole farm or ranch, not just for economic health but for environmental and social benefits as well.[3] While Sharon grew up on the ranch, Pat is a first-generation rancher. From day one, he adopted the holistic management practices that for so long have been part of Sharon's family legacy. With their children taking on other elements of the business, the ethos of stewardship lives on.

To the O'Tooles, there is no inherent conflict between production and conservation. As Pat puts it, "We were always taught to keep one eye on the livestock and one eye on the landscape. One does not do well without the responsible management of the other. This is the resource ethic that we try to pass down through the generations."

WATER MANAGEMENT

Ladder Ranch, like many ranches in the interior West, relies on irrigation water derived from melting mountain snowpack. That water feeds a myriad of purposes. It grows hay and grass pasture, which supports the financial bottom line. It buffers soil against drought and fills creeks and streams. It supports trout fisheries and the anglers who seek them. It enhances biodiversity and provides water to wildlife that use Ladder Ranch as a migratory corridor. It draws in beneficial insects and pollinators and helps build a beautiful landscape. The O'Toole's holistic approach manages for all of these values simultaneously.

On 600 acres of irrigated land for hay and tens of thousands of additional acres of non-irrigated grazing land, the O'Tooles carefully monitor soil health. They plant

ABOVE: The O'Tooles have received many awards for conservation
TOP of PAGE: Ladder Ranch
Ladder Ranch photos courtesy Pat and Sharon O'Toole

Baling hay for the herd

cover crops on the farmland and utilize rotational grazing, which Sharon's father, George Salisbury, pioneered in the fifties. Rotational grazing imitates the movement of wild animals by rotating large herds of grazers—in this case sheep and cattle—on a carefully planned schedule. This allows the grasses ample time to regenerate while adding organic matter to the soil.

The irrigation practices the O'Tooles use vary depending on the nuances of the specific tract of land they are irrigating. Side-roll sprinklers irrigate about one-third of their pastures and flood irrigation waters the other two-thirds. While flood irrigation is considered less efficient, at the Ladder Ranch the "excess" water is essential to supporting waterfowl habitat. The water moves slowly across the land and eventually seeps back into rivers and streams to feed nine miles of trout fisheries and to provide irrigation for downstream users. In this specific case, increased irrigation efficiency could hinder other conservation values, a key example of the need for nuanced approaches to water management.

LEVERAGING PARTNERSHIPS

Another way the O'Tooles have conserved their lands' agricultural heritage is by partnering with land trusts to place a significant amount of acreage under conservation easement. Conservation easements are critical legal tools used to protect open space and working agricultural lands from development. The O'Toole's easement requires future owners to uphold the conservation values the family has agreed to, long into the future.

These decisions have made the O'Tooles leaders in collaborative conservation. Their partnerships include Trout Unlimited, Audubon Wyoming, and The Nature Conservancy—organizations some ranchers once viewed as adversaries. The O'Toole's recognize they share a common goal with many in the conservation community and have collaborated to protect threatened species, restore native habitat, and promote biodiversity.

A FAMILY ADAPTING TO A CHANGING CLIMATE

For the family, conservation is a pragmatic business choice that enhances their operation and ensures a productive landscape for future generations. With careful and specific management, the O'Tooles have watched their business and the landscape thrive together. In a changing climate—with a less reliable snowpack and thus a potentially less consistent water supply than in earlier years—they remain highly adaptable and responsive. Nothing is ever set in stone. As Pat puts it, "Our ranch is 135 years old, and we are still learning."

SNAPSHOT

Years owned by the same family: 135

Irrigated acres: 600

Commercial land use: cattle, sheep, working dogs, agritourism

Water management: Cover crops, rotational grazing, integrating ecosystem services

3 http://holisticmanagement.org/wp-content/uploads/2011/12/HolisticManagement-1-22.pdf

HOTCHKISS, CO

Cynthia and Ira Houseweart

PRINCESS BEEF

Raising grass-fed beef on the triple bottom line

RECORD OF RESILIENCE

Along the North Fork of the Gunnison River, a tributary of the Colorado River, orchards, ranches, and farm stands dot the landscape. This valley is home to rancher Cynthia Houseweart, who owns and operates Princess Beef, a grassfed beef operation she founded over 15 years ago with her husband, Ira. Like all farmers and ranchers in this arid region, Houseweart is constantly pushed to adapt her operation to an increasingly unpredictable water supply.

A historic drought in 2012 led many ranchers to cull their herds as they watched their pastures—and thus their winter feed—dry up. Yet Houseweart's pastures stayed alive, even after irrigation was turned off in August. Houseweart attributes this to how she manages her soil. As she recalls, "Down here on our place […] it stayed green. You couldn't really tell it was a drought. [The soil] holds the moisture so much better when the ground can soak it up." The unique way Houseweart manages her herd, her soil, and her water kept her afloat through one of the worst drought years on record. She is an example of how many innovative ranchers today think about their operations.

ROTATE RATHER THAN TILL

Houseweart's first tool for resilience is to keep the soil covered. She does this through rotational grazing and no-till pasture management. Traditional ranching involves moving cattle infrequently, leaving them out in open pastures to graze for extended periods of time. This often leads to over-grazing, which, in turn, compacts soil or makes it prone to erosion, heightens rates of evaporation, and prevents the soil from soaking up precious moisture.

Rotational grazing, on the other hand, is the practice of moving the herd frequently to allow previously grazed pastures to regenerate. Houseweart rotates her cattle every two to three days. This brings some short-term disturbance to the soil, but by resting each pasture for much longer than it was grazed, Houseweart builds up organic matter and naturally fertilizes her land through the cattle's urine and manure. This also helps restore the carbon and water cycles on her ranch.

In addition, Houseweart has not tilled her pastures in the nearly two decades she has managed them. Underneath the soil surface a complex ecosystem of life delivers water and nutrients to the plants. Tillage would disrupt and damage that ecosystem and the soil structure.

ABOVE: Cynthia Houseweart and her herding companion
TOP of PAGE: Cattle graze on healthy forage
Princess Beef photos courtesy Cynthia Houseweart

The Houseweart family on their centennial ranch

Houseweart has found that by not tilling her pastures, her forage grows more vigorously throughout the year and is supported by this subsurface ecosystem. She has also reduced fuel costs by not running a tractor over her pasture. These practices build soil structure and sequester carbon, which allows the soil to work as a sponge to hold water in place for when it's most needed. This means that even in extremely dry years, or when surface water is tenuous, Houseweart has a buffer against drought.

Houseweart's ranch is also unique in the efficiency of its irrigation technology. Instead of flood irrigating her pastures, as is common, Houseweart has invested in a center pivot sprinkler, which is typically around 80% efficient versus 65% efficiency for flood.
But Houseweart has taken her efficiency to the next level by integrating this technology with stewardship practices. She rotates her cattle behind the sprinkler, which both increases the fertility of her pasture and reduces the amount of cutting and baling hay she needs to do.

THE TRIPLE BOTTOM LINE

From the get-go, Houseweart has managed for the whole health of her ranch and family. The decisions she makes for economic reasons must also be ecologically viable while supporting the well-being of each individual on the ranch, her family, and the community. This way of managing is possible on any operation at any scale.

But it is not Houseweart alone who drives this. She collaborates with a broad host of partners, from her local Natural Resources Conservation Service (NRCS) agent to a strong local growers' network. The Housewearts rely not only on a supportive community but on their willingness to adapt and try new things to meet modern challenges. As snowpack and irrigation supplies become more variable, and aridity continues to be a growing pressure, producers like the Housewearts point to a viable way ahead.

SNAPSHOT

Years owned by the same family: 100

Irrigated acres: 100

Commercial land use: Grass-fed beef

Water management: Rotational grazing, no-till, center pivot irrigation

4 http://www.cprl.ars.usda.gov/pdfs/Howell-Irrig%20Efficiency-Ency%20Water%20Sci.pdf P. 468

HOTCHKISS, CO

Steve Ela

ELA FAMILY FARM

A highly efficient, 80–acre, organic orchard building soil for the future

WATER ONLY WHERE IT'S NEEDED

High up on a south-facing hillside overlooking the North Fork Valley in north-central Colorado, orchardist Steve Ela grows 80 acres of organic tree fruits. In the peak of summer, Ela Family Farm is a locus of bounty: apples, peaches, pears, plums, and cherries hang heavy from the trees, tempting passersby with their undeniable sweetness. But the bounty doesn't grow itself: In as hot and dry a region as this, averaging less than 15 inches of precipitation a year, water is a top limiting factor to success. In his decades of farming, Ela has learned a thing or two about water.

When Ela's family bought the orchard in 1987 it was furrow irrigated. This form of irrigation, which remains a standard practice for many orchards to this day, lets water flow by gravity from a ditch or stream through furrows running through the crop. Based on the specific needs of his orchard, Ela felt he could improve the growing environment for his trees—and thus his productivity—by becoming more efficient.

Upgrading the orchards' irrigation system was Ela's first priority. He worked with his local Natural Resource Conservation Service (NRCS) agent to design and install a permanent drip irrigation system, an array of flexible plastic tubing with small emitters that release water directly where and when it's needed. The cost of this upgrade was significant, running nearly $2,500 per acre. The upgrade required care during installation to avoid damaging the tree roots as well as additional maintenance. But the increased efficiency has allowed for more effective watering, so the trees are irrigated consistently and with only the amount of water they need.

MANY SOURCES OF IRRIGATION

One of the primary challenges when it comes to irrigation water for farmers in the valley is late-season irrigation water. Surface water there is stored in a series of reservoirs and released into a network of ditches throughout the growing season. When the reservoirs are empty, the ditches are shut off. The amount of water in the reservoirs is primarily determined by that years' snowpack and subsequent spring melt.

Snowpack in recent years has been well below average. To mitigate this, Ela uses a few techniques. First, the farm owns and utilizes a broad array of water rights from multiple sources. These include Leroux Creek, the Highline Ditch, and numerous small reservoirs. Not only does this offer Ela options throughout the growing season, many of these rights are senior rights. That means that in the event of a "call," or when water supplies are too low for every user to get their full share, senior rights take priority. These rules are based on western water law that is over a century old. When Ela is unable to pull from the ditches, he can then tap the reservoir supply.

ABOVE: Ela admires his orchard
TOP of PAGE: Spring blossoms mark the start of the growing season
Ela Family Farm photos courtesy Steve Ela

A view of the North Fork Valley from Ela Family Farm

But relying on this system of water allocation isn't Ela's only approach. Nor is being as efficient as possible with his irrigation technology. Ela takes it yet a step further: into the soil.

HEALTHY SOIL GROWS HEALTHY FRUIT

Step into Ela's office and you will find binders full of farm records tracking the soil fertility of his orchard. Before becoming a full-time farmer, Ela received his Masters degree in soil science from the University of Minnesota. With the desire to someday return to his family's land, he knew that growing healthy soil would be essential to fostering a thriving business.

On his orchard, Ela curates what he calls a "soil smorgasbord," meaning he manages for overall soil health so the ecology of his orchard can provide the crops with what they need at a given time. A key part of this "smorgasbord" is a permanent cover crop mix, which holds water in the soil, provides nutrients, and produces a healthier fruit crop. The mix, which includes species such as alfalfa and white clover, provides the orchard with 50% of its nitrogen needs and the majority of its mineral needs. This greatly reduces the need to apply organic fertilizers and also reduces the associated cost. Ela mows the cover crop three to four times a year, which has built his soil organic matter (SOM) to 3-4%, an impressive percentage for a region where average SOM is 2% or less. These healthier soils wick up moisture and maintain cooler temperatures in the orchard throughout the hot summer months. The less water the trees expend under heat stress, the less water needs to be applied to keep them thriving. And the more water they can keep in the soil to grow larger, sweeter fruit.

DOLLARS AND "SENSE" OF CONSERVATION

Economics may best explain the value for these improvements. When the orchard was purchased in 1988, gross revenue was about $200,000. Now, 27 years later, the orchard's gross revenue is $1.1 million, a 450% increase using the same amount of water and acreage. By integrating modern irrigation technology, soil health practices and a tenacious marketing sense, Ela has watched his productivity climb and his operation withstand the tests of time. Water efficiency and conservation have proven smart business risks that turned into real returns. For Ela, managing his orchard for long-term ecological health and economic viability just makes sense.

SNAPSHOT

Years owned by the same family: 27

Irrigated acres: 80

Commercial land use: Organic apples, peaches, pears, plums, and cherries

Water management: Drip irrigation, microsprinklers, cover crops

PAONIA, CO

Harrison Topp

TOPP FRUIT

Beginning farmer brings an octogenarian orchard back to life

LEARNING TO FARM

In the fertile North Fork Valley outside of Paonia, Colorado, Harrison Topp prepares for his second season growing organic cherries and plums. The orchard, which Topp's parents purchased in 2007, has been in production for over eighty years. His family previously leased the orchard to a larger farm in the valley, but due to the age and condition of the trees, the operators decided to end the lease. In 2014, the responsibility of bringing the orchard back into working order fell to Topp.

At a spry 28 years old, Topp first began farming six years ago on small-scale vegetable operations, first as an apprentice and then as manager. It wasn't until last year that Topp took the leap from annual vegetable production to perennial fruit and became the primary operator of his new business, Topp Fruit. When asked what drew him to farming, Topp notes a desire for the lifestyle and a good dose of stubbornness. Now he is figuring out the day-to-day work of growing food in a region with just 15 inches of average annual precipitation.

WATER MANAGEMENT

As Topp experiments with the arts of pruning, cover cropping, harvesting, and caring for the daily needs of his orchard, he is also learning the intricacies of irrigation. Topp has a single source of irrigation water: surface water from the Fire Mountain Canal. The canal runs just upslope of the orchard and carries water to many producers throughout the valley. In Colorado, as in many western states, this is the original irrigation structure: Canals, also known as "ditches," supply users water that has often been captured and stored in reservoirs. Many ditches in Colorado are earthen—the same canals hand-carved through the landscape by homesteaders or, in some places, by native farmers millennia ago. The Fire Mountain canal is concrete lined, while others in the area have been piped to save water.

The way the Fire Mountain Canal is operated determines to a great extent the choices Topp can make with his irrigation practices. Some ditch systems deliver water to users throughout the season according to their rights and needs. The Fire Mountain Canal, however, runs on what is called a constant flow: when water flows through the canal, Topp and the other water users must use it before it flows downstream. However, neither Topp nor any individual producer alone can determine canal or ditch operations as the ditch is operated by the Fire Mountain Canal and Reservoir Company whose members include shareholders along the ditch. When water is released from Fire Mountain Canal, Topp receives the entire amount diverted at this point for four-and-a-half days straight on an ongoing cycle until the water is turned off. There

ABOVE: Topp takes a break for a photo shoot
TOP of PAGE: Gated pipe irrigates Topp's orchard
Topp Fruit photos by Kate Greenberg

Topp and fellow farmer Elizabeth Woods Darby mark irrigation furrows

is no benefit to him as a producer—and in fact some disincentives—to use less than his full allocation.

RESILIENCE IN HEALTHY SOIL

Topp uses furrow irrigation, or shallow channels that run alongside the trees. This type of flood irrigation is often considered less efficient than such technologies as sprinklers or drip irrigation. But for Topp, installing more efficient irrigation comes with a steep price tag, one he might be willing to consider if it did not also pose a risk to the health of his orchard.

Some years, particularly in drought years, the Fire Mountain Canal can be turned off as early as July. This is often due to scant snowpack producing below-average runoff. Summer rains can help but are not reliable. This means Topp risks losing late-season irrigation, which is critical to fruit ripening. Topp relies on furrow irrigation to store water in the soil. As water flows through the furrows, some of it is used by the trees, some returns to the river, and some is stored in the soil. Topp is essentially using his irrigation technology to do what the larger irrigation infrastructure prohibits him from doing: storing water on-farm for late-season irrigation. His management also supports multiple values, including building healthy soil, enhancing river flows, and growing delicious fruit. While water conservation and efficiency are critical to the future of the West, Topp offers an example of why their nuances must be sufficiently understood.

The limits on Topp's irrigation infrastructure have urged him to build the health of his soil. This year he is planting multiple mixes of cover crops—an amalgamation of crop types that bring nutrients and organic matter to the orchard. The healthier the soil, the more water it can store. And the more water Topp can store in his soil, the less he risks losing his crop in a drought year due to lack of surface water. (See the Appendix for an in-depth discussion on options for supplementing irrigation supplies).

YOUNG FARMERS OF THE FUTURE

Conservation means many things to farmers and ranchers. Soil conservation is critical to Topp's ability to conserve water, while his operation is also driven by the constraints of his irrigation infrastructure, the cost of efficiency improvements, and the particular operations of his ditch. Yet Topp is perpetually questioning how to do things better. He looks to his neighbors who, as one-time beginning farmers, have navigated decades of their own challenges. Topp says there have been few things more valuable than the mentorship of fellow farmers.

When asked where he sees himself in forty years, Topp replies, "I'd like to say I'm still farming [….] If I do continue, I'd like to expand to a scale that gives me more flexibility so I can grow fruit for a greater portion of the population." It will take a reliable water supply for Topp to realize that future. There is no easy answer. But one thing is clear: We need more young farmers like Topp on the land, learning from their predecessors, forging innovative routes to conservation, and adapting to the variables of a changing climate.

SNAPSHOT

Years owned by the same family: 8

Years operated by Topp: 2

Irrigated acres: 4.4

Commercial land use: Organic cherries and plums

Water management: Cover cropping, soil moisture management, furrow irrigation

Paul and Elizabeth Kaiser

SINGING FROGS FARM

A small-scale, organic, no-till vegetable operation

GROWTH IN DROUGHT

Take a tour of Singing Frogs Farm and you will see crop rows packed with purple kale, butterhead lettuce, and heirloom tomatoes—over one hundred vegetable varieties in total. In this cool, low valley just outside of Sebastopol, California, farmers Paul and Elizabeth Kaiser are surprising their neighbors. In the midst of California's driest year on record, the Kaisers are increasing revenue on their two-and-a-half acres of cultivated bottomland while drastically reducing water consumption, an unlikely combination when the drought is driving farms elsewhere out of business.

Even in a historically unprecedented dry year, and in a region with an average of 30 inches of annual precipitation, the Kaisers are not daunted by the drought. Instead, they take it as a challenge to build drought resilience on their farm, where the precious groundwater they use to irrigate is just as tenuous as surface flows elsewhere. Whether through no-till, composting, or an intensive greenhouse schedule, the Kaiser's resilience always comes back to the health of their soil.

THE PATH TO NO-TILL

Like many young farmers today, the Kaisers did not grow up on a farm. In 2004, ready to raise a family and try out the ideas they experimented with while working on land restoration in The Gambia, West Africa, they purchased eight acres in Sonoma County. This land was not exceptional. The light, tan soil had only 2.4% soil organic matter (SOM) when the Kaisers bought the property, relatively low for the area. Only a couple of the acres were arable. Cold air funnels in from the surrounding vineyards, driving temperatures below freezing in the winter and bringing frost dates as early as September and as late as May.

The Kaisers started out tilling the soil, as is still the norm on most operations big and small. Soon they realized tillage, the process of breaking up the soil for cultivation, was disturbing critical life processes taking place underground. Now with no-till, Paul and Elizabeth are building their soil structure. This means they are able to capture more water—not to mention beneficial carbon and nitrogen—and store it in the soil where it supports the soil biome and the next crop.

The Kaisers also use an intensive greenhouse schedule to rotate crop successions and keep the soil covered at all times. The beds are not bare for more than a few

ABOVE: Farm employee Marty harvests a head of lettuce
TOP of PAGE: Singing Frogs Farm produces over 100 varieties of vegetables
Singing Frogs Farm photos courtesy Paul Kaiser

Most of the Singing Frogs Farm Crew: L to R (back row) Miguel, Elizabeth, Paul, John, Marty & Kim. L to R (front row) Anna, Lucas, Nina and Bryanna

hours at a time, which greatly reduces water loss to evaporation. Paul and Elizabeth are able to achieve this with transplants grown in their greenhouse and ready to plant-out immediately following harvest. They also apply a massive amount of compost, which they top-dress to the beds rather than tilling in. They plant directly into the compost, which retains moisture, builds organic matter, and delivers nutrients to the crop.

MORE ORGANIC MATTER, LESS IRRIGATION

Now, after eight years of no-till production, composting, and keeping the ground covered, the Kaisers have measured their soil organic matter at a twelve-inch depth at 6.5% and at a six-inch depth an astounding 9.5%. That's an increase of over four-fold from when the couple turned over their first row on this land. With every percent increase in SOM, the soil can hold upwards of twenty thousand gallons of water per acre, with some sources citing that number up to twenty seven thousand gallons[5] So when the rains come, as they have been and are predicted to continue in more intense events, Kaiser's soil not only captures and retains that moisture, but also evades damaging erosion. After a recent eleven-inch downpour, the Kaiser's fields remained intact.

The Kaisers's soil water savings is showing up as savings in their irrigation, too. The Kaisers use precision drip irrigation across the farm. Two slender tubes run the length of each thirty-inch wide bed, dripping water precisely where it's needed. This system irrigates at around 90% efficiency, meaning that 90% of the water diverted to the farm is used by the crop, rather than lost to evaporation, runoff, or deep percolation, an extremely high level of efficiency for any farm.

The Kaiser's attribute the efficiency of their farm to a combination of healthy soil, efficient irrigation technology, and refined management practices. Paul explains, "When we started farming here […] I was typically running the irrigation system two to three hours every-other day. And that was pretty standard. Now I am down to 45 minutes to an hour every five to seven days." The Kaisers grow the same crops now as they did then.

Not only are the Kaisers saving water, they're making more money doing it. Their high-intensity production pumps out over seven times the average volume of similar farms in California, pulling in around $100,000 an acre in sales and supporting four full-time staff.

A COMMITMENT TO INNOVATION

The improvements at Singing Frogs Farm didn't happen overnight. The Kaisers have put in seasons of trial and error integrating biology, ecology, and human stewardship to realize a profitable, productive, and conservation-oriented operation. They have invested in efficient irrigation and continue to refine their water management. Rather than finding productivity and drought resilience at the expense of healthy soil and an intact ecosystem, the farm is thriving precisely because they foster both.

SNAPSHOT

Years owned by the same family: 11

Acres owned/managed: 8

Irrigated acres: 2.5

Commercial land use: Diversified vegetable operation

Water management: No-till, composting, constant soil cover, drip irrigation

5 http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1082147.pdf

6 https://scripps.ucsd.edu/news/8155

GLOSSARY

WATER MANAGEMENT

Acre-foot: Amount of water that will cover an acre of land at a depth of one foot, or 325,851 gallons of water[1]

Center pivot: A type of automated sprinkler irrigation that rotates around a fixed point

Ditch: A channel constructed to deliver water for irrigation (see also "canal")[2]

Efficiency: Quantity of water consumed by crops versus the amount of water delivered[3]

Flood irrigation: Water diverted from ditches and spread across the field or pasture[4]

Furrow irrigation: A type of flood irrigation that applies water into shallow, evenly spaced channels that convey water through a field to the crops[5]

Irrigation canal: A channel constructed to deliver water for irrigation (see also "ditch")[6]

Micro sprinklers: Small sprinklers that deliver water just above the soil surface[7]

Reservoir: An artificial lake built to store water

Side roll: A type of automated sprinkler irrigation that moves in a line across a field

Sprinkler Irrigation: A form of irrigation typically higher in efficiency than flood; includes such technology as side rolls and center pivots[8]

Surface drip irrigation: Pipes or hoses that deliver water directly to the soil surface through small emitters[9]

Subsurface drip irrigation: Pipes or hoses that deliver water below the soil surface through small emitters[10]

SOIL HEALTH

Conservation tillage: Any tillage system in which at least 30% of the previous crops' residue is left in the field to protect the soil

Cover crops: Non-cash crops that can provide multiple benefits including erosion prevention, nutrient availability, weed suppression, and water availability[11]

Holistic management: A whole farm planning system that helps farmers, ranchers and other land stewards better manage resources for environmental, economic, and social benefits[12]

No-till: Process of crop production that does not disturb the soil through tillage

Rotational grazing: Rotating livestock frequently throughout many small pastures to allow for pastures to regenerate[13]

Soil food web: Diverse soil community that includes bacteria, fungi, protozoa, nematodes, worms, insects, and more that work in tandem to create healthy soil

Soil health: The continued capacity of the soil to function as a vital living ecosystem that sustains plants, animals and humans[14]

Soil organic matter (SOM): The part of the soil that contains anything that once lived. It aids in crop growth, reduces erosion, retains nutrients, stores water, and sequesters carbon, among other benefits[15]

SOM: Short for "soil organic matter"

Tillage: Preparation of the soil for cultivation

WATER LAW

Beneficial use: The lawful use of water for a beneficial purpose which includes agricultural, industrial, and household use and may include environmental use

Call: In times of shortage senior water rights holders may "call" for water, thus curtailing deliveries to undecreed or junior water users in order to fulfill the beneficial use need of the decreed senior use right[16]

Consumptive use: Water use that permanently withdraws water from its source; water that is no longer available because it has evaporated, been transpired by plants, incorporated into products or crops, consumed by people or livestock, or otherwise removed from the immediate water environment[17]

Diversion: Removing water from its natural course or location, or controlling water in its natural course or location, by means of a water structure such as a ditch, pipeline, pump, reservoir, or well[18]

Return flow: Water that returns to streams, rivers or aquifers after it has been applied to a beneficial use[19]

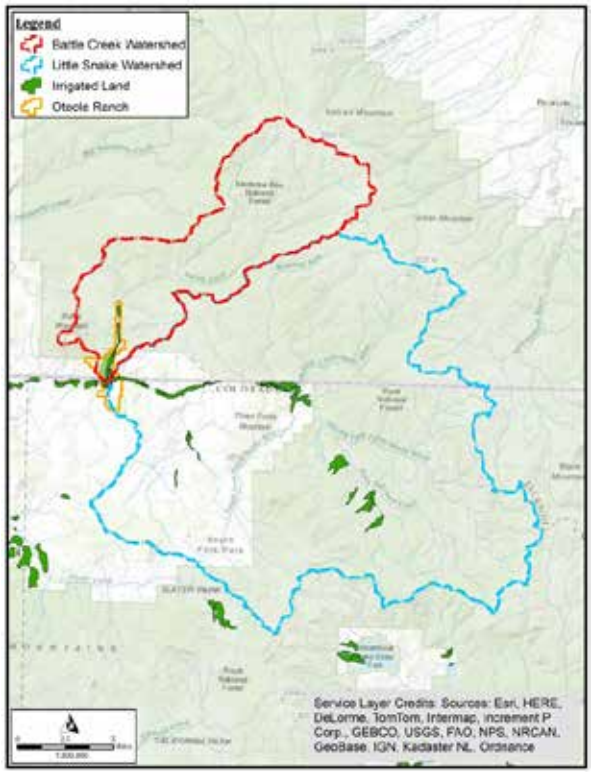
Water right: Considered a property right; the right to use a portion of the public's surface or groundwater resource under applicable legal procedures[20]

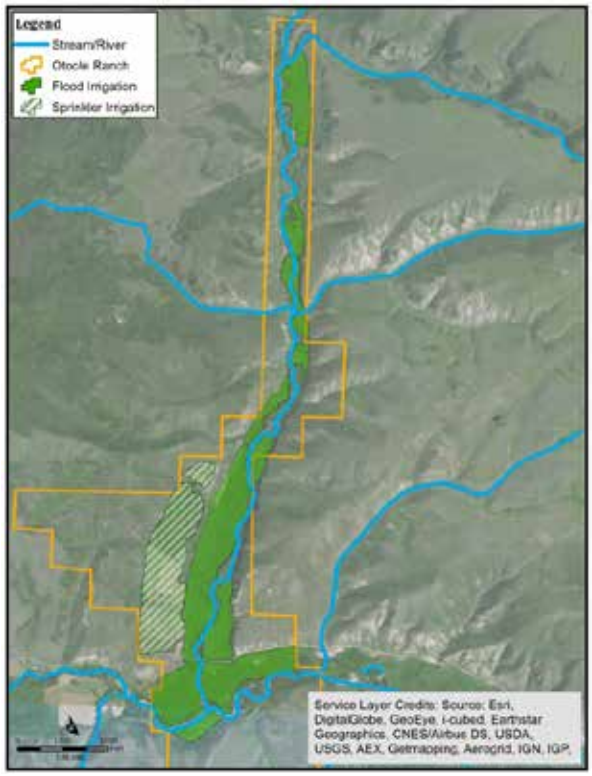
Definitions #1, 3, 4, 7-10, 16-20 courtesy of Colorado Foundation for Water Education (CFWE) from their publications *Citizen's Guide to Colorado Water Conservation* and *Citizen's Guide to Colorado Water Law*. Visit yourwatercolorado.org
Definitions #5, 11, 13-15 courtesy of the Natural Resources Conservation Service (NRCS), visit nrcs.usda.gov; #2 and #6 courtesy of the Bureau of Reclamation (BOR), visit usbr.gov; #12 courtesy of Holistic Management International, visit holisticmanagement.org

APPENDIX I: LADDER RANCH WATER BALANCE

Background

Ladder Ranch is located at the confluence of Battle Creek and the Little Snake River and straddles the Colorado-Wyoming border. The ranch draws water from Battle Creek and the Little Snake at multiple points for the irrigation of over 600 acres of hay pasture. Approximately 400 acres of flood irrigated pastures lie within a quarter mile of the two streams. Pressurized side roll sprinklers are used to irrigate approximately 175 acres on higher ground on the west side of Battle Creek.



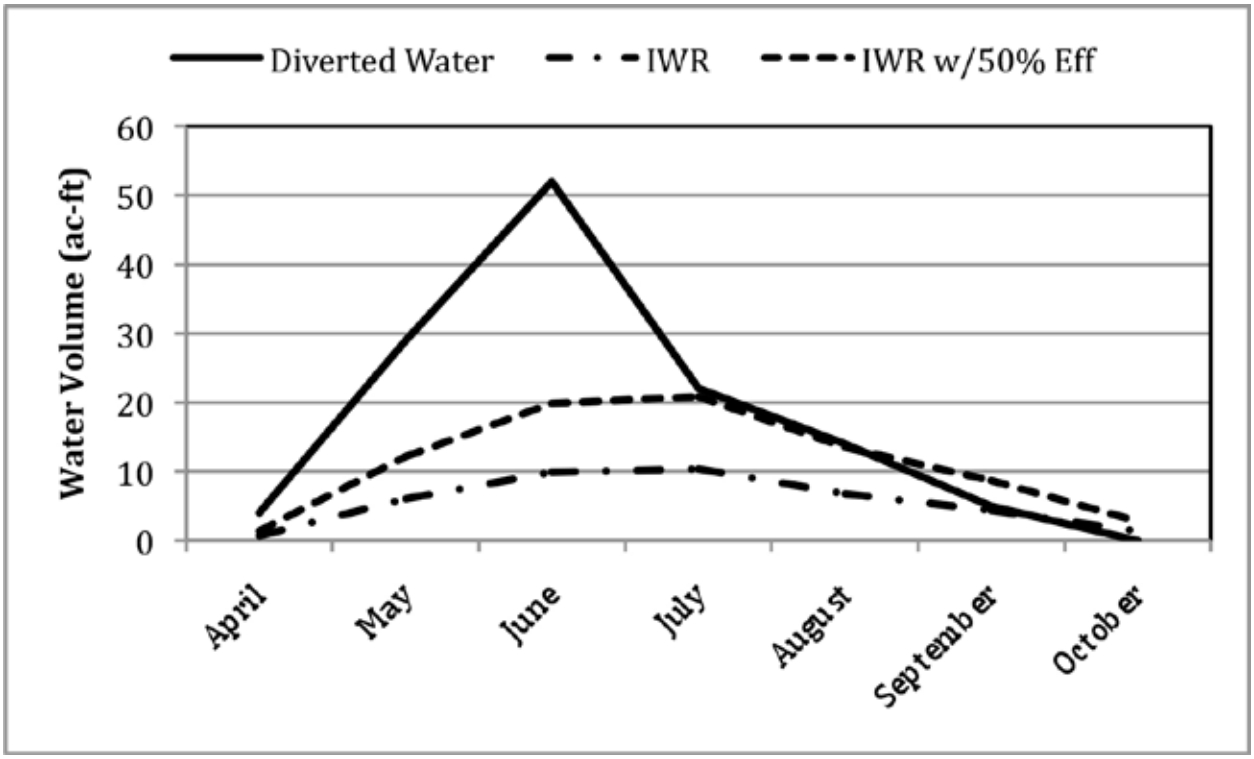


Water Rights

There is no irrigation and very little water use located above the ranch on Battle Creek, while there are approximately 2,200 acres of irrigated land above the ranch on the Little Snake. There is very little reservoir storage in the basin, which results in high peak flows that quickly taper off once the snowmelt is over. The ranch holds very senior water rights in Wyoming and Colorado, and these rights have never been called out or subject to administration during historical calls on the Little Snake in 2002 and 2004. Pat O'Toole stated that the ranch does reduce their irrigation diversions during low flow periods in order to leave sufficient water in both streams to maintain the fisheries there.

According to a recent study by CDM entitled "Agricultural Water Needs Study," hay pasture in this area requires approximately 2.28 acre-feet of supplemental irrigation water per acre to adequately meet the annual crop water demand. This means that crops on the ranch consume approximately 1,350 acre-feet of water annually (one acre-foot can cover a football field with one foot of water). Supplying a maximum crop demand of approximately 0.30 inches per day would require a total peak diversion flowrate of 15 cubic feet per second (cfs) assuming a system efficiency of 50 percent. Some diversion records are available from the Colorado Water Conservation Board for water rights filed with the state. One water right with fairly complete records is the Porter Salisbury Pump 1 & 2. The diversion records are compared to the irrigation water requirement (IWR) for this right in the figure on the next page.

LADDER RANCH WATER BALANCE, CONTINUED



This figure confirms comments by Pat O'Toole that when excess water is available, it is diverted, but once runoff tapers off, diversions are reduced to better match needs.

Irrigation Practices

The potential conversion of additional lands to sprinkler irrigation has helped many farmers and ranchers better manage their limited water supply. The impacts, however, of making such a change has both pros and cons that must be evaluated on a case by case basis. As mentioned previously, most of the irrigated lands on this ranch are located close to the creek. When excess water is applied in the spring, some of it would quickly return to the stream via surface return flows and be available by the next diverter downstream. In many cases, on this ranch the water is diverted from the stream and return flows accrue to the stream all within the ranch property, which implies that the only potential beneficiary of reduced diversions would be the stream in between. Some water would also penetrate below the root zone of the crops and travel through the soil back to the creek. This practice would tend to build up the amount of water stored in the soil and delay its release back to the stream system, thereby acting as an uncontrolled reservoir.

Future Water Conservation Measures

The "Agricultural Water Needs Study" mentioned earlier estimated that 72 percent of return flows in this area return to the stream within the same month that they are diverted, while most of the remainder returns over the following 4 months. This implies that most of the excess water diverted in May and June would return during those months; however, stream flows would continue to benefit from this return water through October. Based on our analysis of available data it appears that the current practices on the ranch are reasonable. While converting more areas to sprinklers would reduce the amount of flow diverted during the runoff season, it could negatively impact stream flows during the late summer and fall periods. Additional data would need to be collected to better predict the potential impacts of any large scale irrigation changes on the ranch.

Water balance researched and written by Applegate Group

APPENDIX II: ELA FAMILY FARM WATER BALANCE

Background

The Ela Family Farm is located on the upper portion of Rogers Mesa at an elevation of 5,850 feet near Hotchkiss, Colorado. The farm primarily grows a variety of fruits including apples, pears, cherries, peaches, and plums. The growing season extends from a blooming of the trees in mid-April to mid-May and concludes with harvest primarily in late August and September. The climate in this area is semi-arid with rainfall only contributing a small percentage of the annual crop water requirements. Crop production is heavily reliant on irrigation water. The soils consist of up to 20-24 inches of stony clay loam with an organic content of 3-4 percent.

Water Rights

The farm owns a wide variety of water rights that are used on the property, all of which are delivered through a combined ditch system off of Leroux Creek. Direct flow decrees include shares in the Allen Mesa, Highline, and Ellington Ditches, which have been physically combined into one ditch system. Their most senior decree includes 0.5 cubic feet per second out of Leroux Creek, which is typically in priority until August. After all the direct flow decrees are out of priority, the farm utilizes 250 shares it owns in the Leroux Creek Water Users Association, which operates numerous small reservoirs in the Leroux Creek Drainage.

The amount of water available from these shares varies depending on the snowpack. On average years, these shares will net about 190 acre-feet of water, but the volume can range from 100 acre-feet in dry years up to 225 acre-feet in wet years (one acre-foot can cover a football field in one foot of water). In order to have a firm water supply during dry years, Ela leases an adjoining parcel of land to the south and fallows the majority of that land in order to focus the water supply on the orchards. Ela also owns 200 shares in the Fire Mountain Canal, which equates to approximately 0.13 cubic feet per second (cfs). However, that water is leased to other users and is not used on Ela's property.

Irrigation Practices

Information regarding the property and associated irrigation practices were obtained from a meeting with Steve Ela on January 8, 2015. The property was originally purchased by the Ela family in 1987. At that time the entire orchard was irrigated with flood irrigation in furrows between the rows of trees. The family immediately started installing the backbone of infrastructure that would be required to convert over to micro-sprinklers in 1989. This included an NRCS Yak screen, main pipeline, and filtration system. Water would pass through the yak screen at the pipeline entrance and pressurize using the gravity fall from that point to the filter location. Pressures in the northeast corner of the property were not sufficient, so a 2 horsepower pump was added to increase the pressure there. Overflow from the Yak screen is conveyed to the alfalfa pastures for irrigation there. No flow measurement device is in place to determine the amount of overflow water, but according to Ela, during dry years there is very little overflow once spring runoff is over.

The first micro sprinklers were installed in 1990 and all orchards on the property were converted by 2000. Around 2002, the Ela family started to install buried drip lines in some orchards. After experimenting with multiple arrangements they determined that three drip lines per tree row is most effective. The drip lines contain pressure compensating drippers spaced 2 feet apart with flowrates of 0.25 gallons per hour. Once buried, the drip lines have assisted with controlling the ground cover near the tree trunks since that area is drier than between the rows where the cover crop can be managed easier. The drip system currently covers approximately 30 acres of the farm in 1-acre zones with the rest remaining on micro sprinklers. One distinct advantage to the drip system is that it is set up so that the user can adjust the application rate by simply entering the percentage of a full irrigation that is required. This makes seasonal adjustments much simpler than the micro sprinklers.

Installing the drip system necessitated increased water filtration in order to avoid plugging the drippers. After experimenting with numerous filtration options, the farm determined that sand media filters were the most effective. There are currently six of these filters in the system, and they are automatically backwashed as necessary. The frequency of backwash cycles depends greatly on the time of year.

Irrigation Demand vs. Supply

Aerial photography obtained from the National Aerial Imagery Program (NAIP) was used to determine the number of irrigated acres. The farm has 83.3 acres of orchards on the sprinkler and drip system and 6.4 acres of alfalfa/hay that are currently irrigated. Another 5.4 acres of potential orchard exists between older remaining rows of some crops. Evapotranspiration (ET) data was obtained from Colorado Agricultural Meteorological Network

ELA FAMILY FARM WATER BALANCE, CONTINUED

(CoAgMet) from their nearby station on Rogers Mesa. The station is located about 1 mile to the south and about 200 feet lower in elevation. The ET data is for a reference crop of alfalfa, which can be converted to other crops such as orchards by applying a crop coefficient to the data.

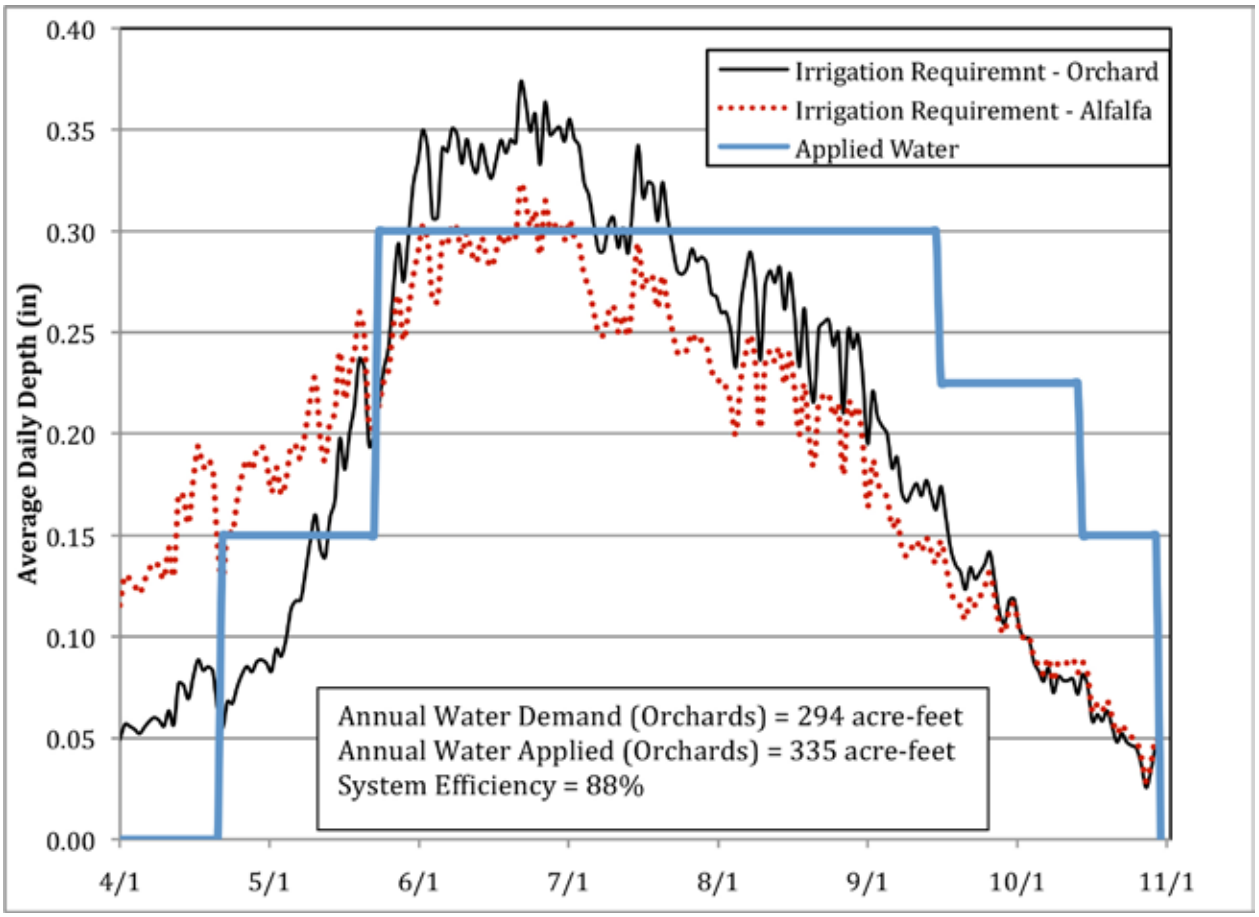
The Food and Agricultural Organization (FAO) published crop coefficients for a wide range of crops including orchards. These values were used to estimate the ET demand for the crops. Average precipitation data was also obtained from CoAgMet and to the ET demand at an 80% efficiency rate in order to calculate the Irrigation Requirement (IR) for the orchards. The amount of irrigation water supplied to the orchards was calculated by applying the dripper/micro sprinkler spacing and flowrate to the average irrigation schedule described by Ela. The figure below depicts a comparison between the irrigation supply and demand for an average year.

This analysis shows that the orchard irrigation system is achieving an efficiency of approximately 88%, which is very close to accepted values of 90% for drip systems and 80-90% for micro sprinklers.

Future Water Conservation Measures

There does not appear to be a significant amount of additional water that could be saved by increasing water conservation practices on the orchard portion of the farm. Converting more land to drip would allow the system to be managed so that the supply can even more closely follow the demand, but this will not likely result in a significant amount of conserved water. Rather it would allow the user to easily adjust the system to better match daily demand and maintain more consistent soil moisture. Backwash water could be used if a larger settling pond was provided to store backwash sediment and water, but another pump would be required to inject this water back into the system. This would also increase the complexity of operations while not resulting in a significant amount of water savings. Ela's willingness to experiment with various technologies and his efforts to continuously improve the system have resulted in a very efficient system overall.

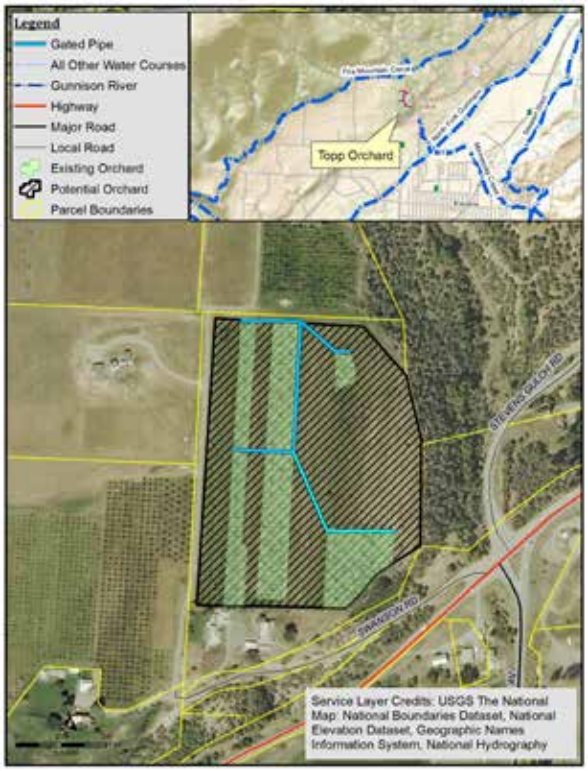
Water balance researched and written by Applegate Group



APPENDIX III: TOPP FRUIT WATER BALANCE

Background

The orchard owned by Harrison Topp is located on the upper portion of Rogers Mesa at an elevation of 5,850 feet near Paonia Colorado. The orchard has not been intensively managed in the past and only 14 acres of the site remains planted. The growing season extends from a blooming of the trees in mid-April to mid-May and concludes with harvest, primarily in late August and September. The climate in this area is semi-arid with rainfall only contributing a small percentage of the annual crop water requirements. Thus crop production is heavily reliant on irrigation water. The soils consist of up to 20-24 inches of stony clay loam.



Water Rights

The orchard owns 480 shares of water in the Fire Mountain canal, which is the only irrigation water supply on the property. These shares equate to 0.33 cubic feet per second (cfs) of water according to the Fire Mountain Ditch Company. Water is diverted from the Fire Mountain Canal in conjunction with the neighbors' shares on the north side of the property. The entire amount diverted at this point is routed to the Topp Orchard 4.5 days per week, while the northern neighbor takes the water the remaining 2.5 days a week.

The Fire Mountain Canal has a relatively junior water right on the North Fork of the Gunnison River, and it is called out every summer. When direct flows are not available, water is released from Paonia Reservoir in order to achieve a full decreed flow of approximately 175 cubic feet per second (cfs). The canal typically turns on around mid to late April and runs at a full canal flow until the reservoir is drained. After the reservoir is drained the canal typically has to shut down for the season. The average shutdown date is September 24th; however it varies greatly from late July to late October. The figure on the next page shows the frequency of start and stop dates for the canal.

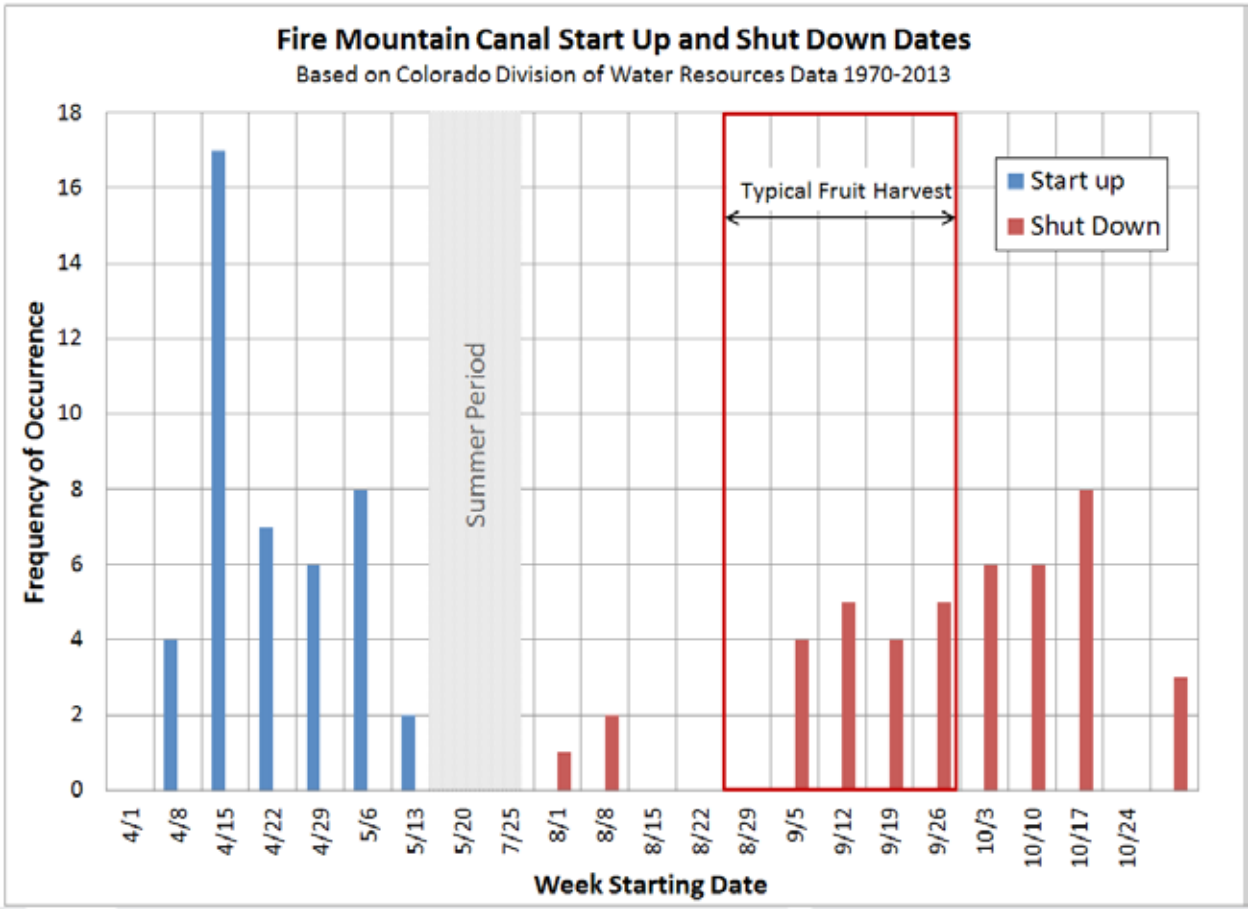
Irrigation Practices

Information regarding the property and associated irrigation practices were obtained from a meeting with Harrison Topp on January 8, 2015. The property was originally irrigated with flood irrigation in furrows between the rows of trees. The farm has 14.4 acres of potential orchard; however, many of the trees were recently removed and there is currently only 4.4 acres of orchard under irrigation. Gated pipe has been installed along the top and middle of the remaining orchard blocks as shown in the attached map. The remaining land is irrigated on a very limited basis.

Irrigation Demand vs Supply

Aerial photography obtained from the National Aerial Imagery Program (NAIP) was used to determine the number of irrigated acres. Evapotranspiration (ET) data was obtained from Colorado Agricultural Meteorological Network (CoAgMet) for their nearby station on Rogers Mesa. The station is located about 12 miles to the southwest and about 200 feet lower than the orchard. The ET data is for a reference crop of alfalfa, which can be converted to other crops such as orchards by applying a crop coefficient to the data. The Food and Agricultural Organization (FAO) published crop coefficients for a wide range of crops including orchards and these values were used to estimate the ET demand for the crops. Average precipitation data was also obtained from CoAgMet and to the ET demand at an 80% efficiency rate in order to calculate the Irrigation Requirement (IR) for the orchards. The amount of irrigation water available for the orchards was assumed to be constant since flows in the Fire Mountain Canal are typically constant when the canal is in operation. The figure on the next page depicts a comparison between the average demand, the average supply, and the supply in 1977.

TOPP FRUIT WATER BALANCE, CONTINUED



This analysis shows that on an average year the orchard irrigation system has surplus water when water is available. The largest potential hindrance to a productive orchard at this location is the uncertainty of late season water, which is critical as the fruit is ripening. Data from the Colorado Division of Water Resources shows that the canal is typically turned on in mid to late April but turns off as early as late July in extreme drought years. The driest year on record was 1977. During that season, approximately 47.7 acre-feet of water was available, which is nearly enough to meet the annual demand of the orchard. The timing of the water, however, would not have been sufficient to produce a crop and may have even resulted in tree mortality.

Harrison Topp indicated that he estimates he applied 18 acre-feet to the remaining orchards in 2014. Based on the irrigation requirement estimated from CoAgMet, the 4.4 acres would have required 15.5 acre-feet. This results in an estimated efficiency of 86 percent. This would be very high for gated pipe, which is typically around 60-70 percent efficient.

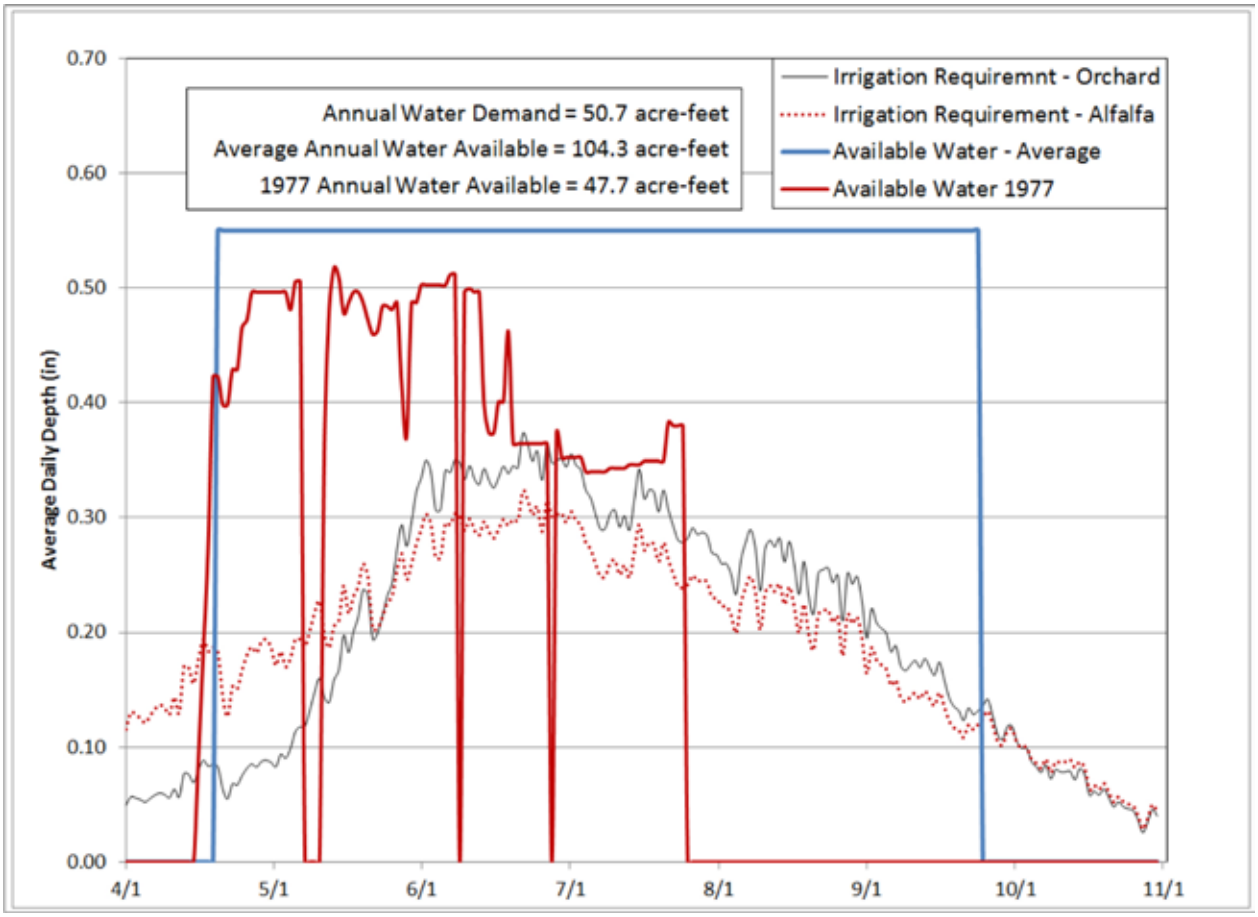
Future Water Conservation Measures

In order for this property to reach its full potential as an orchard, late season water would be required. In extreme drought years it would take approximately 18 acre-feet of storage to bank extra water in the spring for use in the fall. Constructing a reservoir of this size on the property would significantly reduce the amount of orchard acreage. Another option would be to seek out a supplemental water supply.

If a new supply was obtained through a well such diversions would require augmentation water to offset stream depletions when it was used. It is our understanding that augmentation water is difficult to find in the North Fork of the Gunnison due to the lack of storage available. A final option to address this shortage would involve operating the Fire Mountain canal at lower flowrates in late summer and fall when the canal is relying on storage water. This would require a major organizational change for the Ditch Company but the benefits to the users could be substantial.

Under the current method of canal operation, converting to micro sprinklers or a drip system would not help solve

TOPP FRUIT WATER BALANCE, CONTINUED



the potential water shortage late in the season and it could, in fact, negatively impact the orchard. Under flood irrigation, while the canal is on the entire soil profile could be irrigated to the field capacity. Then when the canal is shut down, there will be a sufficient amount of water stored in the soil column for use by the trees. If micro sprinkler or drip irrigation was installed it could limit the amount of soil moisture that could be built up and stored in the soil for later use. These systems would conserve water while the canal is on, but without the benefit of a local storage vessel the water supply for the property would remain unchanged.

If the orchard was completely replanted and irrigated with all 480 shares of water, on an average year about 53.6 acre-feet of water would return to the stream system through seepage or surface runoff. Some of this water might be intercepted by the North Fork Farmers Ditch and incorporated into their system for use by downstream users. The remaining water would enter the North Fork of the Gunnison upstream of a couple of very senior ditch diversions. This water would help fulfill their water decrees and be diverted into their system.

Another option would involve buying additional land that does not have a sufficient water supply and using some of the excess shares from this property to bolster irrigation there. Assuming the Fire Mountain Canal continues to operate the canal at a constant flow, we estimate that the 480 shares would be sufficient to irrigate approximately 6 additional acres. This estimate also assumes that drip or micro sprinkler irrigation systems were installed and managed to achieve 90% efficiency, similar to other local orchards. This option would actually increase the consumption of water since only 10% of diverted flows would then be returning to the stream system.

In summary, the best alternative for this property would involve changing the diversion patterns of the Fire Mountain Canal. However, that is beyond the control of a single shareholder. The lack of late season water likely explains why there are not as many orchards on in the North Fork Valley that rely strictly on Fire Mountain Canal water.

Water balance researched and written by Applegate Group

youngfarmers.org

familyfarmalliance.org

Testimony of Dan Keppen
Executive Director
Family Farm Alliance

Before the Committee on Energy and Natural Resources
United States Senate

Legislative Hearing on Western and Alaska Water Legislation

Washington, D.C.
October 8, 2015

Good morning Chairwoman Murkowski, Ranking Member Cantwell and Members of the Committee.

My name is Dan Keppen, and on behalf of the Family Farm Alliance (Alliance), I thank you for this opportunity to present this testimony on a matter of critical importance to our membership: the Western drought. The Alliance is a grassroots organization of family farmers, ranchers, irrigation districts, and allied industries in 16 Western states. The Alliance is focused on one mission: To ensure the availability of reliable, affordable irrigation water supplies to Western farmers and ranchers. We are also committed to the fundamental proposition that Western irrigated agriculture must be preserved and protected for a host of economic, sociological, environmental, and national security reasons – many of which are often overlooked in the context of other national policy decisions.

The Family Farm Alliance has a well-established relationship with Congress, with nearly 50 invitations to testify before Congressional committees on Western agriculture, water and environmental matters in the past decade. But more important, the Alliance has a long history of collaboration with constructive partners in all levels of government, with conservation and energy organizations, and with Native American tribal interests who seek real solutions to water resources challenges in the West. Policy-makers and problem-solvers work with the Alliance because our members deal with the realities of the arid West at the ground-level, every day. They are the men and women who run farms, ranches and irrigation districts. They are people for whom scarcity is a fact of life and cooperation and innovation are tools of survival.

Earlier this year, the Family Farm Alliance released a report, "*Innovations in Agricultural Stewardship: Stories of Conservation & Drought Resilience in the Arid West*," which focuses on five case studies that profile producers across the Colorado River Basin and beyond, who -- with curiosity, creativity and seasons of trial and error -- are conserving resources while enhancing productivity. (A copy of the report is attached.) The Alliance partnered with the National Young Farmers Coalition on this report with the aim of elevating the voices of farmers and ranchers

who are employing smart solutions to build drought resilience, steward water and grow good food.

Government needs to support, encourage and facilitate such efforts. The Alliance believes achieving genuine, lasting solutions requires a more productive and proactive federal role in Western water matters: a role that focuses on research and development; and full integration, coordination and maximum sustainable use of water resources. It requires water resource policies that are driven from the "ground up" – not from the "top down" – and water resources planning and management that acknowledge irrigated agriculture as an asset to our still-growing nation.

Periods of drought are not new to the West, but the negative impacts of today's droughts have reached staggering levels for our farmers and ranchers, their families and the irrigated agricultural economy. Earlier this summer, California farmer Cannon Michael represented the Family Farm Alliance when he testified[1] before this Committee on the Western drought, with emphasis on the drought challenges faced by him and his neighbors in the Central Valley of California. Our organization is composed of farmers and ranchers like Mr. Michael from all over the West. The drought problems they face vary by region, topography, climate, soil conditions, hydrology, and crop. But these problems also share some common elements, including:

- Inadequate or deteriorating water management and storage infrastructure;
- Inflexible or outdated operational requirements and regulatory conditions;
- Increased competing demands on existing water supply systems for growing municipal, industrial and environmental uses; and
- Public agencies that either are not nimble enough, or not motivated enough to seek out and embrace better ways of ensuring the most benefit for the broadest suite of public interests.

Mr. Michael's testimony also illustrated that solutions also vary by state and region, but they, too, are characterized by certain common elements, including creativity, flexibility and balance.

Chronic Water Shortages in the West

Droughts occur routinely in the West; that is why the Bureau of Reclamation (Reclamation) made such important investments in water supply infrastructure over the past century. However, this infrastructure was never designed to meet the burgeoning demands of growing communities and environmental needs, while continuing to help farmers, ranchers and rural communities make it through periodic droughts. Unfortunately, future droughts in the West are predicted to be deeper and longer than we have historically experienced in the 20th century.

[1] Mr. Cannon Michael's written testimony from the June 2, 2015 Senate Energy and Natural Resources Committee hearing is *available at*: http://www.energy.senate.gov/public/index.cfm/files/serve?File_id=1786822e-5a9a-4d2b-be51-e474b8eaa9b4.

The larger issue, the underlying problem, is the ever-present and worsening shortage of water. Droughts only exacerbate water shortages. They also highlight the need to re-examine how we manage our limited water resources in the West.

The Alliance believes that we need a new approach to Western water management, one that includes a broader view of how water is used, along with consideration of population growth, food production and habitat needs. Our past water development investments in the West have provided economic certainty for both rural and urban communities, afforded the Nation with a stable, safe, and healthy year-round food supply, and allowed people to recreate, raise families and live a high quality life. Those achievements should not be sacrificed to meet growing demand for water with static or shrinking supplies. When planning our water infrastructure and management, we must consider how we will continue to maintain existing rural economies, support food production and enhance the quality of life and the environment, rather than plan to abandon those things to accommodate future needs arising from population growth or environmental demands. We can't expect to thrive in the 21st Century with a water-supply system and management regime that weren't adequate to the needs of the late 20th Century.

The fact is that, in many areas of the West, we have outgrown our aging water supply infrastructure. We have been living off our forefathers' investments in water infrastructure and have not planned well enough (or in some cases at all) to replace or add to those investments to meet the demand for water into the future.

Climate and hydrologic conditions are not the only causes of water shortages in the West. Other factors include the adversarial application of federal environmental laws, such as the Endangered Species Act (ESA), the Clean Water Act (CWA), and the National Environmental Policy Act (NEPA). There can be no doubt that these laws have provided significant benefits to our society. But they also have been used as weapons to thwart new investments in water development, to reallocate existing water supplies away from traditional uses, and to destabilize water supply systems, often in pursuit of the unattainable goal of turning back the clock to a "better" time. Too frequently the result is minimal environmental improvement gained at great financial cost and significant water shortages both in the short- and long-terms.

In order to respond to current and future water shortages, as well as today's drought conditions, we believe Congress should provide federal agencies with more flexibility under existing environmental laws and regulations to encourage a cooperative approach toward achieving multiple goals. And where such flexibility currently exists in laws, Congress should demand that agencies use it promptly and with a minimum of bureaucratic nonsense. Time is of the essence when making water management decisions during a drought.

Western drought legislation should shift the regulation of water resources away from the current adversarial structure and towards an approach that produces better results through cooperation and innovation. This includes promoting the use of new technology in water management. Real-time monitoring and data collection can be used to fine tune water supply management decision-making to more closely match water supply operations to actual fishery and environmental needs. Congress must empower local stakeholders and the states – and federal agencies – by recognizing and rewarding collaboratively developed solutions where all sides have come together to work out differences and build future solutions to complex water issues.

Finally, we must invest (and reinvest) in the Western water infrastructure necessary to meet current and future demands. Our existing water infrastructure is aging and in need of rehabilitation; we need new water storage in order to adapt to changing hydrology and develop usable and sustainable supplies to meet growing demands for water. Small cost-shared grants for water management improvements and conservation projects through Reclamation's WaterSMART program have assisted many local water providers in making significant investments in their aging water delivery systems. Coordinating federal conservation programs at the U.S. Department of Agriculture (USDA) and with other water programs at Reclamation can result in much more effective investments in on- and off-farm water management improvements.

Streamlining regulations and permitting processes, along with federally-backed loans and loan guarantees that provide affordable financing tools for local water investments can help to replace the more traditional approach to water infrastructure development that relies on mostly federal water projects. The federal government can continue to be a partner in solving these water problems in the West by using financing mechanisms that have very low federal cost and make water resources investment more attractive and affordable for non-federal interests.

Taken together, the bills before the Committee today incorporate nearly all of these elements, and the Alliance commends their authors for their hard work and foresight.

H.R. 2898, the "*Western Water and American Food Security Act of 2015*"

While we have a few suggestions on how to improve the House-passed bill, in general, the Alliance supports the approach taken by H.R. 2898 because it provides for more flexible, multi-purpose drought water management in California's Central Valley. It offers a path for water users in California and other Western states toward streamlining regulatory hurdles and encouraging the development of crucial new water storage projects. And, it upholds and protects state-based water rights, which forms the cornerstone of Western water allocation policy.

H.R. 2898 includes provisions that would give water project managers and regulators additional flexibility to address water conveyance and flows in relation to fish populations under the ESA. Specifically, the bill would address certain operations of the Central Valley Project (CVP) and

the State Water Project (SWP) in relation to the biological opinions (BOs) associated with the threatened Delta smelt and with threatened and endangered salmon species under the ESA.

Especially during times of crisis, operational entities need to be able to weigh the needs of the environment as well as the needs of the economy and our communities. There should be ways for federal agencies to exercise some discretion when making decisions regarding resource management. We have seen that the application of rigid regulatory standards can have a very detrimental effect at a time when every gallon of water is important.

We support provisions that would improve management of the Delta smelt, such as mandating greater data collection on the smelt population through a Delta smelt distribution study. We also support the authorization of greater real-time monitoring of Delta smelt which, along with the best scientific and commercial data, can be used to advise water conveyance management and maximize the use of water for humans as well as fish species.

Also, we support the provisions in H.R. 2898 that seek to ensure that salmonid management is responsive to new science. The bill contains specific directions for implementing new science and data into the management of salmon stocks in California's Bay-Delta. We strongly support legislative direction for agencies to address "stressors" in the Bay-Delta environment, especially non-native fish that prey on the ESA listed species such as Delta smelt and Chinook salmon. For example, the drought bills before the Committee today would authorize pilot projects to implement an invasive species control program authorized in the *Water Supply, Reliability, and Environmental Improvement Act* (P.L. 108-361) as part of the CALFED Bay-Delta program. The goal is to reduce and remove invasive vegetation and predator fish species in the Delta that adversely affect water supply operations and the health of ecosystems. The bills also authorize Reclamation's participation in a locally funded program to reduce predation of salmon by non-native fish on the Stanislaus River.

In addition, predation control in the Delta is one of the measures that H.R. 2898 directs federal agencies to assess within a framework intended to identify various non-regulatory means to protect salmon populations or to offset any potential adverse effects to the species that might be caused by easing regulatory restrictions on water deliveries. This is one of the several ways in which H.R. 2898 emphasizes operational flexibility and drought relief. More regulation usually reduces flexibility. Federal agencies managing the competing demands for water in the West have in some cases failed to examine or pursue opportunities for more flexible water management that serves both economic and environmental goals. This lack of flexibility and innovation exists in no small part because Congress has not explicitly directed agencies to be flexible and innovative, so they default to the actions that are least likely to get them sued.

The pending bills in very general terms direct the Secretaries of Commerce and the Interior Departments (Secretaries) to maximize water supplies to CVP users and SWP contractors by

approving, consistent with applicable laws, projects and operations that provide additional water supplies. H.R 2898 provides permanent and broad authority to the Secretaries to approve any project or operational change to address emergency provisions, although it does also contain limitations on this authority.

West-wide Scope

In addition to its California Delta-focused sections, H.R. 2898 contains a number of provisions that would apply throughout the West and have been supported by the Alliance's West-wide membership. For example, H.R. 2898 would streamline permit decisions and authorize expedited procedures to make final decisions on operations and water projects that can maximize water supplies. It also provides the Secretaries with new authority to approve projects that normally would require congressional authorization. In addition, H.R. 2898 would require the Secretaries to develop a drought operations plan.

H.R. 2898 also would inject more balance into water management decisions so that human and community needs have a priority closer to that given to environmental and water quality objectives. H.R. 2898 addresses compliance under NEPA by directing the Secretaries to consult with the Council on Environmental Quality (CEQ) to make alternative arrangements to comply with NEPA.

As we stated above, the Alliance supports new sustainable water storage projects in order to increase usable supplies of water to help meet current and future demands. Both drought bills would direct Reclamation to complete certain ongoing feasibility studies for new or augmented surface water storage in California that were originally authorized nearly 20 years ago and have languished ever since. H.R. 2898 would compel Reclamation to meet deadlines by imposing financial penalties for failure to do so. The bills also allow Reclamation to partner or enter into an agreement on certain water storage projects identified in the *Water Supply Reliability and Environmental Improvement Act* with local joint powers authorities formed pursuant to state law by irrigation districts and other local water districts and local governments within the applicable hydrologic region. H.R. 2898 authorizes the Interior Department to carry out feasible water storage projects, but prohibits federal funds from being used for construction.

Both federal and non-federal storage projects would be authorized under the House drought bill to receive reimbursable funding from a proposed new "Reclamation Surface Storage Account" (authorized under Title IX). H.R. 2898 would authorize accelerated repayment (or prepayment) by non-federal Reclamation project users of certain project construction costs that are currently paid over 40-year or 50-year terms. The new surface storage account would be funded with proceeds from the accelerated repayments, with 50% of the revenues available for new surface water storage projects. In allowing early repayment, H.R. 2898 also allows for the conversion of water service contracts to repayment contracts. This provision would allow contractors to forgo

certain requirements (e.g., acreage and full-cost pricing limitations) under Reclamation laws sooner than would otherwise be the case, but water users would still have to pay their share of project operations and maintenance (O&M) costs.

Safety of Dams Provisions

The Alliance has always been supportive of Reclamation's Safety of Dams Act (SOD) Program. The average age of the 84,000 dams in the United States is 52 years old. That is of great concern to us. In order to avoid dam failures, which would cause substantial economic damage and, more importantly, loss of human life, significant investment and regular maintenance are necessary. Under current law, Reclamation identifies dam repairs and modifications that arise from "new hydrologic or seismic data" or those actions that are "deemed necessary for safety purpose," and carries out repairs or remediation actions on a cost-shared basis with project beneficiaries. Work that would create new or additional project benefits cannot be carried out under the SOD program and must instead be authorized and funded separately by Congress.

H.R. 2898 and S. 1894, the *"California Emergency Drought Relief Act of 2015,"* include similar provisions that would authorize the planning, design and construction of additional project benefits, subject to a feasibility analysis, as part of regular SOD repairs. This could include development of additional reservoir storage. Under H.R. 2898, the Interior Secretary can move forward on construction of additional project features or benefits only if "*the costs associated with developing the additional project benefits are agreed to in writing between the Secretary and project proponents.....*"

It is important to note that this latter provision does not say that the parties agree to pay, only that they agree as to what the costs are. H.R. 2898 further provides that such costs "*shall be allocated to the authorized purposes of the structure and repaid consistent with all provisions of Federal Reclamation law.....*" Those cost allocations are already in place and are obligations of existing project contractors.

While we strongly support the concept behind the proposed SOD provisions, some of our members are concerned with the relatively vague nature of the title language, which could have some unintended negative consequences. For example, nothing in the title requires "*project proponents*" to be project contractors, assume any cost responsibility, or pay the total bill under cost causation principles. In fact, nothing in the bills explicitly requires the Interior Secretary to consult with, or even agree with, water and power contractors regarding the construction or costs of additional benefits, although S. 1894 requires a cost-sharing agreement with *"applicable Federal, State and local agencies…"*

Other key concerns are primarily centered on the Interior Secretary's discretion and lack of definition regarding "*additional project benefits*" and how that might be implemented in the

future. Under the proposed amendments to the SOD Act, authorizing "*additional project benefits*" is not qualified by limiting those benefits to existing project purposes. Given the ESA challenges that many of our members are facing, the fear is that the storage (new, expanded, or potentially reallocated) would be used for purposes (fish flows, ecosystem functions, and/or water quality) that do not directly benefit the existing water and power contractors, even though those interests would bear the costs.

We believe a broad mandate to increase Reclamation dam capacity should be specific, not be limited to situations where there are dam safety concerns, require beneficiaries of new projects to pay for them, and require the consent and cooperation of existing contractors.

Water Rights

Finally, the Alliance has always taken the position that the Western system of prior appropriation still fundamentally works. The doctrine of prior appropriation and the need for certainty in Western states' water rights systems make it the cornerstone of Western water resource allocation policy. The Alliance has long advocated that solutions to conflicts over the allocation and use of water resources must begin with the recognition of and the traditional deference to state water allocation systems. We are pleased that the drought legislation before the Committee today includes specific provisions intended to protect water right holders. In addition, Title XI of H.R. 2898 requires the Interior Department and USDA to coordinate with states to ensure that federal actions are consistent with, and impose no greater restrictions or regulatory requirements than, state groundwater laws and programs. The bill also prohibits the Interior Department and USDA from taking actions that adversely affect: (1) water rights granted by a state, (2) a state's authority to adjudicate water rights, (3) groundwater withdrawal conditions and conservation measures established by a state, or (4) the use of groundwater in accordance with state law.

H.R. 2898 is a large, detailed bill that aggressively and constructively attempts to tackle the drought challenges of California's Central Valley and also provides solutions that will assist other Western states. It would take a dozen or more pages of additional testimony to address the multitude of details contained in this bill, but overall, we can safely conclude that the Alliance supports the intent and vast majority of the bill's provisions.

Principles to Consider

The Congress and the federal government certainly cannot change the hydrology of the West, but there is a role it can play to support family farmers and ranchers. As the Committee continues its efforts to address the current drought and development policies to improve water management in the long-term, we ask that you consider the following observations and principles:

- State water laws, compacts and decrees must be the foundation for dealing with shortages.
- Water use and related beneficial use data must be accurately measured and portrayed.
- Benefits of water use must reflect all economic / societal / environmental impacts.
- Water conservation can help stretch water supplies, but has its limits in certain situations.
- Public sentiment supports water remaining with irrigated agriculture, and developing strategic water storage as insurance against shortages.
- Technologies for water reuse and recycling are proven effective in stretching existing supplies for urban, environmental and other uses.
- Urban growth expansion should be contingent upon sustainable water supplies; using irrigated agriculture as the "reservoir" of water for municipal growth is not sustainable in the long run.
- Planning for water shortage in the West must look to the long-term in meeting the goals of agriculture, energy, cities, and the environment.
- A successful water shortage strategy must include a "portfolio" of water supply enhancements and improvements, such as water reuse, recycling, conservation, water-sensitive land use planning, and water system improvements. New infrastructure and technologies can help stretch water for all uses.
- Temporary fallowing proposals should be approached in a thoughtful, thorough manner only after urban, energy and environmental users of water demonstrate a better management of their share of the finite supply.
- Unintended consequences associated with reducing productive agricultural land/groundwater recharge/riparian habitat benefits should be avoided and, if unavoidable, minimized and fully mitigated.

Conclusion

There are no guarantees that the West will not experience more intense multiple drought years in the future. In order to avoid disaster and to ensure that all reasonable water demands are met in the future, California and the West must begin to manage water as if every year was a drought year. This will require everyone in the West to adopt a new paradigm, one that promotes wise, cooperative management of the resource and protects carryover storage for future use in dry periods. This new paradigm will also mean additional investments in technology, conservation, and new infrastructure in order to deal with the uncertainties that lay before us.

The House has passed H.R. 2898 to address this crisis, and California's Senators have introduced S. 1894. However, two separate bills are of absolutely no value to a parched West. What is needed is a single bill that can be enacted by Congress and signed into law by the President, and time is not on our side. More than a year ago, thousands of Californians from all walks of life signed an open letter to their Congressional Delegation pleading for action to address the

drought. The message they sent speaks for all of us working in Western agriculture, and I reiterate it here:

On behalf of our member farmers and ranchers, we must respectfully insist that Members of Congress set aside their regional, ideological and political differences and work together to address the West's current (and future) water supply crisis. Our farmers and ranchers need you – all of you, urban and rural, Republican and Democrat – to come together and find a way to fix this broken system now, before it breaks us all.

What happens this year and next could fundamentally change the face of Western agriculture forever. Family farmers have been good stewards of the land for generations, but are now facing catastrophic losses from which they may never recover. Young farmers just starting out are at great risk of being driven off the land. Thousands of men and women working throughout our great and diverse community, from the field, to the store, to the restaurant, are overwhelmed by the uncertainty of what this "mega drought" means for their families.

We must all work together to ensure that Western water users have every tool available to survive and recover from the current drought and the hard, dry years that the future may hold.

Thank you and I would stand for any questions you may have.