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THE WESTERN WATER CRISIS: CONFRONTING PERSISTENT DROUGHT AND BUILDING RESILIENCE ON OUR FORESTS AND FARMLAND

HEARING

BEFORE THE

SUBCOMMITTEE ON
CONSERVATION, CLIMATE, FORESTRY, AND
NATURAL RESOURCES

OF THE

COMMITTEE ON AGRICULTURE,
NUTRITION, AND FORESTRY

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C O N T E N T S

Tuesday, June 7, 2022

THE WESTERN WATER CRISIS: CONFRONTING PERSISTENT DROUGHT AND BUILDING RESILIENCE ON OUR FORESTS AND FARMLAND

TUESDAY, JUNE 7, 2022

U.S. SENATE,
COMMITTEE ON AGRICULTURE, NUTRITION, AND FORESTRY,
SUBCOMMITTEE ON CONSERVATION, CLIMATE, FORESTRY, AND NATURAL RESOURCES,
Washington, DC.

The subcommittee met, pursuant to notice, at 10 a.m., via Webex and in room 562, Dirksen Senate Office Building, Hon. Michael Bennet, Chairman of the Subcommittee, presiding.

Present: Senators Bennet, Luján, Marshall, Boozman, Hoeven, Tuberville, Thune, and Braun.

STATEMENT OF HON. MICHAEL F. BENNET, U.S. SENATOR FROM THE STATE OF COLORADO

Senator BENNET. Good morning, everybody. I am pleased to call this Subcommittee meeting on Conservation, Climate, Forestry, and Natural Resources to order. I am grateful to Ranking Member Marshall for his partnership in organizing today's hearing on Western water resilience. I know he shares my concern about the unprecedented drought the West faces, especially as it relates to declining water levels in the Ogallala Aquifer.

Our purpose this morning is simple, to sound the alarm about the water crisis in the American West. The West has not been this dry in 1,200 years. 1,200 years. If we do not get our act together here, it is going to not only put our western agriculture at risk but the American West as we know it.

My State sits at the headwaters of the Colorado River, which starts as snowmelt in the Rockies before cutting across 1,400 miles to the Sea of Cortez. The Colorado River Basin is the lifeblood of the American Southwest. It provides the drinking water for 40 million people across seven States and 30 tribes. It irrigates five million acres of agricultural land. It underpins the West's $26 billion outdoor recreation and tourism economy, and it is running out of water. The two largest reservoirs in the Basin, Lake Powell and Lake Mead, are at the lowest levels they have been since they were filled over 50 years ago. Lake Powell has dropped more than 30 feet just in the last few years.

The water crisis is not limited to the Colorado River Basin. The most recent data from the U.S. Drought Monitor found that more

than 50 percent of the entire contiguous United States is experiencing severe drought and right now more than 75 percent of the Western Region is seeing severe drought.

These conditions threaten to put farmers and ranchers out of business, threaten the communities that rely on water to support their families and their livelihoods, which is every community in the West, and frankly, threatens our way of life in the West.

Farmers like Joel Dracon, a dryland wheat farmer near Akron, Colorado, he told me he has had to tear up 400 acres, nearly a third of his land, because there was not enough water. He has also had to sell a tenth of his herd because there is not enough grass to graze his cattle.

Paul Bruchez is a rancher in Grand County, Colorado. He remembers when water from the Colorado used to flow 6,000 cubic feet per second. Today, he said they are lucky to have 1,000 cubic feet per second.

Harrison Topp, a fruit grower from the North Fork Valley, told me has lost hundreds of thousands of dollars in the last three years from drought. There is no longer even a slim margin for error in our production practices, he said.

A farmer in the same county, James Henderson, said it used to take one hour to irrigate his soil; now it takes six hours because the ground is so parched.

The main reason for all of this is climate change. Rising temperatures means less snowpack in the Rockies, which means less runoff to feed our rivers, and that means less water for farmers, for ranchers and communities across the West. On top of that, the rising temperatures mean that whatever water makes it into our rivers evaporates and gets absorbed into the ground more quickly because it is so dry.

This is a five-alarm fire in the American West. When hurricanes and other natural disasters strike the East Coast or the Gulf States, Washington springs into action to protect those communities. That is what a Federal Government is supposed to do, to bring the full power and resources of the American people together to help our fellow citizens. We have not seen anything like that kind of response to the Western water crisis even though its consequences, I would argue, are far more wide reaching and sustained than any other natural disaster.

That is just water. I have not even mentioned how climate change is incinerating our forests and blanketing our communities in smoke from wildfires. Three of the largest wildfires in Colorado's history were all in 2020. The day before New Year's Eve, the Marshall Fire destroyed over 1,000 homes in Boulder County, Colorado, in 24 hours. It was sheer devastation.

Last year, communities in my State had some of the worst air quality in the world because of wildfire smoke. I am sad to say this, but on the same day northern Utah and Colorado had the worst air quality in the world, worse than Beijing. That led Senator Romney and me to take a raft trip in Moab to talk about water and climate and forestry, which I deeply appreciated. There are days when people cannot go outside, they cannot open their windows, they cannot see the mountains. The dangerous air pollution puts Coloradans' health at risk, and it has left people across the West

to reckon with a sobering possibility of a future where this is not the exception but the norm.

I deeply worry that if we do not act urgently on climate change it will make the American West unrecognizable to our kids and to our grandkids. I refuse to accept that, and the people of my State refuse to accept that. They have a reasonable expectation that our national government is going to partner with them and help protect the American West.

My hope is that our hearing today will help shake the complacency in Washington and create the momentum we need to act urgently. I would like to thank the witnesses who are here today for sharing their expertise in this area. I look forward to hearing about what they are seeing and experiencing on the ground and the ways they are trying to manage the crisis. We need to act now to bring immediate relief to these Western communities, and we simply cannot address the Western water crisis in any meaningful way unless we come together in a partnership.

To underscore the crisis at hand, I have a map of the current U.S. Drought Monitor and testimony from the Colorado Water Congress, the Family Farm Alliance, the Colorado Association of Wheat Growers, Trout Unlimited, and a rancher in Grand County, Colorado, describing the situation we face in the American West. I ask unanimous consent that they be entered into the record. So, moved.

[The documents can be found on pages 106–142 in the appendix.]

I would like to also say thank you to Senator Boozman, the Ranking Member of the Agriculture Committee, for being here. It means a lot that you are here, especially coming from Arkansas, a place where they do not quite have the same drought conditions that we have. It is too much water, not too little.

Let me turn it over now to my Ranking Member, the distinguished Senator from Kansas. Thank you, Senator Marshall.

STATEMENT OF HON. ROGER MARSHALL, U.S. SENATOR FROM THE STATE OF KANSAS

Senator MARSHALL. Well, thank you so much and good morning, everybody. I want to thank our Subcommittee Chairman Bennet and his staff and my staff for holding today's hearing and all the work they have done. I want to thank all the witnesses sincerely for making the trip out here, taking several days out of your daily life as well. Again, I am honored, of course, to have our Ranking Member Boozman and all my colleagues here, Senator Tuberville, for coming as well. We appreciate that.

It has been almost a decade since drought was a key focus on an Ag Committee hearing, and I am hoping we can gain some real insight today on how to address the challenges we are facing out West with regards to drought, wildfires, and conservation.

Senator Bennet, the western third of Kansas, the eastern third of Colorado look a lot alike these days——

Senator BENNET. They do.

Senator MARSHALL [continuing]. and they always have. You mentioned the Colorado River, but the Arkansas River is very important to us. Now the "Ar-Kansas" River is spelled like "Ar-Kansaw", but we pronounced it "Ar-Kansas" River as it goes out of Colorado through Kansas. I am not sure what the Okies call it.

Senator BOOZMAN. "Ar-Kansaw."

Senator MARSHALL. They call it Arkansas. I thought they might. I have enjoyed fly fishing in the headwaters of the Arkansas River. The mayfly hatchery up there is incredible, but much of the riverbed is dry.

Senator BENNET. My wife is from Arkansas, and her grandfather told me the story of coming to Colorado and having the Arkansas River between his legs at the headwaters. He just could not believe it because by the time it got to Arkansas, obviously, it was much, much wider than that.

Senator MARSHALL. Unfortunately, through much of Kansas, it is literally a four-wheeler trail ride for us.

In 1935, after surveying the aftermath of the worst dust storm ever recorded in North America, Robert Geiger was an Associated Press reporter from Washington, DC. He summed up the life in our region with three—the quote from him: Three little words achingly familiar on a western farmer's tongue, rural life in the Dust Bowl of the Continent, "if it rains." "If it rains."

This is not new, but it is certainly exacerbated. Even today, these three words dictate entire livelihoods on the high plains, especially in our home States of Kansas and Colorado. Just last month, the National Oceanic and Atmospheric Administration deemed April as one of the driest months on the record in the last hundred years. Currently, over half of Kansas is designated moderate drought, and over a third of the State is designated as severe, again, as the Chairman commented already, so much of Kansas and Colorado in those extreme drought conditions.

Just last week, the Topeka Capital-Journal reported that the projected wheat yield in Kansas is expected to drop by over 100 million bushels. I think that is about a 30 percent of our average yield is going to be impacted by drought this year. That is a value of over a billion dollars to the State of Kansas.

This lack of rain not only hurts farm production at its most crucial time, but it also adversely affects ranchers and families, who fall victim to raging wildfires, and yes, we have had horrible prairie fires the past several years.

This lack of rain hurts the farm production at its most crucial time, but it adversely affects farmers and ranchers, who fall victim to raging wildfires across the Plains, incurring hundreds of thousands of dollars, millions of dollars lost in assets and, at the worst, the lives of homes and the personal lives as well as genetics of cattle they will never be able to replace.

Many of our friends in the private sector and our region's universities have been working on solutions in drought resiliency and fire mitigation, and I am excited to hear from them and hope this hearing will yield positive results for the future of the Western United States.

Thank you, and I yield back.

Senator BENNET. Thank you very much, Senator Marshall. I appreciate that. It is nice to have a neighbor actually as the Ranking Member because we have a lot in common.

Senator Boozman, do you have anything that you would like to add?

Senator BOOZMAN. No.

Senator BENNET. Okay. I am now going to introduce the three witnesses that I invited to testify at today's hearing, and then Senator Marshall will introduce his two from the Arkansas River Valley. These are all leading experts in their fields with decades of experience in the sustainable management of our water from snowpack to forest, streams and wetlands. All of them spent years partnering with diverse groups across the West to manage our water resources in a way that preserves our economy and way of life for the next generation.

Our first witness, Mr. Andrew Mueller, is a longtime leader in Western water issues with extensive policy, legal, and technical expertise. He currently serves as General Manager of the Colorado River Water Conservation District headquartered in Glenwood Springs, Colorado. The river district leads the protection, conservation, and management of the Colorado River for 15 western Colorado counties along with the broader use of the river water in my State. The Colorado River District has led efforts to protect critical waterflows to sustain agriculture and protect four endangered fish species in the Colorado's upper basin.

Before leading the river district, Andy spent 23 years practicing law in Ridgway, Colorado, where he specialized in water, natural resources, and land use issues. Andy earned his law degree from the University of Colorado and his B.A. in history from Kenyon College in Ohio.

Mr. Mueller, thank you for your leadership in our State and thanks for being here.

Dr. Courtney Schultz is a leading expert at the intersection of forestry, social science, and policy, who has authored over 50 publications on U.S. forest policy issues along with a book on the Collaborative Forest Landscape Restoration Program at USDA. Dr. Schultz currently serves as a professor of forest and natural resource policy at Colorado State University in Boulder, where her research focuses on landscape restoration, fire management, and adapting to climate change on U.S. forestlands. Dr. Schultz also serves as the Director of the Public Lands Policy Group which produces research to strengthen natural resource management and policy related to our public lands.

Dr. Schultz also started the CSU Climate Adaptation Partnership which connects scientists, resource managers, and policymakers to work collaboratively to help the American West adapt to climate change.

Dr. Schultz holds a B.A. from Stanford and an M.S. in conservation biology and sustainable development from the University of Maryland and a Ph.D. in forestry at the University of Montana.

Thank you for being here, Dr. Schultz.

The last witness I will introduce is Dr. Ellen Herbert, a senior scientist at Ducks Unlimited. As members of this Subcommittee know well, Ducks Unlimited is a leading advocacy group of sportsmen and women committed to conserving America's wetlands. To date, the organization has conserved over 15 million acres of waterfowl habitat, and its leadership has supported the protection of another 177 million acres of wetlands nationwide. Dr. Herbert is a member of Ducks Unlimited's national and international science team, where she evaluates the outcomes of their conservation work

through field experimentation, numerical modeling, and data synthesis.

Before joining Ducks Unlimited, Dr. Herbert completed field research on the effect of drought on sea level changes in the San Francisco Bay and coastal Georgia.

Dr. Herbert earned a B.A. in biology from Kenyon College and a Ph.D. in Environmental Science from Indiana University, where she was also a graduate research fellow for the National Science Foundation.

Dr. Herbert, Dr. Schultz, and Mr. Mueller, I cannot thank you enough for your leadership on these issues and for making the trip for today's hearing. I look forward to your testimony. I hope it will give our Senate colleagues a better appreciation for the specific, immediate, and growing danger climate change poses to the American West. Thank you.

I now recognize Ranking Member Marshall who will introduce our next two witnesses.

Senator MARSHALL. All right, Chairman Bennet. I am pleased to introduce two panelists today hailing from Kansas, Mr. Earl Lewis and Mr. Tom Willis. In full disclosure, these gentleman are both good friends, friends I have known for decades. They live, eat, and sleep conservation, and I appreciate both of them being here today.

Earl Lewis is, of course, the Chief Engineer of the Kansas Department of Agriculture's Division of Water Resources and a member of the Western States Water Council. He has dedicated his career to water resources in Kansas. In his role, he is responsible for any laws in the State which are related to water conservation, management, and control.

In addition to his role as Chief Engineer, Earl has served on the Governor's Water Vision Team, developing the long-term vision for the future of water supply in Kansas, and is on multiple councils and boards related to water policy and conservation.

Now Tom Willis is a titan of agriculture. He is an entrepreneur, a businessman, and again, a lifelong conservationist before it was in vogue. He has many ventures, but one of them is the owner of T&O Farms just south of Garden City, Kansas, where he tries to grow crops on about six or eight inches of rain every year. Tom was the first to establish a water technology farm in the State of Kansas in partnership with the Kansas Water Office. Since 2016, Tom and his son, a veteran, have been studying and implementing new technologies such as soil moisture probes, drip irrigation, and aerial photography to manage irrigation methods on their operation.

As we continue discussing solutions for water management and usage, I am confident that the perspectives of these two Kansans will provide beneficial to the Committee.

One final shout-out. I want to shout out to Dr. Herbert and DU. You have been a lifelong partner for my family. You have been one of our choices for charitable contributions. We have helped establish hundreds of water habitat for ducks on our personal property.

Your work has not gone unnoticed. No one does a better job of taking the moneys you are given and establishing habitat which we all get to enjoy, and we appreciate DU being here and represented. I think that was a great choice on your part, Chairman.

Thank you. I yield back.

Senator BENNET. Thank you, Senator. You are certainly right, and I appreciate that, Senator Marshall.

Okay. To the witnesses, who actually know what they are talking about, we are very happy that you are here. Please try to keep your testimony to about five minutes each, and any written testimony beyond that we will certainly include in the record.

Mr. Mueller, you may proceed with your testimony, and we will go right down the line. Thank you.

STATEMENT OF ANDY MUELLER, GENERAL MANAGER, COLORADO RIVER WATER CONSERVATION DISTRICT, GLENWOOD SPRINGS, COLORADO

Mr. MUELLER. Chairman Bennet, Ranking Member Marshall, members of the Subcommittee, thank you for the opportunity to speak today about the crisis that I am seeing play out before my eyes in western Colorado.

My name is Andy Mueller. I am the General Manager of the Colorado River Water Conservation District. As a regional government, we lead in the conservation, development, and protection of the headwaters of the Colorado River in the 15 county area in western Colorado. The precipitation in our district alone provides 65 percent of the Colorado River's annual average flow. We are at the headwaters of a river system that supports 40 million people, five million irrigated acres of agriculture, 2 countries, 30 sovereign tribal nations, and seven States and 11 national parks. We are the first link in an immense chain vital to the health and future of the single most important natural resource in the American Southwest.

The Colorado River is aptly referred to as the hardest working river in America. Maybe the folks from Arkansas would disagree with us, but . . . even in wet years, the river no longer reaches its natural mouth of the Sea of Cortez, and claims to water exceed its annual average flow every year.

The massive system of Federal reservoirs on the Colorado River was designed and built to accommodate the known natural variability in the river system and worked extremely well for over 50 years. However, after the longest and most severe drought on record, that once highly functioning Federal system is dangerously depleted with only 34 percent of system storage remaining, forcing the Department of Interior and the Basin States last year and this year to resort to emergency actions to keep the system from collapse.

Over the last 22 years, the flows of the Colorado River have been 20 percent below average, and sound science tells us we should anticipate and plan for significant reduction in flow in the future. The climate we have experienced in the last 20 years, as Senator Bennet alluded to, has been hotter and drier than any period in the last 1,200 years. There is a direct causal relationship between rising temperatures and the volume of water flowing in the Colorado River and its tributaries.

Western Colorado, the most significant regional source of water in the Colorado River, is an epicenter for significantly above average rise in temperatures. Most of our 15 counties have experienced a more than four-degree Fahrenheit rise in temperatures since 1895, with greatly accelerating temperatures over the last decade,

a very concerning trend for those of us in the Basin. For every one degree Fahrenheit rise in average temperature, we see stream flow reductions between three and nine percent.

None have felt these climate impacts more than our family owned farms and ranches in our Colorado River District. The plentiful water resources of the past are no longer physically or legally available for many of our ag producers. Families who have been involved in ranching for multiple generations are being forced to sell their cattle and confront tremendously uncertain futures. This drought is threatening our local, regional, and national food supply.

We cannot, nor will we, throw up our hands and surrender the thriving American Southwest to the forces of climate change. Citizens, communities, and governments throughout the Southwest are developing strategies, but as in the past, when our Nation has been confronted by existential threats, we need the Federal Government to be an integral partner in our efforts.

We must recognize that there is no single solution which will allow us to escape this rapidly changing climate. It is a multifaceted effort, and I want to touch on a few concrete examples which are worthy of your consideration.

We need additional strategically placed small reservoirs in our high mountain valleys. These will help us successfully mitigate climate change by retiming the flows, which will provide essential water for our streams, our communities, and our food supply. Federal assistance through funding tools like PL 566, the Watershed Act, will be essential to our effort to adapt and retime this water.

We need more robust agricultural efficiency projects such as the Lower Gunnison Project in my district, where agricultural producers team up with local, regional, State, and Federal Government agencies to adapt to climate change. Through the expanded and streamlined Regional Conservation Partnership Program (RCPP), we can help producers and stream quality in many other watersheds in the American West.

The high-mountain snowpack is the greatest reservoir in the Colorado River and for our water users on the western slope of Colorado. The 2023 Farm Bill presents opportunities to encourage public investment in proper forest management, forested natural water infrastructure, enhancing climate resilience of water supplies, and supporting work force development, and increasing the pace and scale of watershed restoration and adaptation.

The multi-decadal drought and conclusive climate science clearly demonstrate that our demands greatly outstrip the water supply in the Colorado River Basin. To survive and continue to thrive in the Southwest, we will need to implement and all hands-on-deck approach, and every water user sector from the agriculture industry to municipal water users will have to meaningfully reduce their water consumption.

If Congress is to incentivize the reduction of irrigated ag in the Colorado River Basin, any such program must support productive agriculture while focusing incentives on fallowing hobby farms and marginally productive lands. The Federal Government should not fund the retirement of productive agricultural lands.

In conclusion, we are only beginning to see this climate crisis in the American West. We cannot afford to remain idle as rivers and

reservoirs dry and families shutter their businesses. Wishing for snow and rain is no longer an adequate plan at any level of decisionmaking. If our communities are going to survive in Colorado and downstream, decisive action at the Federal level is needed to help us adapt to this hotter and drier future.

Mr. Chairman, this concludes my testimony.

[The prepared statement of Mr. Mueller can be found on page 34 in the appendix.]

Senator BENNET. Thank you, Mr. Mueller, very much appreciate it.

Mr. Lewis, you are next. Thank you.

STATEMENT OF EARL LEWIS, CHIEF ENGINEER, KANSAS DEPARTMENT OF AGRICULTURE, DIVISION OF WATER RESOURCES, WESTERN STATES WATER COUNCIL, MANHATTAN, KANSAS

Mr. LEWIS. Thank you, Mr. Chairman, Ranking Member Marshall, and members of the Subcommittee. I appreciate the opportunity to appear before you today to talk about this very critical issue.

My name is Earl Lewis. I am the Chief Engineer of the Kansas Department of Agriculture's Division of Water Resources and a member of the Western States Water Council, who I appear on behalf of today. The Western States Water Council is a member organization representing the 18 Western States, and members are appointed by, and advise, each of the Governors.

As each of the people that have talked before me have mentioned, the situation in the West is dire. We have heard about the Colorado River Basin, the 40 million people, and 5 million acres that are challenged with low water supply.

The situation in the Great Plains is similar in the fact that over time we are receiving less precipitation and are challenged by drought. Each year, when we have less precipitation, that means that our farmers are pumping more water, exacerbating the decline of the Ogallala Aquifer. This is a vital resource for our region, and if we do not act we will end up with the situation of that resource going away as well as the agricultural production that is associated with that irrigation.

There are three roles that I believe the Federal Government plays when it comes to drought: first, operation of Federal infrastructure, particularly with the Bureau of Reclamation and Corps of Engineers; second, collection, analysis, and distribution of data to all levels of government and individual producers; and third, cost share programs for producers and communities that help to mitigate drought and its effects.

The collection, analysis, and open sharing of reliable data is important for water availability for all levels of government, and I would like to touch on a few of those that deal with the Federal Government. The National Integrated Drought Information System, or NIDIS, is a multi-agency partnership that coordinates drought monitoring, planning, and forecasting, including the Drought Monitor which we have talked about here today. The Western States Water Council supports NIDIS and co-chairs its executive council with USDA and NOAA. Senator Thune has been a

champion of NIDIS and Drought Monitor improvements, and we thank him for his past support.

In much of the West, winter snowpack and spring runoff dominate stream flow and water supply. USDA's Snow Survey and Water Supply Forecasting Program and SNOTEL within NRCS is critical for water users, managers, and planners. Program funding has been flat at about $9 million per year over the last two decades while equipment, staffing, and other costs have increased, challenging the program to meet staffing levels and to maintain an adequate network. An anticipated 50 percent increase in the President's 1923 budget has not been realized although we would encourage your consideration of this request.

The Western States Water Council also supports robust programmatic funding for improved season to sub-seasonal precipitation forecasting, often known as S2S. It is critical to improve lead time for water supply planning as well as reservoir and agricultural operations. Pilot programs have been proposed to improve NOAA's 90-day precipitation forecast, but funding has been inadequate to date.

Water resource managers and agricultural interests are reliant on evapotranspiration data or ET data for irrigation scheduling, management, water rights administration, and a host of other issues. Satellite-based ET data is already available in some regions, but it is not often not readily reliable for modeling and decisionmaking at the watershed or field scale. The Council supports legislative proposals for an open ET program that fills the urgent need for an operational system that can produce accurate consumptive crop water use estimates, such as Senate 2568 introduced by Senator Cortez Masto.

We encourage the Subcommittee to consider USDA's role and resources needed to participate in building a national water data network as well as partnerships to advance the use of water information to serve the needs of agriculture. Senator Luján, together with Senator Heinrich, has introduced legislation to establish a national water data framework. Western States Water Council welcomes the introduction of the Water Data Act and supports coordination and leverage of State and Federal resources.

Finally, USDA conservation assistance programs help the agriculture industry thrive in good times and survive in hard times. The Council supports collaborative, targeted, and voluntary programs promoting conservation practices and groundwater recharge to preserve the long-term ground and surface water resources. Programs such as EQIP, the Regional Conservation Partnership Program, and the Conservation Reserve Enhancement Program are all programs which implement best management practices on the ground to lessen the need for water and help mitigate drought. Likewise, the USDA's Rural Development Agency helps rural communities plan and implement projects to have a reliable water supply.

Planning for, and limiting, the impact of drought will take all levels of government working together, which is why I appreciate the opportunity to be here today. Thank you for that opportunity, and I will be happy to answer questions at the appropriate time.

[The prepared statement of Mr. Lewis can be found on page 41 in the appendix.]

Senator BENNET. Thank you, Mr. Lewis. We appreciate your being here today and thank you for your testimony.

Dr. Schultz.

STATEMENT OF COURTNEY SCHULTZ, PH.D., ASSOCIATE PROFESSOR, FOREST AND RANGELAND STEWARDSHIP, WARNER COLLEGE OF NATURAL RESOURCES, COLORADO STATE UNIVERSITY, FORT COLLINS, COLORADO

Dr. SCHULTZ. Thank you, Chairman Bennet, Ranking Member Marshall, and members of the Subcommittee. I appreciate the opportunity to speak to you today. My name is Courtney Schultz. I am a professor of forest and natural resource policy at Colorado State University in Fort Collins, Colorado, and I also lead our university's Climate Adaptation Partnership.

In Colorado and across the country, climate change is leading to increased fire, smoke, flooding, and drought. In April of this year, USDA designated the entire State as a primary natural disaster area due to severe drought conditions that are likely to persist for years. Drought is projected to cost the State more than $500 million in annual agricultural damages by 2050, and reduced water availability will affect municipal and agricultural water users alike.

Fire is also increasing in Colorado and across the West. Three of the State's largest wildfires in history occurred in 2020 alone, and the State witnessed its costliest fire in State history in December, which is supposed to be winter, the Marshall Fire, which burned 6,000 acres and over 1,000 homes in a suburban setting last year. When fires are followed by heavy rains, which will only become more likely, we will see landslides, millions of dollars in damage to water infrastructure, and flashfloods that lead to the loss of life and property. In some places, forests are also not growing back, and smoke from fires is increasing with major implications for human health.

These impacts fall disproportionately on low-income and marginalized populations in our State and beyond. As a headwater State for vital rivers that supply 18 other U.S. States and Mexico, drought and fire have impacts that extend well beyond our State borders.

At CSU, our land grant university, we are undertaking extensive work related to climate change. We are truly at the forefront of research on fire, researching resilience of the built environment to natural disasters like fire, climate adaptation strategies on forest and rangelands, post-fire issues in Colorado and across the West with a focus on rural and indigenous communities, examining wildfire impacts on forest, snowpack, stream flow, and sediment yield, and we collaborate with USDA extensively on these efforts and appreciate the partnership with the Agency's research arms.

Others at our university are working on climate-smart agriculture, soil-based climate solutions, sustainable livestock systems, and agrivoltaics innovation.

We are home to the Partnership on Air Quality, Climate, and Health, whose members are studying smoke and, importantly, smoke communication to protect human health. We are also grow-

ing partnerships with USDA Climate Hubs related to drought and adaptation planning. These are core activities of our extension efforts at CSU.

We are developing educational opportunities that would serve the existing work force, train new graduate students, and train and recruit youth into these fields.

I want to highlight a few potential areas for future attention and investment. We see potential for augmenting funding for climate adaptation research and possibly for more land grant-USDA Climate Hub partnerships, perhaps with multiyear funding to support partnerships for agriculture and forest resilience. There also may be value in exploring authorizing the Climate Hubs. A recent five-year review of the hubs indicated that there is significant demand for their work and a lot of areas for growth.

For forest and fire management, which is my area of expertise, the situation will only get worse, and it is far more expensive to respond reactively than it is to work proactively. Thinning and reintroducing beneficial fire in forest can reduce fire hazard near communities. It can give firefighters greater opportunities to engage fire as it moves toward the interface where people live and can serve to reduce fire intensity which can protect the forest ecosystem for the benefits it provides, including water provisioning and carbon storage.

At the same time, the best way to protect communities is to work on defensible space and fuel reduction right around homes because embers can come from miles away and most ignitions are actually human-started on private land. If we are trying to protect communities, work needs to be done across jurisdictions with strong community-based partner engagement.

Partners have noticed that forest management in high priority areas would require a 40 to 60-billion-dollar investment across jurisdictions in the next 10 years and must rely on Federal, State, tribal, NGO, and private partnerships to accelerate action. We got partway there in the Infrastructure Bill, and I would encourage you to continue seeking the necessary funding, with a few recommendations.

Partners are seeking greater involvement, transparency, and accountability for how these funds are being spent to ensure they are going to the intended purpose, being placed strategically, utilizing community-based partnerships, promoting carbon storage, and going to areas that have been historically underserved.

I would recommend a clear plan specifically for the funding in the Infrastructure Bill that is dedicated to prescribed fire, which is an essential forest management tool, and a transparent discussion of how to deploy funds where they are needed most given current work force shortages and limited industry capacity to do restoration work.

I would also be happy to work with you on how future investments can be guided through improved performance measures that focus on outcomes, such as more emphasis on the acres mitigated target, with strong external oversight and engagement.

In light of the impacts of a changing climate, the challenge of managing our connected forests, watersheds, and farmlands is monumental in Colorado and across the West. My colleagues and

I are ready to assist in this endeavor and greatly appreciate the opportunity to discuss these issues with the Committee today. Thank you.

[The prepared statement of Ms. Schultz can be found on page 77 in the appendix.]

Senator BENNET. Thank you, Dr. Schultz, and we will take you up on your offer of assistance.

Mr. Willis, thank you for being here, and the floor is yours.

STATEMENT OF TOM WILLIS, OWNER/MANAGER, T&O FARMS, LLC, AND KANSAS FARMER WITH THE KSU WATER FARM, LIBERAL, KANSAS

Mr. WILLIS. Well, thank you, Chairman Bennet, Ranking Member Marshall, and members of the Subcommittee, for giving me the opportunity to speak today. My name is Tom Willis. Senator Marshall, we are not in Kansas anymore.

You guys can read my testimony. There is three or four points that I would like to make in the allotted time that I have got.

No. 1, this drought is real. Easiest way I can signify that, we have not had natural precipitation on my farm, my farm in four counties in western Kansas, since last year. This morning, at three in the morning, I got a call from my wife. Usually when that happens, it means they have got cows out on the highway and my cowboy is drunk somewhere. That is not why she called. She called to tell me it was raining. We got an inch or two last night. That is the first rain we have had since last August.

No. 2, when that happens in our area, because of the harshness of the climate, we pull heavy on the aquifer. When I first bought my farm—we farm—my son and I farm about 7,500 irrigated acres in Kansas, southwest Kansas. When I first bought it, after the first year, my pulldown on my average well from that farm was 10 feet. That is 10 feet of water that we used out of the aquifer that was not replenished, and I could see that that was not sustainable.

Working with the State, we developed one of the first water tech farms, and in that was to say how can we be profitable and still conserve water. Working with the State, we put in—changed nozzle packages on our sprinklers. We redid our sprinklers. We put moisture probes in because the average farmer will look at his—you know, everything he sees is above ground. By using moisture probes, we were able to go down as far as five feet and say: Really, what does the water look like down there? How much water does it actually need?

We also used telemetry. Telemetry allows me to look at the well when it is running, and if I get tempted to turn it up a little faster I can actually see what it does to the aquifer in that particular well, and most of the time it is enough to make you kind of slow it back down. That has been helpful.

We have used remotes on all of our circles. Why is that important? In the past, when a pivot broke down, you might not know about it for four, five, six hours. It would stand in one place and sprinkle the same place. We are able to know instantaneously, and my sons and our hired men are really good at fixing or turning sprinklers off at three in the morning so that we do not waste water.

We changed our crop rotation. When I got there, it was corn-soybeans, soybeans-corn. We have implemented sorghum. As a disclaimer, I am on the National Sorghum Producers, but I will tell you that sorghum is the resource-conserving crop and it is suited very well for southwest Kansas. It is hardy, and it can be made to be profitable because that was our goal.

All of that combined, I guess to get right to the bottom line on it, we saved—in six years, we have saved 8,887 acre feet or, to put that in terms of gallons, that is 1.2 billion gallons of water that we have saved by changing rotation, by using the technologies that are out there. That is real water, and that will be there for my son, for my grandson, and for the way of life that we chose to live, so very happy with that.

I do use—utilize State programs. I get asked sometimes, why don't you use the Federal programs? The reality of it is this. The State is simple. They will cost share a water program with me. They will cost share a meter with me. They will cost share telemetry with me. Depending on what the year brings, I can be very flexible.

Unfortunately, with the Federal programs, they mean well, but the flexibility is not there. I cannot afford that. Given the ever-changing climate and what I have to deal with from an environment perspective, I have to have maximum flexibility.

One of the asks that I would have is that we construct this new Farm Bill. If we put anything in there, remember one size does not fit all and the key to getting farmer adaptation to all this is flexibility.

The other thing you have to look at is risk. In today's margins, farm margins, with input costs where they are, it is hard to get a farmer to think outside what his work—he does not want to lose his farmer. Incentivizing that change would be good.

Anyway, I am out of time, but I appreciate you listening to me. I want to tell you this: This problem is real. It cannot be kicked down the road. It cannot be kicked down the road, at least in western Kansas.

I look forward to answering any questions that you might have, and again, thank you for letting me be there.

[The prepared statement of Mr. Willis can be found on page 90 in the appendix.]

Senator BENNET. Thank you, Mr. Willis. I would say that if there were Colorado producers here they would be talking about their children and grandchildren as well, so appreciate your focus there.

Dr. Herbert, you have the last word, and then we will go to questions.

STATEMENT OF ELLEN HERBERT, PH.D., SENIOR SCIENTIST, DUCKS UNLIMITED, MEMPHIS, TENNESSEE

Dr. HERBERT. Mr. Chairman, Ranking Member, and members of the Subcommittee, thank you for having me today. I am Dr. Ellen Herbert, Senior Scientist for Ducks Unlimited, North America's leader in voluntary incentive-based wetland and grass conservation. I appreciate the opportunity to testify today on behalf of Ducks Unlimited regarding the western water crisis. Water is at the center of what we do as an organization.

Western States have lost between 20 and 90 percent of their original wetlands through direct drainage and conversion of wetlands. Others have been lost through the diversion of source water for other uses. It will come to no surprise that drought is further exacerbating wetland loss. This has a profound effect on water birds and other wetland-dependent wildlife as well as the important ecological functions wetlands provide to people by capturing floodwater, augmenting river flows, recharging deep aquifers, and regulating climate.

The drought situation is dire. However, when I can, I want to offer solutions on the role of Farm Bill programs and other programs like the National Wetlands Conservation Act. Wetland restoration in States like Colorado and Kansas can be part of the drought mitigation solution.

We have heard from other witnesses about flow retiming. Wetlands with subsurface connectivity tend to regulate hydrology by capturing water during snowmelt or flood periods and direct that water through shallow subsurface flows, providing a constant subsurface discharge through streams and rivers during drought periods.

DU and other multiple partners in public and private entities deliver the South Platte River wetland augmentation wetlands in Colorado to direct water to wetland ponds during high flows, snowmelt periods, where it slowly infiltrates into the alluvial aquifer and returns to the river over time. These projects offset agricultural well depletion, supplement base flow during dry periods, and provide habitat for waterfowl, wading birds, cranes, and other threatened and endangered species.

Wetlands can also play a role in recharging deep aquifers. DU works with USDA through the SAFE program and other partners in the Southern High Plains to restore playa wetlands. As the Ranking Member knows too well, the Ogallala Aquifer is being depleted at an alarming rate, but scientists estimate that aquifer recharge rates in playa wetlands are 10 to 1,000 times higher than recharge rates in upland systems and playa wetlands contribute up to 95 percent of the aquifer recharge. By restoring functional playas, we can improve water security for future generations and provide important migratory bird habitat.

These playas, among other CRP wetlands, are also the subject of a newly funded USDA project led by DU and partners from USGS, ARS, and six State and tribal universities, examining the climate mitigation potential of the CRP program. Previous research indicates these wetlands and surrounding grasslands are important carbon reservoirs.

Water efficiency is another important component of drought resilience, especially in arid western States, where it can be difficult to supply enough water to support a significant human population, globally important agriculture industry, and vital habitat for waterfowl and other wildlife. The Klamath Basin Irrigation Project, for instance, supports tens of thousands of wetland acres and hundreds of thousands of acres of cropland, requiring 440,000 acre-feet of water annually. This year, it is slated to receive only 50,000 acres of 11 percent of that demand. Lower Klamath and Tule Lake National Wildlife Refuge, once the most important waterfowl ref-

uges in North America, will receive no water and be completely dry.

In a typical winter, the Central Valley of California hosts between six and eight million ducks and geese, which rely on wetlands and winter-flooded rice. This year, rice planting will be around half of what it normally is. Rice is an important commodity and provides more than half of all waterfowl food in the Central Valley. The rest of the wetlands of the Central Valley of California are slated to get 20 percent or less than normal water supplies.

While there is no single solution, other than increased snowpack and more rain, which is becoming increasingly unlikely with changing weather patterns and warmer winters, we can implement more water-efficient practices better use what we have. To meet water demands in California, water is delivered to users through an elaborate system of water storage and conveyance infrastructure, but these systems are often inefficient. Working with multiple partners on two projects, Gray Lodge and the Llano Seco water supply, DU is pursuing design and construction projects to replace leaking and inefficient siphons and canals. These projects will create nearly 47,000 acre-feet of new and improved water conveyance capacity and provide reliable water delivery to 29,000 acres of agricultural land and 9,000 acres of wetland.

As drought continues to worsen, we want to ensure our policies are maximizing water resilience, water reuse, and water efficiency to minimize conflict between water users. Working with public and private partners, including in the USDA, Ducks Unlimited will continue to advocate and implement multi-benefit water projects to maintain vital habitat and support human use.

Thank you and I would be more than happy to answer any questions you may have.

[The prepared statement of Dr. Herbert can be found on page 100 in the appendix.]

Senator BENNET. Thank you, Dr. Herbert. I would like to thank all of the witnesses for your substantive and sober testimony.

We are now going to turn to a round of five-minute questions for each of us. Mr. Mueller, assuming we move forward as we are now, with no changes to our water use and no meaningful action to slow climate change, can you describe what you think the Colorado River Basin will look like in 20 years or 40 years? Could you also give the Committee a little bit of a sense about what is happening in Lake Powell and Lake Mead as well?

Mr. MUELLER. Absolutely. Thank you, Senator. I would say 20 or 30 years from now the Colorado River Basin will be a starkly different place if we do not act quickly and act intelligently. All of the scientific consensus is clear that we will—are facing a situation where we can expect additional cuts to the flow of the Colorado River as great as 30 percent, so a 50 percent reduction from 20 years ago.

This is river system that, again, is already over appropriated and over used. What that means it that we will have great conflict between our growing cities and the river basin and our national food supply. It means that the price and value of water will exceed the current value of agricultural production water and it is likely that

our agriculture in the Colorado River Basin will be greatly diminished.

It is a situation that is dire, frankly. You know, I talk about our family farms and ranches in western Colorado, but the reality is our farmers throughout the Colorado River Basin feed America. You look to the Lower Basin, any of us who have enjoyed a salad in the winter, it is coming from Yuma, Arizona, or in the Imperial Irrigation District it is watered with Colorado River water. We simply cannot see that disappear over the next 30 years.

Today, that massive system of reservoirs that I referred to has the two largest. It is Lake Mead at Hoover Dam and Lake Powell with the Glen Canyon Dam. You may have read in the paper that the States and the Department of Interior, very cooperatively this year, enacted some extremely shocking emergency actions and did so in the space of about two weeks of dialog. We are talking about a water bureaucracy that moves at the pace of melting glaciers 200 years ago, not in today's pace.

They came together because the reality is that Lake Powell was predicted to drop below minimum power production at the lake. That is bad enough because the western United States depends on that cheap power coming out of the crisp reservoirs, but it is even worse when you look at the infrastructure issue associated with that. That leaves us with two outlets out of Glen Canyon Dam.

The concern at the Bureau of Reclamation was that those two river bypass outlets would actually cavitate like they did in the 1980's and erode the concrete tunnels that pass that water because they appear not to be functioning as they were designed in the early 1960's.

The concern was that we would not be able to pass water to the Lower Basin at all, no water in the Grand Canyon, no water for California, no water for Nevada, and that is a stark warning to all of us. We were within months of hitting that level in Lake Powell. We moved water around, did not release as much out of Glen Canyon down through the Grand Canyon this year, about half a million acre-feet, and we also moved another half a million acre-feet from Flaming Gorge Reservoir up in Wyoming and Utah down into Lake Powell.

These are one-time fixes. These are one moment in time. We do not have any more of those IV bags, as I call them, or Upper Basin reservoirs.

You know, the three reservoirs that sit—that the Federal Government controls, that sit above Lake Powell are approximately 23, 27, and somewhere around 50 percent full, respectively. They are stark and empty.

This year, snowpack, as we sit here today, has melted a full month earlier than the average runoff. Our runoff peaked at about 60 percent of average runoff. As I referenced in my written testimony, last year, we had about an 89 percent snowpack in the Colorado River Basin, pretty good, close to average. Well, the inflow into Lake Powell, where it really matters, was less than 37 percent. So the change in the heat is just killing this river.

I would just say that we need to act. We need to act in a way that supports our agricultural community, and I think that the Federal Government and through the Department of Agriculture

has a tremendous ability to do that with our producers hand in hand.

Senator BENNET. Thank you, Mr. Mueller.

I am going to reserve my other questions till my colleagues have a chance to ask theirs. Senator Marshall?

Senator MARSHALL. I am going to give my time to Senator Tuberville, and I will come back.

Senator BENNET. Great.

Senator TUBERVILLE. Thank you very much. Thanks for being here today. Very interesting. I am from Alabama. We got a lot of water. We do not have this problem, but I have spent a lot of time out West, a big hunter, duck hunter. I understand your problem, and it is a huge problem. I have been on Lake Powell several times. What a mess.

My question is: We know we got a problem. Why do we have a problem? I mean, we got to figure out the problem before we get a solution. Is it Governors? Is it we are sending too much water to the cities? I know Dallas and Fort Worth are draining the aquifer in north Texas. They are sending millions of gallons a day.

Why? Why are we in this situation? Who wants to take it first? Mr. Mueller, you can start. Anybody else want to answer this?

Why do we have this problem? I hear climate change. I am fine with climate change. Why? How do we stop this?

Mr. LEWIS. I might take the first crack at that. I would say, twofold. First, the majority of the western States fall under what is called the Prior Appropriation Doctrine, and individual water rights are private property rights dedicated and owned by the owner of the property. A lot of times, that development happened clear back in the 1800's and certainly by 1970, 1980. We really did not have adequate data at that point to have a good handle on what the situation was going to be. So that is part of it, just lack of understanding at the time we were allocating the water supply and water rights.

The second is that as we think about it from the standpoint of making those decisions we are using the best available data that is available to us at that point. Our history, you have heard the Chairman talk about the fact that the West is as dry as it has been for 1,200 years. Well, we do not have 1,200 years' worth of record to make decisions on. At that point, we had 50 to maybe 100 years of record.

I think if we look at the overall history of the record we allocated a lot of that water supply during a fairly wet period, and so we consequently, in a lot of cases, over allocated the resource and did that in a private property rights situation. We certainly want to respect those private property rights, but it puts us in a situation of how do we manage a more limited situation than we thought we had at the time those water rights were issued.

I think, you know, it has been pointed out that the question of is it urban versus ag—I think we are all in this together. Whether it is ag or urban, industry, environment——

Senator TUBERVILLE. It is going to take both.

Mr. LEWIS. It is going to take all of us working together to resolve this.

Senator TUBERVILLE. Yes. We have this problem, and you look at it, and you say, you know, the climate is changing, which it obviously moves back and forth. You know, is it because we are concentrating more people in one area, that they are stopping the water from coming down south? He is the end of the food chain here in South Arizona.

We have got to figure out the problem. We cannot just throw money at something that is not going to help.

Anybody else want to answer this? I mean, where do we start?

Senator BENNET. I will give you a little more time because I think this is such a fundamentally important question, Senator Tuberville.

Senator TUBERVILLE. Thank you. Dr. Schultz, did you want to take a crack?

Dr. SCHULTZ. Yes, thank you. Thanks for the question, Senator Tuberville. I can mostly speak to the research on forest fires. That is my area of expertise. I can say that we are seeing a lot of data that indicates because of anthropogenic climate change, human-caused climate change, we are seeing significant increases in temperatures, which is leading to rain that is not falling as snow anymore. We have different timing of flows, water that is evaporating. We are looking at potential low- to no-snow futures in just a few——

Senator TUBERVILLE. Why is it doing that, though? Why are we having——

Dr. SCHULTZ. Because it is getting hotter, primarily, and then we are having changes in precipitation patterns. For example, there is these predictions that we will see much more intensive flooding after fires because these atmospheric rivers will come in and we will have more extreme rainfall in the summertime than we have ever seen before. It is the increased temperature is leading to changes in how and when water is coming and then changes in precipitation patterns.

If we look at patterns for forest fires, you know, for a while we were talking about the fact that past fire suppression in our fire-prone forest was a big reason we were seeing more fires, but now we are seeing that climate change effects—and this is when I talk to my, you know, fire scientist colleagues, they are saying climate change and increased heat is leading to higher temperatures, different relative humidity wind speeds, and increased fire behavior in ways that we have never seen before. A paper just came out that said there were three times the amount of fires in our high-elevation forest than ever has been seen on the record.

I think, to a large extent, we can think about how we can adapt to climate change, you know, how do we live it, what do we do for our forest in the meantime, but fundamentally, we have to reduce carbon emissions and slow climate change. That is ultimately where the solution lies.

Senator TUBERVILLE. Thank you.

Senator BENNET. Thank you, Senator Tuberville.

Senator Marshall.

Senator MARSHALL. Thank you again. I think I will start with Mr. Lewis on the same topic of managing flood events. I think, you know, it sure seems like we are having more flood events. How can

we manage that water from rivers that are flooding and store them better? We have talked about this in Kansas for decades. How do we take advantage of that situation? Any thoughts?

Mr. LEWIS. Well, I think as we look at the situation, at least in our part of the world, the Central United States, what the forecasts or the long-term models would say is that we will get roughly the same amount of precipitation and more intensive events and maybe more time in between the events. Really, what that means, if you are going to manage the water, we kind of have to go back to where we were at maybe in the middle part of the last century with storage. As was just mentioned, we may see much more intense rainfall, and that can lead to more flooding if we do not have the infrastructure in order to capture that and then ideally put that to use once the flood passes us.

Senator MARSHALL. Have you seen anybody being successful at this? You know, it seems like the Corps just wants to build dikes higher and higher, and I keep thinking about natural spillways and ways to manage those floodwaters.

Mr. LEWIS. You know, there are a few examples certainly as we see more and more demand primarily from our cities and urban centers for water we are seeing certainly in Texas and California. In north Texas, there was recently a reservoir that was permitted as being built, called Lower Bois d'Arc, which is about 13,000 surface acres. That is probably the largest reservoir of its kind being built in the United States at this point. That had to be done by the local water supply district. The Federal Government and most of the State governments are not really in the business of building storage and managing that type of infrastructure at this point.

Senator MARSHALL. Okay. My next question is kind of a generic one that we will see if we have time for everybody to answer. I want to know what is in the Federal Government programs—Tom, I will come to you first. What is working for water conservation? What is not working? How would you improve water conservation if you were king? If you were writing the next Farm Bill, what would that look like to give you more flexibility?

Mr. WILLIS. First of all, yes, flexibility is the key to it, maybe shorter-term type programs. The key to getting, in my opinion, in production agriculture is to be able to incentivize the producer to try new technologies without feeling like he is going to lose his farm if things do not work because we are an aging population in production agriculture. That willingness to step out of the box and say, hey, I am going to switch the way that I am doing things, that is hard. That can be a very hard decision, especially again with overall farm income, net farm income projected to be down.

What would I do with them? I think I would mirror a little bit what we do in Kansas, where we say, hey. You know, I go to them. I would like to put in some probes. I would like to do this. There are some incentives for me to try that.

Then they do not tell me what I have to do from there. They look at the results. I tell them what I want to do.

In my case, I said I will reduce the use, my water usage, by 50 percent.

Senator MARSHALL. Okay.

Mr. WILLIS. We were able to do that, and we were able to hold that income at the same level. I think that would be my one suggestion.

Senator MARSHALL. Mr. Lewis, kind of expand upon that. What have you seen working from the Federal Government? Obviously, the States are giving them some flexibility. If you were to help us direct the next Farm Bill dollars, what can we do to give you more flexibility or to make this work for your people, our people?

Mr. LEWIS. Well, I think Mr. Willis hit it pretty well, frankly. You know, much of the programs that are dedicated to this type of activity really were not built for irrigation efficiency or water management. They were primarily built coming out of the 30's and the 50's with dust bowls, and they were focused on soil conservation and those kinds of things, very laudable goals and very important activity.

It is really difficult to then take those same programs and then apply them to the type of things that Tom just talked about. I think some more focus on irrigation technology, on water management, maybe dedicating some of the resource and some of the programs toward that would be helpful in trying to move us in the right direction from the Federal side.

Mr. MUELLER. Yes, if I could just add, Senator Marshall, I appreciate that question. I would say there are a couple things real quickly.

In our district, we deal with both the NRCS and the Bureau of Reclamation in the Far West, and the problem we have is that the two agencies have completely different NEPA compliance processes. We have projects where we combine the money from the two agencies together with State and local money and we end up spending years doing extra NEPA compliance because we end up having to comply with the Bureau of Policies and then the NRCS policies.

We would love to see a Farm Bill that directs the NRCS to be able to use the U.S. Bureau of Reclamation NEPA compliance program and policies. If we do that first, we can move forward with both agencies. It would be tremendously helpful.

The only other thing I would say is that we are looking at these huge increases in prices on piping in particular. It is one of our most—best way to increase water efficiency and water conservation on off-farm delivery. The process that the NRCS uses through EQIP oftentimes combines both the design and the construction in one contract, and so we—by the time we get the design approved, we get the contract approved, the construction prices have escalated recently as much as 100 percent and the original contract price cannot cover the on-farm and off-farm delivery systems.

We would ask that you consider supporting and reestablishing the Index Payment Rate program within the NRCS and authorizing the NRCS to break those two phases of contracting up so that when we finally contract for construction it is a realistic number and not one that is futile. Thank you.

Senator BENNET. Thank you, Senator Marshall. Thank you for that testimony.

Senator Luján is actually next in order, but he has kindly offered to let Senator Braun go first since you were here—and thank you for coming.

Senator BRAUN. Thank you, Mr. Chair. I actually live on a farm and have practiced conservation my entire life, watched with horror sometimes when I see what is happening especially in the Far West to where it looks like—agriculture is a long-term enterprise, and your main asset is your land and your water table. When that starts going the wrong direction, I do not know how you strategically make the decisions on what you are going to do long-term. Most other businesses do not have that dynamic in play.

I would like Mr. Mueller and Mr. Lewis to give me an idea. Especially in maybe the Near West, are you in as bad a shape or impending as what we see through places like California, where I do not know how owning a farm there would look like you could say that is a long-term enterprise, you know, when you literally could run out of water? How far east is that situation for all of us to be concerned about in terms of what the future holds?

Mr. MUELLER. Well, Senator Braun, maybe I can take that, and then we can move further east to Kansas. I would tell you that our farmers in the high mountains of Colorado, our ranchers and farmers, deal with drought and they are used to dealing with drought on a fairly regular basis. Many of our ditches are direct-supply ditches. We do not have the benefit of groundwater in our area. We are very heavily reliant on surface water, snow runoff.

Our farmers understand, and our ranchers understand, that when they look up at the mountains and they see a dry year they are used to saying, well, that back 40 that is not as productive, I am going to fallow it. I am going to not irrigate that so that I can get the maximum bang out of my most productive fertile soils.

I think that is what we have seen over the last 22 years of this severe drought in Colorado. I would say that we are just as bad off as California. We just maybe do not have as many people demanding it, but we are incredibly dry.

I think that developing a program where we assist farmers on a programmatic scale to remove that marginal ag. I would also say, you know, we have an awful lot of people who have moved into Colorado, just as in California, and getting some of our what my real agricultural constituents would call hobby farmers, getting them to dry up their views in favor of food production, with a little Federal incentive, would truly help us. Targeting those two areas in voluntary conservation programs would be tremendously helpful.

Mr. LEWIS. Thank you, Senator, for that question, and I would say that this probably runs right through the middle of Kansas and Oklahoma and Texas, clear up to North Dakota. We often talk from a water standpoint about, at least in Kansas, of being two States, from a very semi-arid in the western part of the State, groundwater dominated, to much more rainfall, up to 45 inches, in the eastern part of our State.

Senator BRAUN. How much in the eastern part?

Mr. LEWIS. Up to 45 inches. We are at about 15 or 16 in the southwest portion and about 45, so about 3 times difference.

Senator BRAUN. That is about Indiana rainfall then.

Mr. LEWIS. That is right. The western third of our State, we are really in a water mining situation at this point. We have groundwater development declines. It is like any real estate; it is about location. We have got some areas that are effectively leaking water.

We have got other areas that are 25 or 50 years left. We have got areas close to the Oklahoma border that may have 200 years left. I think that making sure that we tailor whatever action we take to that individual area, that individual producer, is key to our long term success.

One thing that has not been hit on yet that I think is key is—and Mr. Willis talked about it just briefly—crop varieties and crop genetics. We are seeing even in the western part of our State, because of drought-tolerant crops, people that can be successful certainly in a normal year, where 25, 50 years ago that was not the case on a dryland situation. I think additional research dedicated to crop genetics that are more suited to the High Plains would certainly make sure that we can keep those farmers viable for the long term.

Senator BRAUN. Thank you. Dr. Schultz, I have been a tree farmer since the late 1980's, and all I can tell you is it is great therapy for this current job. I go back to it every weekend.

Forest ground has a little different dynamic. It has a longer horizon. The biggest thing I deal with would be invasive species, and we have got one called stiltgrass that once it gets into your woods you do not even know that it is not native and you do a poor harvest and it has gone from your skid trails into enveloping the entire woods and you cannot even get a seedling that will break through. I know that you have got similar stuff in the West, cheatgrass, other stuff that you contend with. How big a deal is that, and how much has that become a problem in the recent past?

Dr. SCHULTZ. Thank you, Senator Braun, for the question. My understanding—and I will just caveat to say that that is a little bit outside of my expertise, but my understanding is that there will be insect and disease outbreaks in our forests in the West and they will have a variety of effects. Sometimes it will mean that you will get two cycles of insects in a year because it is warmer instead of one or you will have situations where because you do not get a hard freeze the larvae do not die, so that will exacerbate it.

I think part of what happened when we saw a massive die-off in California a few years ago was that there was an insect outbreak and it weakened the trees and stressed them, and then in addition to the drought and heat conditions it caused, you know, a huge mortality event, and then that can interact with fire in some tricky ways as well.

Senator BRAUN. Very good. I think whenever something becomes weak or the climate is not in sync you now have that issue, less for row crop farming but a big deal for forest management.

Thank you.

Senator BENNET. Thank you, Senator Braun. I really appreciate those questions. We have had terrible beetle kill in Colorado, and it is happening at the headwaters. When the forest dies, this severely affects our water infrastructure for the Rocky Mountain West. I really appreciate your line of questioning.

Senator Luján, my neighbor, is here, and I think you are going to go next and then Senator Hoeven. In your absence, Mr. Lewis, from Kansas, mentioned his support of your bill with Senator Heinrich, the Water Data Act. I just want you to know you were mentioned while you were not here.

Senator LUJÁN. I appreciate that, Mr. Chairman. Thank you, Mr. Bennet, for holding this hearing with you and Mr. Marshall as well.

Mr. Lewis, that is encouraging that you are supportive of that effort. We have an incredible U.S. House Member by the name of Melanie Stansbury. She used to work over here in the Senate, and the good people of New Mexico saw that expertise, and now she is in the House. She really was the brain trust behind some of this with the work she did on similar issues in the Senate. I appreciate that.

Across the West—I am glad to hear across the country right now there is more and more attention to the drought conditions that we are all experiencing.

I, myself, I am fourth-generation on a small farm. Now some people may refer to what we do on a few acres as hobby farming. To us, it is self-sustenance. You know. We eat what comes out of that ground, so do animals. Whether it is sheep or cattle or others that may be grazing on hay or that alfalfa that we are baling, it is all important as well and as we are looking at those impacts.

Dr. Schultz, in New Mexico, like in Colorado—and I think Mr. Mueller mentioned this as well—our water comes from those watersheds, from snowmelt, and from accumulation, like so then Colorado and New Mexico, they are all irrigation ditchways. People may chuckle at what we do, but centuries ago our ancestors saw right to dig three feet across, three feet down, and then they put these headgates. We call them comportas. It is a Spanish name for a door, but headgate. Then we managed the waterflow.

In good years, everyone has more crop production, and in bad years, everyone is fighting. You always have to walk up that ditch, and oftentimes it is with a shovel in your hand because you go look to see who took your water and you have words with one another. Then the water gets flowing again, so it is always positive that way.

Whether it is centuries old or we look at irrigation structures that have been constructed in conjunction with United States of America, within USDA, private entities that have taken these over and doing that work, it is also important.

Last week, I was visiting some areas of New Mexico where we have the largest fire on record now. It was started by a prescribed burn by the Forest Service within the USDA.

Nonetheless, I am very concerned about what dry conditions mean and lower water yields on the front end and what that sometimes can lead to with beetles and other invasive species.

I am much more concerned, at least during this time in New Mexico, with what good water is going to mean for us. Good water is going to mean bad water conditions because that fire burned so hot. We have got ash 6 to 12 inches deep. We have got trees that are going to come down. They are going to clog up the rivers. That ash is going to go into waterways and culverts. Some of these towns that 90 percent of the water that is for drinking water in these communities, they are not going to be able to touch it.

Dr. Schultz, can you touch on that a little bit as well, with you know, fire and water, good conditions before or bad conditions, what that means, too, and then on the back end, what that could

yield to and how we need to be thoughtful about conditions before and conditions after, what could be caused with a fire?

Dr. SCHULTZ. Thank you, Senator Luján, for that question. I am certainly very cognizant of the intense fires you are facing in your State right now. You know, my heart goes out to your State and people who are dealing with that, and it is going to be an issue for a long time to come.

I mean, I live at the—in the footprint of the Cameron Peak Fire, which I think was the largest fire in State history in Colorado, and it has had an enormous impact on our watershed. I have watched that myself because the ash and waterflows are very obviously impacted post-fire.

I think one of the things we should think about is how we can improve our post-fire recovery funding and strategies, and I think that would be an area for emphasis for the Farm Bill. Something that we are going to be working on this summer is trying to understand specifically what people are needing and where they are running into challenges so we can help inform this Committee on those issues.

The other thing that I understand is that a lot of communities do not have backup water supplies, and so sometimes they have to—we have seen some communities where they switch to a backup water supply, but other communities are not going to have that option, and they are just one fire away from having their water supply essentially shut down.

We have also seen tremendous impacts to water infrastructure. For example, I think after the Hayman Fire in Colorado estimates were that the impacts to water supplies for cities around Denver were over $30 million because of those sediment flows into the water infrastructure. There is the impacts of the debris actually into the system, the toxicity of the water, then the impacts to the infrastructure itself, which can be hugely important to clean up.

I think that all leads to the need to do more to limit these kinds of catastrophic fires and also just recognize that they are going to be a bigger part of our future and we are going to have to figure out how to, you know, have some nimbleness with our water infrastructure, with our water supply, and also have more focus on our post-fire recovery for communities.

Senator LUJÁN. Appreciate that, Dr. Schultz.

Mr. Chairman, since my time is out, there are two other issues that I wanted to raise, but it is more to get the attention of the Committee staff as well as we are all working in these areas as well.

It carries off from what Mr. Braun was talking about with the invasive species, with plants and weeds and things of that nature. In New Mexico and in southern Colorado, it is saltcedar in our waterways, and then we have these elms that if we could just figure out how to get fruit growing out of them we would solve a lot of challenges. These things spout up like crazy, and they drink a ton of water. Especially these smaller communities, they do not have the financial means to take those things down. It gets expensive. To the extent that as we are looking at conservation and drought mitigation that we try to plus that up and that we look at smaller

areas maybe where those local governments do not have the means to be able to get that done.

Then the last thing that I will say on conservation is, well, we need to be doing more in these specific areas, with some of these earth and waterways, like Mr. Mueller just talked about. That is what recharges wells and keeps trees, good trees, from falling, that everyone is growing out that way as well.

We find that balance, as we are working with aligning and things of that nature, but that we understand those ecosystems that exist or drinking water in many of these communities which would turn into ghost towns if they did not have water and there is no other way to get it to them, so just that we are thinking about both of those.

I thank everyone for the time and thank you, Mr. Chairman.

Senator BENNET. I also want to say how sorry I am about the fires that are occurring in New Mexico. We know it is just a matter of time when it is happening again in Colorado. It has gotten to the point where we need to write a Farm Bill for the 21st century that understands what we are dealing with.

After one of the fires that we had two years ago in Colorado fell, it then snowed before anybody could do any work on the landscape. You know, that is what happens when you have a world where all of a sudden there is no fire season anymore, and fires strike year-round. That is what we are dealing with. Thank you.

Senator Hoeven, thank you so much for coming, and the floor is yours.

Senator HOEVEN. Thanks, Mr. Chairman. Thanks to you and the Ranking Member for holding the hearing. It is always good to follow "Ray Ban." He is one of my favorites.

Picking up on what the Chairman just said, though—and I would ask this to each one of you. If there is one thing in the Farm Bill that you think we should make sure that we have got there to help with drought, what is it? The first part—I mean, there are going to be a number of things, but you know, priority one. What is it?

Mr. MUELLER. I would say that funds in the Farm Bill to assist with both post-fire recovery and both natural and manmade infrastructure in the high country of our watersheds is what we truly need.

Senator HOEVEN. Is there something now that is targeted to that that you think is effective that we would build on?

Mr. MULLER. There are programs, for instance, the EQIP program.

Senator HOEVEN. Yes, we use EQIP a lot.

Mr. MUELLER. Yes, and it is well suited—I spoke just a little bit earlier on this, that we have been running into some really tremendous issues where people who have approved for, and contracted under, EQIP are unable to actually complete the projects——

Senator HOEVEN. Yes.

Mr. MUELLER [continuing]. because of the inflation that we are seeing on piping, really a problem because I think everybody at the Federal Government and our local partners are really trying to make these things work. Spreading that limited water out is absolutely essential during these——

Senator HOEVEN. Yes, no. I really like that answer because EQIP is—and for a lot of other purposes too, our producers really like it.

Mr. MUELLER. Yes.

Senator HOEVEN. I think that is right on the money, literally. Thank you.

Mr. MUELLER. Thank you.

Mr. LEWIS. Thank you, Senator. I would echo a lot of that comment as well. I think EQIP, making sure it has adequate funding and also has flexibility. Again, the situation all across the West or across the Nation varies greatly.

Senator HOEVEN. Right.

Mr. LEWIS. Being able, in our situation, to be able to target those funds toward things that are more irrigation technology or things that are going to save us water make us more resilient——

Senator HOEVEN. Yes.

Mr. LEWIS [continuing]. I think is key.

Senator HOEVEN. EQIP funding and flexibility, I absolutely agree with both of you.

Doctor.

Dr. SCHULTZ. Thank you, Senator. In addition, I was going to ask for permission to say two things, but these gentlemen covered one of mine, which is great.

I wanted to also bring attention to some of the work we are doing with the USDA Climate Hubs. These hubs are really dedicated to working with agricultural and forest users across the region to do things like drought planning or forecasting of conditions. I have been realizing that universities could bring a lot to that partnership, and it is already a partnership that is in place. We are working on bringing our extension capacity to work on drought planning with the Climate Hubs. We are working on then integrating that into training the next generation work force. We bring some of our research expertise on how to communicate effectively.

I think there might be potential to build that kind of thing out. You know, we see these multiyear partnerships with USGS and universities in the Climate Adaptation Science Centers, and I am wondering if we need something similar on the ag and forestry side of things in partnership with USDA and leveraging the capacity of the universities as well.

Senator HOEVEN. Okay. Mr. Willis?

Mr. WILLIS. Thank you, Senator. I would say, as a producer, the key is flexibility, and I say that in terms of getting people to adopt—producers now to adopt—technology. Sometimes you have to start small. Maybe it is a circle. Maybe it is two. It is having that flexibility so they can try it and see that it works because we face so many risks. Nobody wants another risk, and nobody wants another program that is inflexible or has a ton of reporting that needs to go with it.

If we are truly serious—and I am speaking about western Kansas, okay, and eastern—well, Senator Bennet, I guess I am going to speak for eastern Colorado, too.

Senator BENNET. Please do.

Mr. WILLIS. From a production perspective, it is having that ability to go in and say, try this; try it on two circles.

If somebody came to me 20 years ago and said, you could cut your water usage in half and still keep your bottom line the same, I would have laughed at them, but I tried it. I am unique because I have a few other businesses. If something did not go quite right, it was not like I was going to absolutely lose the family farm. A lot of them do not have that.

Senator HOEVEN. You did not have to bet the farm, so to speak.

Mr. LEWIS. I what?

Senator HOEVEN. You did not have to bet the farm on trying something.

Mr. LEWIS. No. By doing that and having that in there, and saying, hey, come and try it.

When I am talking about flexibility, too, it is saying we will have different programs. You want to cut water by 10 percent? Here is a program. You want to get more aggressive? Here is a program.

In my opinion, you will get a lot better participation, a lot better adaptation, because they will see that it works and they will see that they are not going to lose their farm and they are not going to get bogged down with a lot of the inflexibility, I guess, that we have seen.

Senator HOEVEN. Doctor—is it pronounced "Her-burt" or "Eh-bear?"

Dr. HERBERT. It is "Her-burt".

Senator HOEVEN. It is "Her-burt," Okay. The northern pronunciation then, eh?

Dr. HERBERT. The northern pronunciation.

Senator HOEVEN. Gotcha. I just want to kind of preface your response on this, too, with Mr. Willis said a couple things really important. One, the program should fit the producer, the farmer or the rancher. You should not make the farmer or the rancher for the program. Right?

A lot of folks think, yes, you know, the farmer or the rancher needs to fit the program, but the program should fit.

When we talk about flexibility, I think Mr. Willis said it awfully well. I call it the programs have to be farmer friendly, and it really is my opinion—and I love to hunt and fish. My wife is a much better fisherperson than I am.

I think conservation is a real benefit when they have that mindset of farmer-friendly programs because they are the ones that are out on the land. They own the land. They live and work there every day. They do not own public lands, but they are out there even on public lands, like in the forest, the grasslands in our case, but in the forest.

Anyway, kind of respond with that thought in mind, right, if you would.

Dr. HERBERT. Yes, and you have set me up perfectly. I agree with everything that has been said, particularly EQIP.

One of the programs that has worked really well for us is the RCPP and the RCPP alternative funding agreement that allows us to do exactly what you are saying. Our soil health and livestock integration program in the Dakotas relies on starting with interviews with ranchers and producers about what will work for them and allows us to be very flexible to design our contracting around what

works for them, and so that RCPP and the AFA program have opened the doors for that.

They are also opening the doors—everything that has been talked about is wonderful, but to execute it, you need people in the field interacting with producers. Again, the RCPP program has allowed us to get much more technical assistance out in the field, talking to producers about what they need and designing programs to fit that need, and so I cannot say enough about, you know, the ability of that particular program to expand NRCS's reach through public-private partnerships and meet farmers where they are because designing those programs around those production systems is critical to the longevity of those programs.

I will add one more thing, which is we have made a significant effort to research and collect data from producers on the financial and other natural resource benefits they see from conservation practices, and we have the data that says if those practices are financially viable producers will continue to do them after the contract expires. That requires data to show the producer, and that requires us to collect data and fund the collection of data.

Senator HOEVEN. Thank you. Thank you, Mr. Chair.

Senator BENNET. Thank you, Senator Hoeven. Fantastic questions.

Senator Marshall, do you have anything?

Senator MARSHALL. I got maybe one more question, Senator Bennet. I just want to again thank you for holding the hearing. It has been one of the more informative hearings. We have had a great panel.

This is why I came to the Senate—to solve problems like this, to solve water conservation issues, to leave this world cleaner, healthier, and safer than we found it, to make sure that future generations have water.

I talk about farmers and ranchers being the original conservationists. I remember my grandfathers building terraces in the 1960's for soil conservation, and now it is our generation's turn to take those next steps as well. I appreciate the input today.

I want to close with just one question for Dr. Herbert. The reason my wife and I support Ducks Unlimited is because you do a great job taking government dollars, the dollars you raise, and then you work with local farmers, local ranchers, and then you make sure those dollars are spent very efficiently. You spend it like it is your own money, and we appreciate that.

Coming back to my original question for everybody that you did not get to answer, and you have alluded to it and parts of it, what has not worked, what are we throwing away money on, and then what would you accentuate? All these ideas are great ideas. Our challenge is how to prioritize the finite dollars that we have, and what we spend we want to be spent very efficiently.

Dr. HERBERT. Yes, and this has been said by multiple other folks from producers to the scientists, but there is a very fine balance between collecting data to demonstrate what works and what does not work. I mean both biophysical data on weather and fires and water use efficiency and financial data on how these interact with our producers and production systems or return on investment. There is a very fine balance there.

For us, as I said earlier, the flexibility of some programs like RCPP, which does again allow us to leverage public and private dollars against Farm Bill, has been extremely important for experimenting with new types of practices.

Senator MARSHALL. Can you tell us—describe a project that you are excited about that has really worked. What does that look like?

Dr. HERBERT. Yes. Our interaction—the Rice Stewardship Partnership is a great example where we have, I believe, close to $100 million in RCPP funds that are leveraged against other funds. We have worked with various industry partners and agribusiness to develop new technologies, like poly pipe, that reduce water use and increase efficiency. It is a really exciting partnership because it is bringing together data on things like water efficiency and water quality, and bringing those together with data on production and the sustenance of waterfowl across multiple flyways.

I think that really exciting partnership was born out of the flexibility of the RCPP program and our ability to get almost 20 staff out in the field to talk to producers. That is, to me, the most exciting thing about some of these programs is it starts with a landowner.

Senator MARSHALL. Thank you.

Senator BENNET. Thank you. Thank you, Senator Marshall.

I just have a couple quick questions, one for you, Dr. Herbert. First, I completely agree with everything you said about RCPP. I think that is an example of program flexibility. It is outcomes-based, and it is partnership-driven. Given the data that, you know, we all now can collect since this is not the 19th century anymore, and being able to measure to those kinds of outcomes is really important. It creates a real opportunity for us to move the Farm Bill forward in a way that would be useful to all of us.

I just wonder, before you leave, whether you—because Ducks Unlimited is so cherished on both sides of the aisle here—if you could talk a little bit about what the effect of this persistent drought is having on bird populations in the United States.

Dr. HERBERT. Thank you for that question, Senator, and I will start with the caveat that I am a water scientist, not a waterfowl scientist, but I have spent many years with my colleagues discussing these issues.

Unfortunately, this current drought has come at a confluence with the COVID pandemic, and that has really limited our ability to collect data on water and waterfowl and other migratory birds.

If we look back to other persistent droughts, such as the 2011, 2015 drought, we saw a drop in the Central Valley of California, about half of the breeding population in that flyway. As I mentioned before, we are looking at the Klamath Basin, which once provided 25,000 acres of wetland. As of last fall there were 600 acres of wetland, and that has contributed to a botulism outbreak that has killed 50,000 birds. You are concentrating them, and the water exchange just is not there.

Then we know we are just now—at least in the eastern part of the Northern Great Plains, the Prairie Pothole Region, the duck factory, we are coming out of a two-year drought. I was just in the prairies, and things look much better than they did two years ago.

We know that at least in North Dakota populations declined 25 percent just over that two-year drought cycle.

The implications are profound for not just waterfowl but migratory birds that depend on these resources. I believe the Fish and Wildlife Service statistic is that 40 percent of all wildlife depend on wetlands for some portion of their life cycle. These droughts do have a pretty profound impact on not just waterfowl but many, many species of wildlife that are economically and culturally important to us.

Senator BENNET. Thank you, Dr. Herbert.

Dr. Schultz, I am going to ask my last question of you. Going to the question of accountability and priorities that Senator Marshall raised, what would you like to see out of the money that is in the Infrastructure Bill that is going to forestry? I think of that as a good down payment. I mean, we have a much greater need than that, but, still. How would you like to see that money spent so that we are doing it well, and could you sort of reinforce what you think the unmet need is in terms of forestry in the West?

Dr. SCHULTZ. Thank you for that question, Senator Bennet. I certainly think that the estimates from the Forest Service and from partners, like I mentioned, were 40 to 60 billion over the next 10 years to really make a dent in reducing risk to communities and also protecting watersheds, and so I think there is a huge still unmet need to address that in investments in our forest.

Then there is going to be a long-term need to really maintain our forests. You know, once we invest in reducing those fuels, we then have to maintain those conditions to get our return on investment, and that is going to need—that is going to mean, you know, putting prescribed fire on those lands to keep fuel loads lower. It is going to mean ongoing thinning and work in those areas near communities and watersheds. I think that that is something that we need to think as a nation as a long-term investment in our fire-adapted forests if we really want to maintain them for water supply and for carbon storage.

When we are thinking about where to invest, I think that the ten-year strategy that the Forest Service has issued makes a lot of sense in terms of investing near communities and in priority watersheds in our dry, fire-prone forests. That is where we really want to focus investments.

There are a few other things that can guide those investments over the next few years. We know that regions and States, in their State forest action planning processes, have identified a lot of priorities. A lot of that was done under this banner of shared stewardship over the last several years. Looking to States and local people to say, where are your true priorities and where do you have community-based capacity to implement them, that is going to be really important.

Thinking about—you know, I think we want to think about this in two ways. One, where do we want to invest in terms of the forest and the ecology bill? Where do we want to invest in really changing our fire culture and really creating communities that are fire-adapted, and so where do we want to invest in the people and places that are ready to do that?

The work takes a lot of capacity from community-based partners, so we want to start where we have collaborative history and partnerships in place. Things like June 13, 2022 CFLRP and the Joint Chiefs program have been working well.

Then I think we want to have more long-term vision of how do we invest in communities and places to build longer-term capacity, maybe places that have not quite built that collaborative capacity and had investments in the past. We do not want to just keep investing in the same places where they have got it going on, but we want to also build that in other places where we have more underserved communities. I think, you know, thinking long-term about how we build that capacity to do forestry work, to do prescribed fire, and to do cultural burning, to support tribes in doing cultural burning and in partnership with tribes is going to be really critical in the long run if we are going to maintain those forest ecosystems in the West.

Senator BENNET. Thank you for that.

Thank you to the panel. I think this has been an excellent panel.

I appreciate what you said Senator Marshall, about why you came to the Senate. This is the point of it. It is supposed to get people that have different points of view, different geographies, different perspectives, and get them in a room and try to hash out solutions.

These kinds of partnerships that Dr. Schultz was talking about, I mean, are what we need because fire does not know any political jurisdiction at all. It can cross from county land to private land to State land to Federal land. They are not making any more water.

Nobody is going to be able to solve these problems alone. The producers in this country cannot solve it by themselves. The Federal Government certainly cannot solve it by itself. I hope that today is the start of being able to help align some of these goals and objectives and partnerships.

I certainly look forward to the work we are going to be doing in the next Farm Bill to address what the landscape looks like in the 21st century and what our producers and others need.

Thank you, thank you, thank you for being here today. I am really grateful.

Thank you, Senator Marshall, for being such a tremendous Ranking Member, and I want to also thank your staff who did great work with my staff as well.

To the other Senators who were here, thanks for showing up. We would ask that any additional statements or questions you may have for the record be submitted to the committee clerk five business days from today or 5 p.m. next Tuesday, June 14th, 2022.

The hearing is adjourned.

[Whereupon, at 11:38 a.m., the Subcommittee was adjourned.]

APPENDIX

JUNE 7, 2022

Statement of Andrew Mueller, General Manager
Colorado River Water Conservation District
Glenwood Springs, Colorado

The Western Water Crisis:
Confronting Persistent Drought and Building Resilience on our Forests and Farmland

Hearing of Subcommittee on
Conservation, Climate, Forestry, and Natural Resources
United States Senate

June 7, 2022

Chairman Bennet, Ranking Member Marshall, members of the subcommittee, thank you for the opportunity to speak with you today about these important issues.

My name is Andrew Mueller and I'm the General Manager of the Colorado River Water Conservation District. For over 80 years, the Colorado River District has worked to protect the water interests of Western Colorado and keep water flowing west. We manage, conserve, develop and protect the West Slope's water on behalf of the State of Colorado and the citizens of our 15 counties that form the headwaters of the Colorado River and its principal tributaries. We are also responsible for the conservation, use and development of the water resources of the Colorado River Basin to which the State of Colorado is entitled under the 1922 and 1948 Colorado River compacts.

The precipitation in our district alone provides 65% of the Colorado River's natural flows, a river system that supports over 40 million people, 5 million acres of agricultural land, 2 countries, 30 sovereign Tribal Nations, 7 states and 11 national parks. We are the first link in an immense chain, vital to the health and future of the single most important natural resource in the American Southwest. It all starts in our headwaters state.

I. Identifying the Single Biggest Threat to Water Security in the American Southwest

Climate Change & Aridification:

The Colorado River is aptly referred to as the hardest working river in America. Even in wet years, the river no longer reaches its natural mouth at the Sea of Cortez and claims to water exceed the average annual flow. The massive system of federal reservoirs on the Colorado River was designed to accommodate the known natural variability in the Colorado River System and worked extremely well for at least half of a century. However, after the longest and most severe drought on record, that once highly functioning federal system is dangerously depleted with only 34% of system

storage remaining.[1] Over the last 22 years, the flows of the Colorado River have been 20% below average and sound science tells us we should anticipate and plan for further significant reductions in flow. To say that all thriving urban and rural communities and the natural ecosystem of the river face a gravely uncertain future is not hyperbole. While we may hope for a cooler wetter future, those of us responsible for our region and nation's water security must pay attention to credible science and plan for the worst. Our nation's leaders must understand what is happening and what lies at the root of this accelerating crisis.

Climate, commonly defined today as the average weather over a thirty-year period[2], has always been variable in the American Southwest. We have experienced long dry periods interspersed with generally shorter wet and cooler periods. The climate we have experienced in the last twenty years, however, has been hotter and drier than any period in the last 1200 years[3]. It is indisputable that the climate of the American Southwest has changed dramatically since the start of this millennium. Climate is generally a combination of meteorological variables, importantly including but not limited to temperature and precipitation. Like many meteorological variables, temperature and precipitation are related to one another. In many regions, higher temperatures enable the atmosphere to hold more moisture and therefore result in greater, more severe precipitation events. We see these extreme weather events in many parts of the United States today. In the desert southwest, however, higher temperatures have generally led directly to the aridification or massive drying of the earth's surface. Hotter temperatures over last 22 years have literally sucked the moisture right out of our snowpack, soil and vegetation.

Important for today's hearing is our growing understanding of the relationship between rising temperatures and the volume of water flowing in the Colorado River and its tributaries. Colorado's Western Slope, and the entire Colorado River Basin continue to suffer from the effects of multi-decadal drought and increasing temperatures. The West Slope, the most significant regional source of water in the Colorado River, is an epicenter for a significantly above-average rise in temperature. Colorado counties from Ouray to Mesa to Moffat have experienced a more than 4-degree Fahrenheit rise in average annual temperatures since 1895.[4] The impact of these hotter, drier temperatures on water supplies are real and meaningful. For every 1-degree Fahrenheit rise in average temperature, we see streamflow reductions between 3% and 9%, with most recent studies, including the most recent and in-depth study by the scientists with the United States

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[1] U.S. Bureau of Reclamation, 1st consultation webinar for AOP, 6/1/22; https://www.usbr.gov/ColoradoRiverBasin/#AOPColoradoRiverReservoirs

[2] Glossary of Meteorology. American Meteorological Society. Retrieved 2008-05-14

[3] A, P. W., Cook, B. I., & Smerdon, J. E. (2022). Rapid intensification of the emerging southwestern North American megadrought in 2020–2021. Nature Climate Change, 12(3), 232–234. https://doi.org/10.1038/s41558-022-01290-z

[4] National Oceanic and Atmospheric Administration's Climate Divisional Database (nClimDiv), monthly temperature data at the national, state and county levels between 1895 and 2019 for the Lower 48 states.

Geological Survey strongly supporting the 9% end of the spectrum.[5] The credible scientific consensus is that we should expect temperatures to continue to rise and therefore natural stream flows and water supply to continue to decrease.

Throughout the headwaters of the Colorado River we have experienced year after year of hot and windy Springs and early Summers that cause our snowpack (which in the American west is our single largest reservoir) to sublimate, or turn directly from its solid state to a gas leading it to disappear into the atmosphere instead of melting and flowing into our rivers. Soil aridification significantly compounds streamflow issues. As temperatures rise, moisture evaporates from our plants and soils, creating a massive water debt due when snows melt, drawing water away from rivers and streams. Never has this issue been clearer than in 2021, when our headwaters snowpack averaged at 89% while inflows to Lake Powell reached only 32%.[6]

Fires in this new arid environment burn hotter and faster and behave in wildly explosive ways. In 2020, Colorado experienced the three largest wildfires in recorded history — all in the same season. Watersheds and water infrastructure on both sides of the Continental Divide were seriously impacted by wildfire, resulting in hundreds of millions of dollars in restoration and mitigation expenses in the Centennial State alone. My own hometown of Glenwood Springs, a town of less than 10,000 residents, experienced this first-hand with the significant destruction of our city's watershed in the Grizzly Fire leading to the emergency expenditure of tens of millions of dollars. These continued drought conditions have renewed regional fears of another catastrophic wildfire season that could further damage critical watersheds and negatively impact agricultural and municipal water supplies.

Family Farms & Ranches in Crisis:

None have felt these climate impacts more than the family-owned farms and ranches of our Colorado River District and Colorado's Western Slope. The food and fiber produced from our region sustains communities across the state and the nation, but drought-based water scarcity has forced many local producers to downsize or completely shut down their operations.

Cattle sell-offs, or "de-herding," has become commonplace across the agricultural communities in our 15 counties. Not only does this practice impact local economies and our national food supply, but it also holds great emotional weight and repercussions for these families and their neighbors. Families that have been involved in and committed to ranching for four and five generations are being forced to sell their cattle herds and confront a tremendously uncertain future.

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[5] Changing climate drives future streamflow declines and challenges in meeting water demand across the southwestern United States (Olivia L.Miller; et al, Journal of Hydrology, vol. 11, May, 2021); Colorado River flow dwindles as warming-driven loss of reflective snow energizes evaporation (P. C. D. Milly, K. A. Dunne, Science 2020)

[6] Calculations from NOAA and the Colorado Basin River Forecast Center with data from https://www.cbrfc.noaa.gov/lmap/lmap.php

While our agricultural producers regularly experience natural fluctuations in the hydrology each year, these River District constituents, regardless of political affiliation, recognize this recent period as the hottest and driest in collective memory. The latest scientific data establishes that this era is the driest in over 1,200 years[7] and they are looking to our regional and national officials for leadership in this uncertain time. Our present and most likely future reality is hotter and drier with declining water supply. This reality presents a risk to all of our communities in the American Southwest and threatens our nation's water and food security. Confronting and developing adaptation and mitigation strategies is the only way to secure our collective water and food security.

II. Adaptation and Mitigation Strategies Must be Developed, Funded and Implemented.

Our country has a long and admirable history of innovation and adaptation to climate. Tremendous engineering feats driven by individual ingenuity and funded by local state and federal governments has allowed cities and farms to thrive in a hostile and arid environment in the American Southwest. While this quickly changing climate can lead to despair and hopelessness, we cannot simply throw up our hands and surrender our thriving American Southwest to the forces of climate change. Citizens, communities and governments throughout the Southwest are developing adaptation strategies, but as in the past, when our nation has been confronted by existential threats, we need our national government to be an integral partner in our effort to adapt and thrive in this new reality. There are many examples of successful adaptation strategies and many opportunities for the federal government to work hand and hand with our local and regional efforts. And we must recognize that there is no single answer which will allow us to escape this rapidly changing climate, it must be a multi-faceted effort. I will discuss a few concrete examples within our District as well as address a few larger regional efforts which are worthy of your consideration.

<u>The Use of High Mountain Reservoirs for Climate Mitigation</u>:

Hotter temperatures and the long-running drought have reduced runoff across Colorado's Western Slope, creating unprecedented conditions in our river basins. In 2018, the Colorado Division of Water Resources placed the mainstem of the Yampa River – one of the major Colorado River tributaries – under active administration for the first time in history, shutting down water diversions for local agricultural producers. In a river that historically enjoyed plentiful natural flows, there simply was not enough water to meet all the historical demands. Unfortunately, 2018 was not an anomaly. The Yampa system experienced administrative curtailment in both 2020 and 2021, and we are anticipating the same again in 2022.

Unprecedented drought has also led to unprecedented innovation and collaboration. Last year, the Colorado River District, working cooperatively with the State of Colorado and other partners, helped keep the call off the river to aid downstream farmers and ranchers with releases from Elkhead Reservoir. Managed by the Colorado River District, Elkhead Reservoir provides multi-

[7] A, P. W., Cook, B. I., & Smerdon, J. E. (2022). Rapid intensification of the emerging southwestern North American megadrought in 2020–2021. Nature Climate Change, 12(3), 232–234. https://doi.org/10.1038/s41558-022-01290-z

purpose water storage that enhances river flows, provides water for electric power production, supports agriculture and livestock production, and provides significant water to protect the four endangered fish in the Upper Colorado River system.

It is widely acknowledged that the era of building enormous reservoirs such as Powell and Mead is over. It is, however, an era in which strategically placed small reservoirs in hour high mountain valleys will allow us to successfully mitigate climate change through the retiming of flows which will provide essential water for our streams, our communities and our food supply. Federal assistance, through funding tools like PL 566 will be essential to our effort to adapt and retime water.

Implemented & Ongoing Local Solutions:

Improving the efficiency and enhancing the conservation of water through infrastructure investment is critical to the future viability of the American Southwest. The Lower Gunnison Project is an excellent example of a successful local effort funded, in part with federal dollars. The project recently celebrated the completion of its first phase, working in partnership with the agricultural community to modernize conveyance systems and upgrade to high efficiency irrigation systems. The Project secured $8 million in funding from the NRCS under RCPP and additionally leveraged over $10 million in funding. Accomplishments included piping nine miles of irrigation canals and installing a regulating reservoir and measurement sensors that collect and record data. The estimated benefits generated by this series of projects are expected to last for decades and is equivalent to $1.3 million per year.[8] This includes salt load reductions, operations and maintenance savings, producer benefits and reduced travel costs. The project is also directly linked to the successful restoration of the water quality in the Lower Gunnison River, an essential water supply for cities, farms and endangered fish. We applaud Senator Bennet's efforts to champion the RCPP Program, paving the way for success in the Lower Gunnison of Colorado.

Building Resiliency Through Natural Infrastructure:

The greatest reservoir for the Colorado River and our water users on the West Slope is our high-mountain snowpack in our forest headwaters. The natural water infrastructure our mountain forests provide allow for slow-timed releases and filtration for the rivers and streams sourced for community drinking water, irrigation and essential habitat for fish and wildlife. Protecting, restoring and properly managing these forest ecosystems can generate incredible public benefits, enhance resilience to climate change and improve water supply.

Emerging science also demonstrates that protecting and restoring natural water infrastructure can help mitigate the impacts of wildfire and drought on water supplies.[9] The 2023 Farm Bill presents

[8] Lower Gunnison Project Final Summary Report - https://www.coloradoriverdistrict.org/wp-content/uploads/2021/11/2021-11-12-rcpp-summary-report-v2-1.pdf
[9] Smokey the Beaver: Beaver dammed riparian corridors stay green during wildfire through the western United States. Fairfax and Whittle, 2020 (https://emilyfairfaxscience.com/research/firebeavers/)

multiple opportunities to encourage public investment in forested natural water infrastructure, enhancing the climate resilience of water supplies, supporting workforce development and increasing the pace and scale of watershed restoration.

Keeping Productive Agriculture Viable:

The multi-decadal drought and conclusive climate science clearly demonstrate that our demands greatly outstrip the water supply in the Colorado River Basin. To survive and continue to thrive in the Southwest, we will need to implement an all-hands-on deck approach. Every water use sector from agriculture and industry to municipal water users will have to meaningfully reduce their consumption of water.

The majority of water consumed in the Colorado River Basin is consumed in the production of food and fiber for our nation. Agriculture in the Colorado River Basin is important to our local, regional and national food supply, and is essential to this nation's food security. We must devise, implement and fund programs aimed at keeping productive agriculture viable while reducing the overall consumptive use of water. Conservation and efficiency programs like RCPP incentivize the transition to lower water demand crops and programmatic soil health efforts – all pieces of a successful effort. Yet even with these endeavors, we will unfortunately still need to intelligently incentivize the reduction of irrigated acreage in the Basin.

Our agricultural producers in the Colorado River Basin are and always have been innovative individuals, and we should look to them for ways to model incentives and programs. When faced with a dry year and low water supply, our farmers and ranchers in Colorado and elsewhere in the Upper Colorado River Basin routinely chose to reduce or remove irrigation from their least productive lands in order to sustain their most productive acreage. If Congress is going to incentivize the reduction in irrigated acreage in the Colorado River Basin, any such program must focus on supporting our most productive agricultural land while focusing the incentives on hobby farms (i.e. 35 acre and smaller tracts irrigated primarily for aesthetic purposes) and marginally productive lands. The federal government should not fund the retirement of productive agricultural lands.

Incentivizing hobby farm and marginal land fallowing for longer periods of time will allow for the long-term success of productive agriculture in the Colorado River Basin, as it provides an incentive to focus scarcer water resources on land that produces more consistently profitable crops. Confronting the system imbalance in the Colorado River Basin will require bold and transformational choices, and we support the frank discussion of these policy goals and ideas. Confronting the crisis on the Colorado River will require strong federal leadership and action.

Coordinated Federal Funding Efforts:

Thank you, Senators, for the passage of the Infrastructure Investment and Jobs Act and your support for Western Water infrastructure. With the infusion of federal infrastructure dollars, there

is no better time to ensure that our federal systems and programs work efficiency together. As an example, we encourage the swift adoption of a Memorandum of Understanding between the NRCS and the USBR to streamline the NEPA compliance process and eliminate duplicative costs, time delays and inefficiencies. We also support greater collaboration and a reduced reliance on autonomous business centers at the federal level that often act as silos and create barriers for local community collaboration and support.

Additionally, our water users are experiencing significant inflation pressure and supply chain backlogs, resulting in delayed projects and increased costs. These barriers delay projects that modernize our irrigation systems, build resiliency across our landscapes and ensure that our farmers and ranchers can support their livelihoods. This has been particularly visible in the EQIP NRCS funding program. We support reestablishing the index payment rate (IPR) and other cost overrun programs to ensure projects move forward with construction. We also support phased contracting to allow for design and construction to operate on the most current payment rate schedule. Addressing these project barriers will result in more water conservation projects moving from idea to action.

Conclusion:

We've only seen the beginning of the climate crisis in the American West. We cannot afford to remain idle as rivers and reservoirs dry and families shutter their businesses. In our District on Colorado's Western Slope, our water users – particularly our farmers and ranchers – have done more with less for a long while. Bound by our hydrology and expectations downstream, drought and shortages have become familiar companions, regardless of conditions at Lakes Powell and Mead.

But wishing for snow and rain is no longer an adequate game plan at any level of decision-making. If our communities are going to survive in Colorado and downstream, decisive action at the federal level is needed to help us adapt to a hotter, drier future.

We cannot adequately protect our water supply if we're constantly playing defense against depleted snowpack, increasing temperatures, megafires in our forest headwaters and the aridification of our productive agricultural lands.

We must act now to ensure the health and security of our multi-generational farmers and ranchers, our thriving cities, our recreational economies, our native fish and wildlife and our precious landscapes that form the headwaters of the greater Colorado River Basin.

I encourage your support of western water users and, most importantly, the communities and landscapes that bring life to the rest of the American Southwest.

Written Testimony
Earl Lewis, Chief Engineer
Kansas Department of Agriculture, Division of Water Resources
On behalf of the
WESTERN STATES WATER COUNCIL

Submitted to the
Senate Agriculture Committee
Subcommittee on Conservation, Climate, Forestry and Natural Resources

June 7, 2022

Chairman Bennet and Ranking Member Marshall, thank you for the opportunity to appear today to discuss The Western Water Crisis: Confronting Persistent Drought and Building Resilience on our Forests and Farmland. My name is Earl Lewis. I serve as the Chief Engineer of the Kansas Department of Agriculture's Division of Water Resources and as a member of the Western States Water Council.

The Western States Water Council (WSWC) appreciates the opportunity to submit testimony. The Council is a government entity, an instrumentality of each and every one of the 18 participating States. Member state representatives are appointed by and serve at the pleasure of their respective governors, advising them on a wide range of water policy issues and initiatives. The WSWC charge is to ensure that the West has an adequate, secure and sustainable supply of water of suitable quality to meet its diverse economic and environmental needs now and in the future. These are difficult times for water in the West and an unprecedented time for agriculture.

All levels of government must prioritize the collection, analysis and open sharing of reliable data regarding water availability, quality, and usage given its importance to research for sound science and data driven decision making. We encourage the Subcommittee to consider the U.S. Department of Agriculture's (USDA) role and the resources needed for USDA to participate in and benefit from building a national water data network, as well as partnerships to advance the use of water information to serve the needs of agriculture.

Water is the lifeblood of the West. This is most apparent in the agricultural sector, which consumes the predominant share of the freshwater resources throughout western states. Agriculture sustains many rural economies, provides important employment opportunities, and is a vital national industry. Federal funding is critically important for many agricultural communities, and USDA plays a crucial role in implementing programs that deliver assistance. USDA programs help to provide water and wastewater infrastructure, technical assistance, financial assistance, and conservation measures that ensure water is available to allow the agricultural industry to survive, if not thrive.

Periodic drought and competing demands for scarce water resources threaten the sustainability of the agricultural economy, highlighting the need to promote efficient water use that achieves net water savings while still maximizing production. In some cases, there is a need for assistance to transition from irrigated to dryland farming. The USDA's Conservation Title

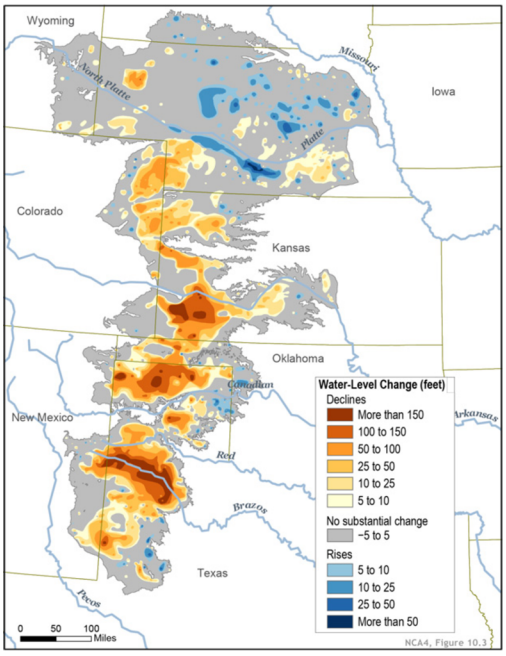
Programs provide solutions for water supply reliability through efforts such as conservation practices and groundwater recharge to preserve long-term ground and surface water resources. The WSWC supports collaborative, targeted, and voluntary conservation actions to address water resource concerns on private and public lands, and urges Congress and the Administration to provide sufficient funding for these programs.[1] (See attached WSWC Position #455.)

Much of the West is arid and water availability is an ever-present constraint defining our economic and environmental wellbeing and quality of life. The Council recognizes the increasing demands on often scarce water resources. The current historic drought threatens the West and its agricultural base, as well as the communities built on that base. (For some brief examples of recent state efforts to grapple with drought in 2022, see Appendix A.)

[1] WSWC Position #455, USDA Conservation Programs and Water Resources (10-15-2020) attached.

"Since 2000, historically dry conditions have added stress to the Colorado River's already over-allocated water resources. The Colorado River provides water to almost 40 million people in two countries, seven states, 29 federally recognized Indian tribes, and 4 million acres of farmland. According to a University of Arizona study, the Colorado River supports $1.4 trillion in annual economic activity – equivalent to 1/12th of total U.S. gross domestic product – and 16 million jobs in Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming. The drought has impacted regional water supplies and other resources, such as hydropower, recreation, and ecological goods and services."[2]

In the Great Plains, the Ogallala Aquifer underlies about 112 million acres, or 175,000 square miles, in parts of eight states, including: Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas and Wyoming. It is the principal water source for agriculture, public water supply, industry, and the environment. USDA indicates that 30 percent of all groundwater pumped in the United States is pumped from the Ogallala Aquifer. The Aquifer serves as an extensive underground reservoir providing water to grow cash crops making up the difference between crop needs and precipitation.

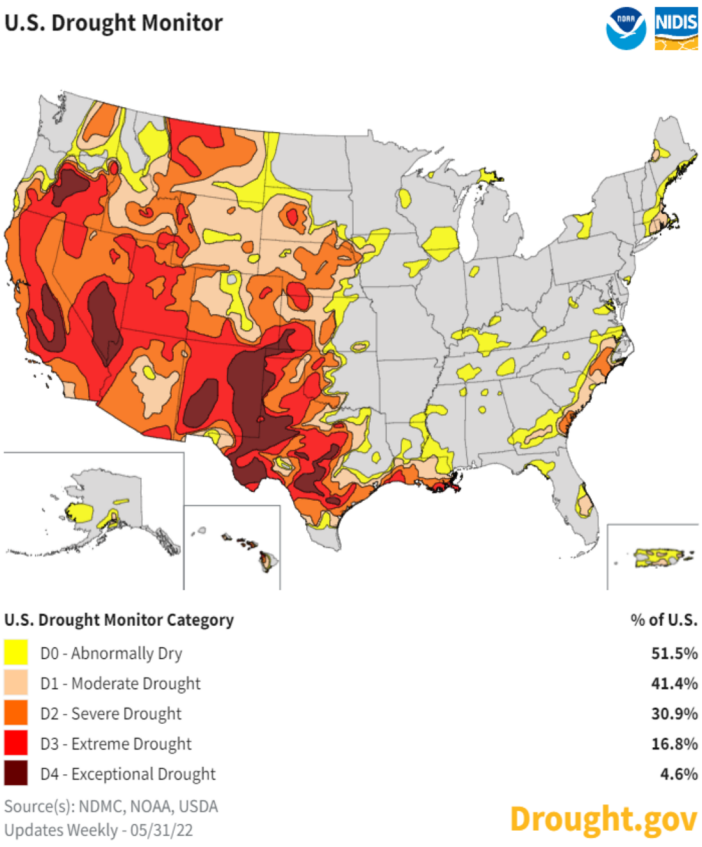


Drought by its very nature reduces precipitation requiring producers to pump more water for irrigation to ensure a reliable food and fiber supply. The correlation is clear that as we have more and longer droughts, the amount of water pumped from the Ogallala Aquifer increases as do the related water level declines. The Ogallala is not an inexhaustible supply as many of the early users believed that it would be. The USGS map on this page shows the levels of decline across the aquifer from predevelopment (roughly the 1940s) through 2015. There are many localized areas where the aquifer is effectively dewatered to the point that it is no longer useful for agriculture. Without additional action at all levels of government and by individuals, we will see this critical resource eliminated.

[2] www.drought.gov/watersheds/colorado

National Integrated Drought Information System (NIDIS)

NIDIS is a multi-agency partnership that coordinates drought monitoring, forecasting, planning, and information at national, state, and local levels across the country. The U.S. Drought Monitor (USDM) is a multi-agency product updated each Thursday to show the location and intensity of drought across the country. Drought categories show experts' assessments of conditions related to dryness and drought including observations of how much water is available in streams, lakes, and soils compared to usual for the same time of year.



Over half the country is abnormally dry, with nearly a third suffering from severe, to extreme, to exceptional drought – according to the U.S. Drought Monitor (see figure below). Given its coarse resolution, the Drought Monitor is an important but imperfect tool, particularly for assessing eligibility for USDA farm and livestock assistance programs.

Improvements to the Drought Monitor to make it a more accurate and effective tool for both members of the agriculture community and policy makers, was part of the NIDIS reauthorization, championed by Senator John Thune (R-SD) in 2018. The legislation also included development of a strategy for a national coordinated soil moisture monitoring network. Drought and its impacts vary from region to region, and NIDIS also involves the development and implementation of regional drought early warning systems (DEWS) that allow for responsiveness to particular geographic and hydrologic circumstances. NIDIS will again need to be reauthorized in Fiscal Year 2023.

The WSWC supports NIDIS and other federal programs and actions designed to improve our drought forecasting and response capabilities.[3] NIDIS is directed by an Executive Council that is co-chaired by USDA, NOAA and the WSWC.

Senator Thune said, in 2018, "Congress must do everything it can to update and modernize drought tools like NIDIS, which our farmers and ranchers depend on to stay up-to-date and fully informed on drought conditions in their area."[4]

Sub-Seasonal to Seasonal Precipitation Forecasting

The 2018 NIDIS reauthorization legislation also amended the Weather Research and Forecasting Innovation Act of 2017 to among other things authorize NOAA to create one or more pilot programs for assessing new or innovative information and technology capabilities and services (132 STAT. 54578). Subsequently, a 2020 NOAA report to the Congress recommended four pilot projects focused on improving sub-seasonal to seasonal (S2S) precipitation forecasting, that is, beyond present 5–15 day weather forecasts to extend out several weeks or months, even one or two years. (https://repository.library.noaa.gov/view/noaa/27408)

The purpose of the pilot projects is to improve S2S precipitation forecasting. As the report noted, NOAA pilot projects were necessary "...based on the existence of major climate phenomena that have huge economic impacts and for which current S2S predictive skill is too low to be effectively used by many stakeholders." Persistent drought conditions across the West highlight the need for better forecasting tools to allow federal, state and local water agencies, soil and water conservation districts, irrigation districts, farmers and ranchers to better prepare for and respond to drought. Forecasts at S2S time scales are needed to support farming decisions, such as seed and fertilizer purchases, field preparation and planting, and equipment investments, as well as water shortage contingency planning, reservoir management, water project operations, etc.

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[3] WSWC Position #474, Drought Preparedness, Prediction and Early Warning Programs (9-16-2021) attached.
[4] https://www.thune.senate.gov/public/index.cfm/press-releases?ID=DE2EA7DC-37F8-4B0A-81D4-9545AA82A84A

NOAA's Climate Prediction Center has been issuing S2S precipitation outlooks since the mid-1990s. Their skill for the western U.S. has been minimal, just slightly better than predicting average weather conditions, and has shown little improvement over time. Forecasting precipitation at S2S timescales is scientifically challenging and has historically received little federal research support. The WSWC has actively supported a $15 million programmatic increase in the U.S. Weather Research Program line item within NOAA's Office of Oceanic and Atmospheric Research appropriations account for S2S pilot projects toward improving our understanding of the science and opportunities to improve the skill of S2S outlooks.[5]

Snow Survey and Water Supply Forecasting

In the West, water is a critical, vital resource and sound decision-making demands accurate and timely data on evapotranspiration, soil moisture, groundwater, precipitation, rain, snow, snow depth, snow water content, streamflow, water quality and similar information.[6]

USDA's Snow Survey and Water Supply Forecasting Program is administered by the National Water and Climate Center (NWCC) in Portland, Oregon, and funded through USDA's Natural Resources Conservation Service (NRCS). Most of the annual streamflow in the western United States originates as snowfall that has accumulated in the mountains during the fall, winter and early spring seasons. As snowpack accumulates each year, NRCS hydrologists measure the snow and estimate the runoff that will occur when it melts. To predict this annual runoff, the NWCC manages and maintains a comprehensive network of manually-measured snow courses and automated Snow Telemetry (SNOTEL) monitoring sites throughout the West that collects and distributes timely, quality-controlled snowpack, water supply, and soil climate data to users westwide.

Funding for the program is critical, but has been flat at around $9 million annually for about 20 years, while equipment, travel and staffing costs have increased leading to challenges due to understaffing and delayed or inadequate system maintenance. An anticipated 50% increase in the President's draft FY2023 budget and related appropriations did not materialize.

Such an increase would allow for expansion of the SNOTEL network, including implementation of an Objective Network Design approach for optimizing placement of new stations and sensor suites within the existing network configuration. This would include improving the accuracy and precision of core observations (air temperature, precipitation, snow water equivalent, and snow depth).

More funding would allow for expanded measurement of new and secondary elements (net radiation, relative humidity, soil moisture, soil temperature, and wind speed). Other possible actions dependent on funding include deployment of gap filling and nested monitoring schemes in both horizontal and vertical space to capture core hydrologic gradients at multiple scales.

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[5] On June 21, 2021, the WSWC submitted to the Senate Appropriations Committee's Subcommittee on Commerce, Justice, Science, and Related Agencies written testimony regarding the National Oceanic and Atmospheric Administration's (NOAA)/National Weather Service's (NWS) U.S. Weather Research Program appropriations in support of improving subseasonal-to-seasonal precipitation forecasting.

[6] WSWC Position # 473, Federal Water and Climate Data Collection and Analysis Programs (9-16-2021) attached.

Increased funding would also help address monitoring solutions in high rugged alpine areas, as well as permitting challenges for stations in Designated Wilderness Study Areas.

Increased funding would accelerate data reliability efforts such as telemetry reliability upgrades (moving away from the use of Mmteorburst technology, which only NWCC uses). Other improvements that would be accelerated include data storage and data quality processes (in early stages of development), as well as mitigation of climate and watershed non-stationarities in forecasting processes (also in early stages).

Western Governors and the WSWC have historically supported the program and continue to be deeply interested in the long-term health and capability of the program's data, products, and services and its role in generating vital snowpack and water-related information. Data on present and future water supplies are critical, as are data on present and future uses, if we are to balance supplies and demands during drought.

Open Evapotranspiration Information

Water resources managers and agricultural interests across the western United States are reliant on evapotranspiration (ET) information for irrigation scheduling, managing water deliveries, water supply planning, water rights administration, and hydrologic modeling and prediction. Some state agencies and agricultural enterprises use simplified methods to estimate ET that rely on crop coefficients and outdated irrigated area maps to estimate consumptive use volumes, while others rely on manual processing of satellite data over limited areas, making processing and coverage for all irrigated lands difficult and costly, and based on available staff, expertise, and agency funding.

Satellite-based ET data may already exist for some regions, but it is often not readily usable for modeling or decision making at the watershed scale. Consistency is also important in ET approaches and products, including irrigated lands identification that spans across political boundaries and covers the entire western U.S. Rapid accessibility and usability of field- and watershed-scale ET summary data is lacking for efficient integration into water management processes.

Additionally, there is a need for ET data from a trusted source that can easily be integrated with water rights information to assess and compare consumptive use for irrigated lands. For example, many state water agencies want to assess if hydrographic basins are truly over appropriated with respect to actual consumptive water use based on ET, rather than simply comparing total water right appropriations to system yield estimates.

The WSWC has expressed our support for an OpenET proposal to leverage the work of a broad network of collaborators to develop and provide credible, transparent, automated, and easily accessible data on evapotranspiration (ET) and consumptive use (CU) using satellite-based sensors and cloud computing.[7] For many years, the Council has supported the use of satellite imagery to estimate ET and CU under actual field conditions over large areas, particularly the use of thermal infrared imaging data available from Landsat 7 and Landsat 8.

[7] Ibid.

OpenET addresses an urgent need for an operational system that can produce accurate consumptive use estimates that are available for automated data transfer to federal, state, and local water agencies that can also be used with irrigation management information systems.

Senator Cortez Masto has introduced S. 2568, the Open Access Evapotranspiration Data Act.

Agrimet

WSWC also supports the Bureau of Reclamation's Agrimet network of weather stations that provide data for irrigation scheduling. Agrimet also serves as an important and efficient means for ground-truthing, calibration, and model validation tool for analysis of information products derived from satellite platforms such as OpenET. Agrimet provides basic data on precipitation, temperature, solar radiance, wind speed and humidity required to calculate reference evapotranspiration (ET) and inform remote-sensing platforms. The Agrimet weather observing network suffers from the challenges of aging instrumentation infrastructure, deferred maintenance, need for technology upgrades, and funding that fails to keep up with these needs, making it difficult to maintain data continuity and coverage for users.[8]

Western States Water Data Exchange

A fundamental principle of the WSWC mission and vision is that all levels of government must prioritize the collection, analysis and open sharing of reliable data regarding water availability, quality, and usage given its importance to research for sound science and data-driven decision making. One of the West's and the nation's most pressing challenges is addressing gaps in data and information to enable us to more sustainably manage our water resource. To address this challenge, the WSWC aimed to formulate a strategy and to develop a framework for its member states to begin to share important water supply, water use, and water administration datasets with each other, with federal partners and with the public. For over a decade the WSWC has been working to create a Water Data Exchange.

Taking a principles-based approach, the Council has sought to articulate and put into action its vision for sharing water data. These principles include making transparency, openness, discoverability, and accessibility the default for public water data, while also ensuring the highest levels of security and privacy for stakeholders. Whenever possible, data is shared using developed standards and machine-readable formats – including thoroughly documented metadata – to promote interoperability, regional analyses, and user flexibility.

Since 2012, the WSWC has been laying the foundation for an effective program. This includes the mundane tasks of surveying and offering outreach to data providers, procuring additional resources for states who needed assistance, forming partnership to oversee the funds and other governance, development of the WaDE code and application, extensive assistance for implementation with state partners, and ongoing maintenance and updates. It's not glamorous work, but cumulatively it represents a tremendous step forward in not only the data-sharing and

[8] Written testimony submitted to the Senate Committee on Appropriations, Subcommittee on Energy and Water Development, and Related Agencies, regarding U.S. Bureau of Reclamation FY2022 Appropriations, June 24, 2021.

publishing practices within the states, but in the way we value the information we have concerning our resources. We are starting to think of water data beyond its limited and specific mission, and beginning to see the limitless value of high-quality data shared in a way that is easily discoverable and accessible. (https://westernstateswater.org/wade-updates)

Western States Water and Data Assessment and Analysis Tool

The WSWC is developing WestDAAT, a dashboard that will be an online operational decision support and planning tool supporting user-friendly design choices. While a prototype has been built, its final operational functions will be driven by outreach that will involve the development of use cases that represent a range of stakeholders and water managers or decision-makers that include governors, state water right administrators [state engineers], state water planners, river basin managers, farmers and ranchers, and local irrigation district and groundwater managers. States and stakeholders are helping identify applications or deriving insights for water management and planning scenarios (e.g., simulating water calls during shortages, promoting water marketing, shepherding conserved water downstream, tracking water use for planning purposes, and administering water rights under state law, interstate compacts, and international treaties). WestDAAT will help make western states' water data more FAIR (Findable, Accessible, Interoperable, and Reusable). At present, data for over 2.5 million water rights is accessible through WestDAAT.

Internet of Water Coalition

The Internet of Water (IOW) Coalition is a group of organizations working together with federal, state, and local government partners to build foundational water data infrastructure across the U.S. and create a community of people and organizations using water data to make better decisions. The Coalition is a multi-sector collaboration co-led by five non-profit organizations: Duke University's Nicholas Institute for Environmental Policy Solutions, the Lincoln Institute of Land Policy's Center for Geospatial Solutions (CGS), the Western States Water Council's Water Data Exchange (WaDE), the Consortium of Universities for the Advancement of Hydrologic Sciences, Inc. (CUAHSI), and the Water Data Collaborative (WDC).

Successfully modernizing our nation's water data infrastructure requires all of us: public agencies, utilities, NGOs, and private industry, working together toward this common goal. "Addressing that challenge, however, requires not just innovative new data discovery and access tools, but also a coordinated effort across the whole water data community to use common standards and share and exchange water data in common formats. We also need to stay close to the needs of water decision-makers and the wider community of water stakeholders to realize the vision of the Internet of Water: equitable and resilient water management outcomes," says Peter Colohan, the IOW Coalition Chair. The WSWC Executive Director is the vice-chair.

At present, IOW includes a network of organized water data hubs across the U.S. that increases the amount of data being shared by public agencies within and across jurisdictions in accessible and interoperable ways. The Environmental Protection Agency and U.S. Geological Survey (USGS) are IOW hubs. IOW public agency water data inventories include more than

500 water data platforms across nine states and the federal government. Public agencies hold large amounts of data. A data inventory is the first step in understanding data fragmentation and identifying areas for improvement.

IOW also hosts a Peer-to-Peer (P2P) Network of nearly 1000 individuals in 40 states. From membership in our P2P Network to collaborative project partners to membership on our listservs, the IOW seeks to grow our connections. Members of this community of practice share their successes, challenges, and lessons learned. It is a network of people committed to improved water data management.

A significant challenge in sharing water data is the myriad use of different terms and definitions used to describe the data. Coming to Terms is the IOW's Water Terminology Collection that tracks definitions, synonyms, and homonyms of water-related terms used by public agencies. There are 7,400 terms are in the collection, which continues to grow.

Geoconnex is a framework for data providers to allow their data to be easily found alongside relevant data from other organizations. Five organizations are now participating, providing geospatial information for four million data points, such as water diversions, USGS streamgages, EPA water quality monitoring sites, etc. Geoconnex provides persistent identifiers for real-world locations, allowing multiple data providers to publish their data tied to a specific location identified in the same manner across agencies.

Agricultural interests and organizations are welcome to join these efforts to expand and magnify the sharing and use of water data to improve decision making.

Federal Water Data Legislation

New Mexico Senators Martin Heinrich and Ben Ray Lujan, together with Representative Melanie Stansbury, have introduced legislation to establish a national water data framework. The WSWC welcomes the introduction of the Water Data Act and supports coordination and leveraging state and federal resources within a national framework consistent with IOW principles.

The Water Data Act will:

- Establish a national water data framework for sharing, integrating, and utilizing water data and supporting the development of innovative water data technologies and tools.
- Develop common standards for water data to unlock the power of existing and future data for use in countless tools and technologies to empower water users and managers.
- Organize and direct federal agencies that generate and use water data to work together.
- Support consultation, coordination, and partnerships with stakeholders by permanently authorizing the Advisory Committee on Water Information.
- Establish a new grant program under the Department of the Interior to invest in improving water data in partnership with state, local, and other organizations.

- Invest in next-generation water data technologies and tools to transform water management.

The Water Data Act would be a catalyst to organize and direct federal agencies that generate and use water data to work together, as well as support non-federal consultation and coordination. It would establishing a new grant program under the Department of the Interior to invest in improving water data in partnership with state, local, and other organizations, which an important step. Permanently authorizing the Advisory Committee on Water Information, of which the WSWC was a member, will also encourage the development of next-generation water data observations, technologies and tools to transform water management.

Critical and vital information is gathered and disseminated through a number of important federal programs under various agencies, including USDA agencies. Such information is used by federal, state, tribal, and local government agencies, private entities and individuals to forecast rainfall, snow, streamflow, flooding, drought and other climate-related events, as well as estimate future water supplies for agricultural, municipal, industrial uses, hydropower production, recreation, and environmental purposes. The WSWC has a long history of support for federal data-related observation, analysis, assessment and dissemination efforts. More needs to be done.

Again, we encourage the Subcommittee to consider USDA's role and the resources needed for USDA to participate in and benefit from building a national water data network, as well as partnerships to advance the use of water information to serve the needs of agriculture. Also, we want to emphasize the importance of maintaining and expanding the NRCS snow survey and water supply forecasting program.

Thank you for the opportunity to testify and I am happy to respond to any questions.

Position #455
Revised and Readopted
(*See also Position #413 adopted Oct 20, 2017*)

POSITION
of the
WESTERN STATES WATER COUNCIL
regarding
USDA CONSERVATION PROGRAMS
and
WATER RESOURCES

Fall No Host - Virtual Meeting
October 15, 2020

WHEREAS, water is the lifeblood of the West and this is most apparent in the agricultural sector, which accounts for the predominant share of consumptive water use westwide; and

WHEREAS, agriculture sustains many rural economies and provides important employment opportunities both directly and indirectly; and

WHEREAS, increasing demands on often scarce water resources and periodic drought threaten the West and its agricultural base and the communities built on that base; and

WHEREAS, many agricultural producers in the West rely on irrigation surface water delivery systems that are shared among multiple producers and operated by an irrigation district, canal company, mutual ditch company, or acequia while others rely on overdrafted and or overallocated groundwater basins; and

WHEREAS, maintaining a sustainable agricultural economy in the West requires promoting efficient water use and achieving net water savings, while maximizing production and in some cases assisting in the transition from irrigated to dryland farming; and

WHEREAS, U.S. Department of Agriculture (USDA) conservation programs focus on conservation of ground and surface water resources, as well as reductions in nonpoint source pollution, including nutrients, sediment, pesticides and salinity; and

WHEREAS, many agricultural producers in the West voluntarily participate in USDA programs to implement conservation practices that improve water use efficiency, water quality and wildlife habitat; and

WHEREAS, the Farm Service Agency (FSA), Rural Development (RD), Natural Resources Conservation Service (NRCS), and National Water and Climate Center (NWCC) administer many water-related programs; and

WHEREAS, multiple USDA farm financial assistance programs are particularly important to producers and rural communities, water users and water quality managers, including the Conservation Reserve Program (CRP), Conservation Reserve Enhancement Program (CREP),

Conservation Stewardship Program (CSP), Emergency Watershed Protection Program (EWPP), Environmental Quality Improvement Program (EQIP) and its Conservation Innovation Grants (CIG) and Colorado River Salinity Control Program (CRSCP), and Regional Conservation Partnership Program, and others such as watershed protection and planning programs; and

WHEREAS, special EQIP funding also covers a number of initiatives, including the Drought, Ogallala Aquifer, National Water Quality, Resiliency to Climate Change, and WaterSMART Initiatives; and

WHEREAS, the Western States Water Council (WSWC) supports USDA Conservation Program funding levels based on need rather than baseline budget targets; and

WHEREAS, the WSWC supports collaborative, targeted and voluntary conservation actions to address locally identified farm, range, forest and water resource concerns on private and public lands; and

WHEREAS, the WSWC supports actions to address secure water supplies, improved water quality, and drought and wildfire resilience, as well as wildlife habitat conservation and invasive species threats; and

WHEREAS, the WSWC supports the role of Conservation Title Programs in providing solutions to resolve water supply reliability, water quality impairments, groundwater recharge, and other water resource concerns facing agricultural water users and agricultural producers; and

WHEREAS, the WSWC supports the continued efforts of Rural Development to provide financial assistance for drinking water, wastewater facilities and other services to rural communities.

NOW, THEREFORE BE IT RESOLVED, that the Western States Water Council strongly supports USDA Conservation Programs, and urges the Administration and the Congress to provide sufficient funding to address water conservation, flood protection and water quality remediation needs.

BE IT FURTHER RESOLVED, that the WSWC supports regional cooperative agricultural programs such as EQIP Initiatives, the Colorado River Salinity Control Project, and the Regional Conservation Partnership Program.

BE IT FURTHER RESOLVED, that, the WSWC supports the work done by Rural Development to bring clean, safe drinking water and sanitation to rural communities.

BE IT FURTHER RESOLVED, that the WSWC supports investment in voluntary, incentive-based conservation programs, including when appropriate assisting in the transition from irrigated to dryland farming, that are implemented in coordination with state and local governmental partners, while providing the maximum flexibility possible and opportunity for innovation to create efficiencies, coordinate funding and achieve real water savings.

Position No. 474
Revised and Readopted
(*formerly Position No. 429, October 26, 2018, No. 386, October 9, 2015, and No. 346, October 12, 2012*)

POSITION
of the
WESTERN STATES WATER COUNCIL
regarding
DROUGHT PREPAREDNESS, PREDICTION AND EARLY WARNING PROGRAMS
Deadwood, South Dakota
September 16, 2021

WHEREAS, the Western States Water Council is a policy advisory body representing eighteen states, and has long been involved in western water conservation, development, protection, and management issues, and western states have a long history of promoting drought preparedness, planning and response programs, in cooperation with federal agencies; and

WHEREAS, in the West, water is often scarce even in "wet" years and drought is a recurring threat to our environment, economy and way of life – affecting not only the West, but also the Nation; and

WHEREAS, according to the National Centers for Environmental Information (NCEI), from 1980-2020, there have been 28 drought events costing over $1B/event with total economic losses of $258.9B due to drought, or an average of $9.2B/event, also leading to an average of 95 deaths/year, with drought contributing to another $102.3B in wildfire losses, and 10 deaths/year, and NCEI noting a rise in vulnerability to drought and wildfire in the western states[i], and

WHEREAS, continuing exceptional, extreme and severe drought conditions afflict the West and elsewhere, highlighting the need for greater attention to developing more comprehensive and coordinated drought prediction, preparedness, planning and response programs at all levels; and

WHEREAS, there is a need for maintaining and improving existing monitoring networks that help provide drought early warning signals, as well as for tracking the impacts of drought; and

WHEREAS, there is a continuing need for developing new monitoring technologies, such as remote sensing, that provide more timely data on water availability and better spatial coverage for assessing drought impacts; and

WHEREAS, early drought warning systems facilitate early drought assessment and mitigation efforts to minimize drought impacts; and

WHEREAS, there is a need for continuing federal research to develop new predictive capability for precipitation at subseasonal to seasonal time scales as described in the report to Congress prepared by NOAA pursuant to Title II of PL 115-25; and

WHEREAS, there is a continuing need for a permanent federal role in coordination of research programs related to drought early warning and prediction; and

WHEREAS, the collection and monitoring of basic data on streamflow, snow pack, groundwater levels, and weather and climate data are essential to understanding water availability and interpreting the early signs of drought.

NOW THEREFORE BE IT RESOLVED, that the Western States Water Council urges the Administration and the Congress to support federal programs including but not limited to the National Integrated Drought Information System (NIDIS), under the National Oceanic and Atmospheric Administration (NOAA), and other efforts designed to improve our forecasting and response capabilities.

[i] 2020 U.S. billion-dollar weather and climate disasters in historical context | NOAA Climate.gov

Position No. 473
(*See also No. 428, 385, 345, 320, 284, 256, and 235*)
Adopted as revised September 16, 2021

POSITION
of the
WESTERN STATES WATER COUNCIL
regarding
FEDERAL WATER AND CLIMATE DATA COLLECTION AND ANALYSIS PROGRAMS
Deadwood, South Dakota
September 16, 2021

WHEREAS, the Western States Water Council is a policy advisory body representing eighteen states, and has long been involved in western water conservation, development, protection, and management issues, and the member states and political subdivisions have long been partners in cooperative federal water and climate data collection and analysis programs; and

WHEREAS, in the West, water is a critical, vital resource and sound decision-making demands accurate and timely data on precipitation, temperature, evapotranspiration, soil moisture, snow depth, snow water content, streamflow, groundwater, water quality and similar information; and

WHEREAS, the demands for water and related climate data continue to increase, and this information is used by federal, state, tribal, and local government agencies, as well as private entities and individuals to: (1) forecast flooding, drought and other climate-related events; (2) project future water supplies for agricultural, municipal, and industrial uses; (3) estimate streamflows for hydropower production, recreation, and environmental purposes, such as for fish and wildlife management, including endangered species needs; and (4) facilitate water management and administration of water rights, decrees, and interstate compacts; and

WHEREAS, without timely and accurate information, human life, health, welfare, property, and environmental and natural resources are at considerably greater risk of loss; and

WHEREAS, critical and vital information is gathered and disseminated through a number of important federal programs including, but not limited to: (1) the Snow Survey and Water Supply Forecasting Program, administered by the National Water and Climate Center (NWCC) in Portland, Oregon, and funded through USDA's Natural Resources Conservation Service (NRCS); (2) NWCC's Soil and Climate Analysis Network (SCAN); (3) the U.S. Geological Survey's (USGS) Groundwater and Streamflow Information Program (GWSIP) and National Streamflow Network, which are funded through the Department of Interior; (4) Landsat thermal data, archived and distributed by the USGS, and other remotely-sensed data acquired through the National Atmospheric and Space Administration (NASA) and its water-related missions; (5) the National Oceanic and Atmospheric Administration's (NOAA) National Weather Service and Climate Programs Office; (6) the Environmental Protection Agency's National Environmental Information Exchange Network (NEIEN); and (7) the Bureau of Reclamation's Agrimet System and similar weather station networks; and

WHEREAS, state-of-the-art technology has been developed to provide real or near real-time data in formats that can be shared and used by different computer programs with the potential to

vastly improve the water-related information available to decisionmakers in natural resources and emergency management, and thus better protect the public safety, welfare and the environment; and

WHEREAS, these federal programs and newly proposed projects and programs provide useful products to assist in visualizing and interpreting data on water and snow, water use, evapotranspiration and other parameters making water supply, demand and availability information more accessible and easy to interpret; and

WHEREAS, over a number of years, the lack of capital investments in water data programs has led to the discontinuance, disrepair, or obsolescence of vital equipment needed to maintain existing water resources related data gathering activities; and

WHEREAS, there is a serious need for adequate and consistent federal funding to maintain, restore, modernize, and upgrade federal water, weather and climate observation programs, not only to avoid the loss or further erosion of critical information and data, but also to address new emerging needs, with a primary focus on coordinated data collection and dissemination; and

WHEREAS, wildfires, floods, and other natural disasters have led to the significant loss of monitoring capabilities and require timely action to restore, maintain, and upgrade sensors and observing systems and networks.

NOW THEREFORE BE IT RESOLVED, that the Western States Water Council urge the Administration and the Congress to give a high priority to the allocation and appropriation of sufficient funds for these critical, vital programs, which benefit so many, yet have been or are being allowed to erode to the point that it threatens the quantity and quality of basic data provided to a myriad, growing and diffuse number of decisionmakers and stakeholders, with significantly adverse consequences.

BE IT FURTHER RESOLVED, that the Western States Water Council supports efforts to enhance and expand the availability of and access to consistent and comprehensive water supply, demand and water use data and information, such as, but not limited to, the Open Access Evapotranspiration (OpenET) data program and related federal authorizing legislation and appropriations.

Appendix A

Several of our western states have been grappling with emergencies related to ongoing and worsening drought conditions in 2022. While this is by no means an exhaustive list, it provides a small sample of some of the challenges across the West, culled from recent articles in the WSWC weekly newsletter. (See https://westernstateswater.org/past-newsletters/)

- California Governor Gavin Newsom expanded drought measures in March, calling on urban water suppliers to meet the requirements of water shortage contingency plans, and calling on state water agencies to enforce laws against illegal water diversions and waste and to engage in activities that improve water supply sustainability.
- Idaho Governor Brad Little and the Idaho Department of Water Resources issued an emergency drought declaration in April, and a curtailment notification in May for water users with priority dates junior to 1979.
- Kansas has seen an average one-foot drop in aquifer levels in the past year as drought conditions continue.
- In New Mexico, Governor Michelle Lujan Grisham has issued emergency declarations for both extensive drought and wildfires.
- Oregon Governor Kate Brown declared drought emergencies across multiple counties in March and April due to low snowpack, low reservoir levels, and low streamflow, with forecasted water supply and precipitation not expected to improve.
- Utah Governor Spencer Cox declared a statewide drought emergency in April, noting the volatile water year, with late spring precipitation unable to make up for the winter snowpack shortages.
- Several states and federal agencies (particularly the Department of the Interior's Bureau of Reclamation) have worked together in an effort to manage water resources for agricultural and urban areas through the worsening drought conditions.

California

On March 28, Governor Gavin Newsom (D-CA) signed an Executive Order (N-7-22) expanding measures to address the ongoing drought emergency in California. It called on urban water suppliers to move Water Shortage Contingency Plans to Level 2, based on a projected shortage of up to 20%, and encourage voluntary activation of Level 3 requirements based on a shortage level up to 30%. The order directed the State Water Resources Control Board (SWRCB) to adopt emergency regulations defining "non-functional turf" and ban its irrigation in commercial, industrial, and institutional sectors. It directed the Department of Water Resources (DWR) to develop strategies to improve conservation, including technical and financial assistance.

The order directed SWRCB to "expand inspections to determine whether illegal diversions or wasteful or unreasonable use of water are occurring and bring enforcement actions…." Further, it suspended ordinances and regulations that prohibit hauling water outside a basin of origin to facilitate hauling water by truck for domestic use to communities with degraded water quality or supply due to drought. To increase the resilience of state water supplies, the order directed DWR to "prepare for the potential creation and implementation of a multi-year transfer program pilot project for the purpose of acquiring water from willing partners and storing and conveying water to areas of need."

To facilitate and protect the use of groundwater during drought, the order directed DWR to work with other agencies to expedite regulatory pathways to repair or reconstruct small community public supply wells. It prohibits local agencies from issuing new permits for groundwater wells – other than domestic wells less than two acre-feet per year – in basins "subject to the Sustainable Groundwater Management Act [SGMA] and classified as medium- or high-priority without first obtaining written verification from a Groundwater Sustainability Agency [GSA]" that the proposed well would not interfere with the local GSA's sustainability plan.

The order directed state agencies to "collaborate with tribes and federal, regional, and local agencies on actions related to promoting groundwater recharge and increasing storage." It directed SWRCB and the Regional Water Quality Control Boards to prioritize "water right permits, water quality certifications, waste discharge requirements, and conditional waivers of waste discharge requirements to accelerate approvals for projects that enhance the ability of a local or state agency to capture high precipitation events for local storage or recharge, consistent with water right priorities and protections for fish and wildlife." It suspends various statutes and regulations to address the need to recharge groundwater during the drought. See https://www.gov.ca.gov/wp-content/uploads/2022/ /03/March-2022-Drought-EO.pdf.

Idaho

On April 29, with approval from Idaho Governor Brad Little (R), the Idaho Department of Water Resources (IDWR) issued an emergency drought declaration for southern Idaho. The declaration allows temporary water right changes in the point of diversion, place of use, and purpose of use for valid, existing water rights, when it is determined that such changes can be accomplished without harming other existing water rights. The declaration may also help with the eligibility requirements for federal drought assistance.

IDWR Director Gary Spackman noted that all Idaho counties south of the Salmon River are classified as being in moderate to severe drought and are experiencing below-normal snowpack. The press release said: "Specifically, total cumulative snow water equivalent (SWE) levels in these basins as of April 1, 2022, ranged from 50 to 78 percent of median. The April-to-September streamflow forecasts for most locations south of the Salmon River are between 25 and 75 percent of median. As of April 1, 2022, storage in most reservoirs serving the southern half of Idaho were between 20 to 65 percent of capacity, increasing the chances that many reservoirs will not fill." https://idwr.idaho.gov/news-releases/

On May 6, the IDWR issued a methodology order, predicting a 162,600 acre-foot shortfall for senior priority surface water users on the Eastern Snake River Plain (ESPA) for the 2022 irrigation season. IDWR will begin curtailing more than 328 junior groundwater users with priority dates junior to 1979, unless they have joined one of seven approved mitigation plans or can otherwise demonstrate how their water use will not cause injury to senior surface water users. Past water litigation on the Snake River, between surface water and groundwater users, resulted in settlement agreements. The IDWR Director is required to issue an order at the beginning of the irrigation season and again in July to determine any shortfalls and curtailment obligations.

Mathew Weaver, IDWR Deputy Director, said: "By law, we have to keep people with senior water rights whole, and we want to make the junior ground water pumpers aware that despite the settlement agreements…if junior ground water pumpers are not participating in an approved mitigation plan, they could be subject to curtailment this year." https://idwr.idaho.gov/wp-

content/uploads/sites/2/news-release/IDWR-order-predicts-162600-acre-foot-water-shortfall-on-Snake-River-FINAL.pdf

Kansas

On March 24, the University of Kansas published preliminary data compiled by the Kansas Geological Survey (KGS) showing that average groundwater levels dropped by more than a foot in 2021. "The KGS, based at the University of Kansas, and the Division of Water Resources (DWR) of the Kansas Department of Agriculture measure about 1,400 wells every year to monitor the health of the High Plains aquifer and other aquifers in western and central Kansas. Those measurements showed an overall average decline of 1.01 feet last year. Most parts of the region saw below-average precipitation for the year, especially during the summer growing season for agricultural crops.... The 2021 decline followed an overall drop of 0.93 feet in 2020, which was another abnormally dry year. Dry years lead to increased pumping demands, primarily for irrigation, which in turn typically cause greater declines in water levels." Most of Kansas continues to experience drought conditions in 2022.The article noted that most of the wells monitored by KGS and DWR are located in Groundwater Management Districts.

New Mexico

On April 25, New Mexico Governor Michelle Lujan Grisham (D) declared a statewide emergency for severe drought and fire conditions. The executive order noted that 93% of New Mexico was experiencing severe to exceptional drought conditions, and that significant fire danger "has increased throughout the State due to warmer temperatures, lower humidity, high winds, and an abundance of dry, fine fuels." According to the National Interagency Fire Center, New Mexico is currently fighting six large fires across more than 235,000 acres. Governor Lujan Grisham has issued five other emergency declarations in April regarding the various fires. https://www.governor.state.nm.us/about-the-governor/executive-orders/

On May 4, Governor Lujan Grisham submitted a request for a Presidential Disaster Declaration through the Federal Emergency Management Agency (FEMA), as well as applied for a hazard mitigation assistance grant. In a press release she said: "The state has aggressively pursued a Presidential Disaster Declaration for New Mexico, using every available tool and technology to document the damage that we know New Mexico communities have sustained and are still experiencing in order to expedite the process. I am laser focused on getting New Mexicans the disaster relief they need and deserve, and I am confident that FEMA and the President will grant our request." https://www.governor.state.nm.us/press-releases/

Oregon

On March 4, Governor Kate Brown (D-OR) declared a severe, continuing drought emergency in Klamath County based on the low snowpack, low reservoir levels, low streamflow, and forecasted water supply conditions that are not expected to improve. "Drought is likely to have a significant economic impact on the farm, ranch, and natural resources sectors, as well as an impact on drinking water, fish and wildlife, important minimum flows for public instream uses and other natural resources dependent on adequate precipitation, stored water, and stream flow in these areas. Extreme conditions are expected to affect local growers, increase the potential for fire, shorten the growing season, and decrease water supplies." The Executive Order 22-02 directs state interagency coordination for mitigation efforts. See https://www.oregon.gov/gov/eo/eo_22-02.pdf.

On April 25, Governor Brown signed an executive order declaring drought across four counties with low snowpack, low reservoir levels, and low streamflow. "Forecasted water supply conditions and precipitation levels are not expected to improve. Drought is likely to have a significant economic impact on the farm, ranch, vineyard, recreation, tourism, and natural resources sectors, as well as an impact on drinking water, fish and wildlife, and important minimum flows for public instream uses and other natural resources dependent on adequate precipitation, stored water, and streamflow in these areas. Extreme conditions are expected to affect the local growers and livestock, increase the potential for fire, shorten the growing season, and decrease water supplies." The order directs agencies to coordinate and provide assistance to water users, to understand the impacts of water availability on wildlife, to assess and mitigate emergency activities, and to assist with federal resources to mitigate drought conditions and agricultural recovery. https://www.oregon.gov/gov/eo/eo_22-07.pdf

Utah

On April 12, Salt Lake City, Utah announced that it would start the peak season of water demand at Stage 2 of its 5-stage Water Shortage Contingency Plan. The Plan's five water shortage stages are triggered by water supply levels, streamflows, and water demand. Under Stage 2, actions are focused on augmenting current water supplies and saving for prolonged shortages, while water customers are asked to meet a 5% reduction in daily water use, and municipal water users, parks, and city-owned buildings will be required to take specific actions to reduce overall water use and adjust lawn watering frequency. The Department of Salt Lake City Public Utilities (SLCDPU), tasked with monitoring water conditions, noted that Utah remains in severe or extreme drought, with many reservoirs below capacity. The snowpack is below normal, although soil moisture has improved, and forecasts indicate a season of higher temperatures and lower precipitation. See https://www.slc.gov/mayor/2022/04/12/salt-lake-city-starts-peak-demand-season-under-stage-2-of-its-water-shortage-contingency-plan/.

On April 21, Governor Spencer Cox (R-UT) declared a state of emergency due to drought. He said: "We've had a very volatile water year, and unfortunately, recent spring storms are not enough to make up the shortage in our snowpack. Once again, I call on all Utahns – households, farmers, businesses, governments and other groups – to carefully consider their needs and reduce their water use. We saved billions of gallons last year and we can do it again."

The press release noted that Utah has been in drought eight of the past ten years, and that this year's snowpack is 25% below normal. The Utah Department of Natural Resources reported that: (1) 99.39% of the state is in severe drought or worse, with 43.46% of Utah in extreme drought; (2) statewide snow water equivalent (SWE), or how much water would be in the snowpack if it melted, peaked at 12 inches (75% of the typical median peak of 16 inches for our water year); (3) nineteen of Utah's largest 45 reservoirs are below 55% of available capacity, with overall statewide storage at 59% of capacity (compared to 67% capacity at this time in 2021); (4) soil moisture – critical for effective spring runoff – is 4% higher compared to normal for this time of year; (5) of the 94 measured streams, 59 are flowing below normal despite spring runoff, and two streams are flowing at record low conditions. See: https://governor.utah.gov/2022/04/21/drought-emergency-order/#:~:text=SALT%20LAKE%20CITY%20(April%2021,triggers%20increased%20monitoring%20and%20reporting.

State-Federal Efforts

California Water Projects

On March 18, the Bureau of Reclamation (USBR) and California Department of Water Resources (CDWR) jointly filed a Temporary Urgency Change Petition (TUCP) with the State Water Resources Control Board to modify requirements in water right permits and licenses for the Central Valley Project (CVP) and State Water Project (SWP) between April 1 and June 30. The requested changes are in response to a historically dry January, February, and first half of March, typically California's wettest months, and a third consecutive year of critically dry conditions. The changes are expected to conserve upstream reservoir storage for critical needs later in the year, including public health and safety, and environmental needs.

After a series of strong December storms, USBR and CDWR hoped Folsom and Oroville reservoirs would provide adequate water supplies and a TUCP would not be necessary. However, following the extraordinarily dry January and February, Folsom and Oroville are seeing unprecedented declines in inflow forecasts and cannot support Delta outflows as expected. There is not enough storage in other CVP and SWP reservoirs to meet water supply and environmental needs later in the year.

USBR Regional Director Ernest Conant said: "Reclamation and DWR, along with the federal and state fish agencies, have been coordinating throughout the winter to address increasingly challenging hydrologic conditions for environmental flows and water supply. We all recognize what a difficult year this is going to be for everyone. It's definitely another roll-up-your-sleeves, all-hands-on-deck water year." CDWR Director Karla Nemeth said: "DWR has been planning for conditions to remain dry since the start of the water year on October 1. We are facing tough but important decisions about how to manage the system for a third year of drought." "We are taking critical steps like submitting the [TUCP] in coordination with our federal and state partners, to balance the needs of endangered species, water supply conservation, and water deliveries to Californians."

Additional projects operational flexibility is needed to: (1) support minimum health and safety water supplies; (2) preserve upstream storage for release later in the summer to control saltwater intrusion into the Sacramento-San Joaquin Delta; (3) preserving cold water in Shasta Lake and other reservoirs to maintain cool river temperatures for Chinook salmon and steelhead; (4) maintain protections for state and federally endangered and threatened species; and (5) meet critical water supply needs. CDWR also plans to refill the notch in the Emergency Drought Salinity Barrier in the Delta to reduce the amount of saltwater intrusion and the need for releases from upstream reservoirs to conserve water storage. https://www.usbr.gov/newsroom/#/news-release/4137

Colorado River

On January 28, the Bureau of Reclamation (USBR) and Colorado River Upper Basin States presented their draft Drought Response Operations Plan for public review and comment. The 2019 Colorado River Drought Contingency Plan (DCP) included a Drought Response Operations Agreement (DROA) between the Department of the Interior and the Upper Basin States to develop a plan to protect critical water elevations at Lake Powell. The DROA establishes a coordinated and collaborative process for considering implementation of two potential strategies: (1) working within the Glen Canyon Dam annual release volume by changing the timing of monthly water releases to temporarily retain more water in Lake Powell; and (2) increasing water releases from the upstream

Colorado River Storage Project Act Initial Units of Flaming Gorge, Aspinall, and Navajo to improve the downstream elevation of Lake Powell.

The Drought Response Operations Plan includes: (1) a framework document naming various reservoirs upstream of Lake Powell, with provisions for the development of yearly plans in the event of drought; and (2) attachments with current hydrological information for each reservoir that would be updated annually to inform the drought operations in the yearly plan.

The initial page of the plan noted that it would be ready to implement as early as April 2022 if needed. "It does not contain specific Drought Response Operations for 2022 but instead describes the process and the decision-making framework the DROA Parties intend to follow as they develop a Plan for 2022 and the following years.... The DROA Parties request a review of this draft document now...as an initial opportunity to obtain input regarding the more durable process and decision-making framework provisions." Following consideration of input, they will develop a plan for 2022 if needed. "No Plan can be developed until more information becomes known such as precipitation, snowpack, runoff, reservoir elevations, and other variables during the winter and spring of 2022." https://www.usbr.gov/dcp/droa.html

On March 4, the USBR announced Lake Powell was expected to temporarily decline below a 3,525-foot target elevation, given the abnormally dry winter. The target is part of the 2019 Drought Contingency Plan Agreements, specifically the Drought Response Operations Agreement. Elevation 3,490 feet is the minimum power pool elevation, the lowest point at which Glen Canyon Dam can generate hydropower. The target elevation provides a 35-foot buffer and allows time for response actions to help prevent Lake Powell from dropping below the minimum power pool.

A very dry January and February led to a drop in projected unregulated inflows into Lake Powell for Water Year 2022 by approximately 2.2 million acre-feet (and 2 to 3 feet below the 3,525-foot target in March). Lake Powell's elevation is expected to recover through the course of the spring runoff season, likely in May. Reclamation, the Upper Colorado River Commission, and the Upper Division States are preparing additional measures to implement later this year to help maintain the elevation above 3,525 feet.

"This year the Colorado River Basin has experienced extremely variable conditions with a record high snowpack one month, followed by weeks without snow," said Reclamation Acting Commissioner David Palumbo. "This variable hydrology and a warmer, drier west have drastically impacted our operations and we are faced with the urgent need to manage in the moment."

Under the Drought Response Operations Agreement, Reclamation, in consultation with the Upper Colorado River Commission, has implemented proactive drought response operations that together have helped protect Lake Powell's target elevation by: (1) sending an additional 161,000 acre-feet (af) of water from Blue Mesa and Flaming Gorge reservoirs downstream to Lake Powell; and (2) temporarily reducing monthly releases from Glen Canyon Dam in order to hold back 350,000 af for release later in the year. These proactive actions ensured that Lake Powell will avoid dropping significantly below 3,525 feet during the Spring of 2022.

"Reclamation is not planning to take further action to address this temporary dip below 3,525 feet because the spring runoff will resolve the deficit in the short term," said Upper Colorado Basin Regional Director Wayne Pullan. "However, our work is not done. Lake Powell is projected to drop

below elevation 3,525 feet again later this year. Reclamation and the Upper Division States continue to collaborate with stakeholders and partners to develop and implement additional actions…."

"We appreciate the collaboration among Reclamation and the Upper Basin States at this critical time to develop the 2022 Drought Response Operations Agreement and Operations Plan. We are optimistic these actions will provide additional protection to critical elevations in Lake Powell," said Chuck Cullom, Executive Director of the Upper Colorado River Commission.

Reclamation is closely monitoring basin snowpack and runoff projections, while actively engaging with the Upper Division States, Tribes, and federal agencies such as the National Park Service, U.S. Fish and Wildlife Service and Western Area Power Administration, water users, non-governmental organizations and key stakeholders to protect the elevation of Lake Powell. https://www.usbr.gov/newsroom/#/news-release/4117

On April 8, Tanya Trujillo, Assistant Secretary for Water and Science, Department of the Interior, sent a letter to representatives of the Governors of Arizona, California, Colorado, New Mexico, Nevada, Utah, and Wyoming outlining the most recent impacts of drought and low runoff in the Colorado River Basin, as well as the finalization of the 2022 Drought Response Operations Plan in the coming month. She expressed additional concerns about hydropower operations. The letter said: "Notwithstanding these robust, ongoing efforts… we believe that additional actions are needed to reduce the risk of Lake Powell dropping to elevations at which Glen Canyon Dam releases could only be accomplished through the river outlet works (i.e., below elevation 3490' mean sea level (msl)), or hydropower operations infrastructure at Glen Canyon Dam would be adversely impacted…. In such circumstances, Glen Canyon Dam facilities face unprecedented operational reliability challenges, water users in the Basin face increased uncertainty, downstream resources could be impacted, the western electrical grid would experience uncertain risk and instability, and water and power supplies to the West and Southwestern United States would be subject to increased operational uncertainty."

The letter continued: "Glen Canyon Dam was not envisioned to operate solely through the outlet works for an extended period of time and operating at this low lake level increases risks to water delivery and potential adverse impacts to downstream resources and infrastructure. In addition, should Lake Powell decline further below elevation 3490 feet, we have recently confirmed that essential drinking water infrastructure supplying the City of Page, Arizona and the LeChee Chapter of the Navajo Nation could not function. Given our lack of actual operating experience in such circumstances since Lake Powell filled, these issues raise profound concerns regarding prudent dam operations, facility reliability, public health and safety, and the ability to conduct emergency operations." The letter requested that the States consider further conservation efforts and potentially reducing Lake Powell releases by 500,000 acre-feet, to 7.0 million acre-feet for the 2022 water year, under the terms of the 2007 Interim Guidelines.

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releases from Blue Mesa and Navajo reservoirs may be required later this year. Similar upstream releases were made during the summer of 2021.

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Klamath Basin Project

On February 11, the Department of the Interior (DOI) announced the conclusion of stakeholder engagement sessions on drought in the Klamath Basin that took place between January 24 and February 10 with federal and state officials, tribes, and local stakeholders. DOI said in its press release: "Over the past 20 years, the Klamath Basin has met unprecedented challenges due to ongoing drought conditions, limited water supply and diverse needs. The Bureau of Reclamation and U.S. Fish and Wildlife Service have diligently sought collaborative solutions for water availability with partners and those intimately connected to land and water conditions. Through this recent series of engagement sessions, the Department demonstrated its commitment to transparency and ongoing review of best practices as we continue to address climate change and work towards long term solutions in the Klamath Basin for current and future generations.... The sessions included focused discussions on critical path issues for the basin, including dam removal, Klamath Power and Facilities Agreement implementation, hydrology issues, and project and National Wildlife Refuge water supply. The discussions also focused on an overview and alignment regarding funding of aquatic habitat and water quality priorities, and water supply reliability in the Klamath Basin."

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The Investments in Infrastructure and Jobs Act provides $162M to restore the Klamath Basin ecosystem and identifies opportunities to support water resilience and infrastructure. "Congressional leaders, including U.S. Senators Jeff Merkley (D-OR) and Ron Wyden (D-OR), and Representatives Cliff Bentz (R-OR), Jared Huffman (D-CA), and Doug LaMalfa (R-CA) voiced their commitment to find economically and environmentally sustainable solutions for the basin and articulated a clear picture of the federal and state resources available to help develop these solutions." See https://www.doi.gov/pressreleases/interior-department-concludes-robust-klamath-basin-stakeholder-engagement-sessions.

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and other ecosystem, agricultural, and tribal culture benefits. It announced the initial water supply allocation of 50,000 acre-feet for limited irrigation in the Klamath Project, based on the Natural Resources Conservation Service's (NRCS) inflow forecast. Reclamation also announced $20M in aid for the 2022 irrigation season, and another $5M in technical assistance for tribal-led projects.

Reclamation Acting Commissioner David Palumbo said: "The Klamath Basin is experiencing prolonged and extreme drought conditions that we have not seen since the 1930s. We will continue to monitor the hydrology and adaptively manage conditions in close coordination with Project water users, Tribes and state and federal agency partners. Reclamation is dedicated to collaborating with all stakeholders to get through another difficult year and keep working toward long-term solutions for the Basin." https://www.usbr.gov/newsroom/#/news-release/4168

Attachment A

Several of our western states have been grappling with emergencies related to ongoing and worsening drought conditions in 2022. While this is by no means an exhaustive list, it provides a small sample of some of the challenges across the West, culled from recent articles in the WSWC weekly newsletter.

- California Governor Gavin Newsom expanded drought measures in March, calling on urban water suppliers to meet the requirements of water shortage contingency plans, and calling on state water agencies to enforce laws against illegal water diversions and waste and to engage in activities that improve water supply sustainability.
- Idaho Governor Brad Little and the Idaho Department of Water Resources issued an emergency drought declaration in April, and a curtailment notification in May for water users with priority dates junior to 1979.
- Kansas has seen an average one-foot drop in aquifer levels in the past year as drought conditions continue.
- In New Mexico, Governor Michelle Lujan Grisham has issued emergency declarations for both extensive drought and wildfires.
- Oregon Governor Kate Brown declared drought emergencies across multiple counties in March and April due to low snowpack, low reservoir levels, and low streamflow, with forecasted water supply and precipitation not expected to improve.
- Utah Governor Spencer Cox declared a statewide drought emergency in April, noting the volatile water year, with late spring precipitation unable to make up for the winter snowpack shortages.
- Several states and federal agencies (particularly the Department of the Interior's Bureau of Reclamation) have worked together in an effort to manage water resources for agricultural and urban areas through the worsening drought conditions.

California

On March 28, Governor Gavin Newsom (D-CA) signed an Executive Order (N-7-22) expanding measures to address the ongoing drought emergency in California. It called on urban water suppliers to move Water Shortage Contingency Plans to Level 2, based on a projected shortage of up to 20%, and encourage voluntary activation of Level 3 requirements based on a shortage level up to 30%. The order directed the State Water Resources Control Board (SWRCB) to adopt emergency regulations defining "non-functional turf" and ban its irrigation in commercial, industrial, and institutional sectors. It directed the Department of Water Resources (DWR) to develop strategies to improve conservation, including technical and financial assistance.

The order directed SWRCB to "expand inspections to determine whether illegal diversions or wasteful or unreasonable use of water are occurring and bring enforcement actions…." Further, it suspended ordinances and regulations that prohibit hauling water outside a basin of origin to facilitate hauling water by truck for domestic use to communities with degraded water quality or supply due to drought. To increase the resilience of state water supplies, the order directed DWR to "prepare for the potential creation and implementation of a multi-year transfer program pilot

project for the purpose of acquiring water from willing partners and storing and conveying water to areas of need."

To facilitate and protect the use of groundwater during drought, the order directed DWR to work with other agencies to expedite regulatory pathways to repair or reconstruct small community public supply wells. It prohibits local agencies from issuing new permits for groundwater wells – other than domestic wells less than two acre-feet per year – in basins "subject to the Sustainable Groundwater Management Act [SGMA] and classified as medium- or high-priority without first obtaining written verification from a Groundwater Sustainability Agency [GSA]" that the proposed well would not interfere with the local GSA's sustainability plan.

The order directed state agencies to "collaborate with tribes and federal, regional, and local agencies on actions related to promoting groundwater recharge and increasing storage." It directed SWRCB and the Regional Water Quality Control Boards to prioritize "water right permits, water quality certifications, waste discharge requirements, and conditional waivers of waste discharge requirements to accelerate approvals for projects that enhance the ability of a local or state agency to capture high precipitation events for local storage or recharge, consistent with water right priorities and protections for fish and wildlife." It suspends various statutes and regulations to address the need to recharge groundwater during the drought. See https://www.gov.ca.gov/wp-content/uploads/2022/03/March-2022-Drought-EO.pdf.

Idaho

On April 29, with approval from Idaho Governor Brad Little (R), the Idaho Department of Water Resources (IDWR) issued an emergency drought declaration for southern Idaho. The declaration allows temporary water right changes in the point of diversion, place of use, and purpose of use for valid, existing water rights, when it is determined that such changes can be accomplished without harming other existing water rights. The declaration may also help with the eligibility requirements for federal drought assistance.

IDWR Director Gary Spackman noted that all Idaho counties south of the Salmon River are classified as being in moderate to severe drought and are experiencing below-normal snowpack. The press release said: "Specifically, total cumulative snow water equivalent (SWE) levels in these basins as of April 1, 2022, ranged from 50 to 78 percent of median. The April-to-September streamflow forecasts for most locations south of the Salmon River are between 25 and 75 percent of median. As of April 1, 2022, storage in most reservoirs serving the southern half of Idaho were between 20 to 65 percent of capacity, increasing the chances that many reservoirs will not fill." https://idwr.idaho.gov/news-releases/

On May 6, the IDWR issued a methodology order, predicting a 162,600 acre-foot shortfall for senior priority surface water users on the Eastern Snake River Plain (ESPA) for the 2022 irrigation season. IDWR will begin curtailing more than 328 junior groundwater users with priority dates junior to 1979, unless they have joined one of seven approved mitigation plans or can otherwise demonstrate how their water use will not cause injury to senior surface water users. Past water litigation on the Snake River, between surface water and groundwater users, resulted in

settlement agreements. The IDWR Director is required to issue an order at the beginning of the irrigation season and again in July to determine any shortfalls and curtailment obligations.

Mathew Weaver, IDWR Deputy Director, said: "By law, we have to keep people with senior water rights whole, and we want to make the junior ground water pumpers aware that despite the settlement agreements…if junior ground water pumpers are not participating in an approved mitigation plan, they could be subject to curtailment this year." https://idwr.idaho.gov/wp-content/uploads/sites/2/news-release/IDWR-order-predicts-162600-acre-foot-water-shortfall-on-Snake-River-FINAL.pdf

Kansas

On March 24, the University of Kansas published preliminary data compiled by the Kansas Geological Survey (KGS) showing that average groundwater levels dropped by more than a foot in 2021. "The KGS, based at the University of Kansas, and the Division of Water Resources (DWR) of the Kansas Department of Agriculture measure about 1,400 wells every year to monitor the health of the High Plains aquifer and other aquifers in western and central Kansas. Those measurements showed an overall average decline of 1.01 feet last year. Most parts of the region saw below-average precipitation for the year, especially during the summer growing season for agricultural crops.... The 2021 decline followed an overall drop of 0.93 feet in 2020, which was another abnormally dry year. Dry years lead to increased pumping demands, primarily for irrigation, which in turn typically cause greater declines in water levels." Most of Kansas continues to experience drought conditions in 2022.The article noted that most of the wells monitored by KGS and DWR are located in Groundwater Management Districts.

New Mexico

On April 25, New Mexico Governor Michelle Lujan Grisham (D) declared a statewide emergency for severe drought and fire conditions. The executive order noted that 93% of New Mexico was experiencing severe to exceptional drought conditions, and that significant fire danger "has increased throughout the State due to warmer temperatures, lower humidity, high winds, and an abundance of dry, fine fuels." According to the National Interagency Fire Center, New Mexico is currently fighting six large fires across more than 235,000 acres. Governor Lujan Grisham has issued five other emergency declarations in April regarding the various fires. https://www.governor.state.nm.us/about-the-governor/executive-orders/

On May 4, Governor Lujan Grisham submitted a request for a Presidential Disaster Declaration through the Federal Emergency Management Agency (FEMA), as well as applied for a hazard mitigation assistance grant. In a press release she said: "The state has aggressively pursued a Presidential Disaster Declaration for New Mexico, using every available tool and technology to document the damage that we know New Mexico communities have sustained and are still experiencing in order to expedite the process. I am laser focused on getting New Mexicans the disaster relief they need and deserve, and I am confident that FEMA and the President will grant our request." https://www.governor.state.nm.us/press-releases/

Oregon

On March 4, Governor Kate Brown (D-OR) declared a severe, continuing drought emergency in Klamath County based on the low snowpack, low reservoir levels, low streamflow, and forecasted water supply conditions that are not expected to improve. "Drought is likely to have a significant economic impact on the farm, ranch, and natural resources sectors, as well as an impact on drinking water, fish and wildlife, important minimum flows for public instream uses and other natural resources dependent on adequate precipitation, stored water, and stream flow in these areas. Extreme conditions are expected to affect local growers, increase the potential for fire, shorten the growing season, and decrease water supplies." The Executive Order 22-02 directs state interagency coordination for mitigation efforts. See https://www.oregon.gov/gov/eo/eo_22-02.pdf.

On April 25, Governor Brown signed an executive order declaring drought across four counties with low snowpack, low reservoir levels, and low streamflow. "Forecasted water supply conditions and precipitation levels are not expected to improve. Drought is likely to have a significant economic impact on the farm, ranch, vineyard, recreation, tourism, and natural resources sectors, as well as an impact on drinking water, fish and wildlife, and important minimum flows for public instream uses and other natural resources dependent on adequate precipitation, stored water, and streamflow in these areas. Extreme conditions are expected to affect the local growers and livestock, increase the potential for fire, shorten the growing season, and decrease water supplies." The order directs agencies to coordinate and provide assistance to water users, to understand the impacts of water availability on wildlife, to assess and mitigate emergency activities, and to assist with federal resources to mitigate drought conditions and agricultural recovery. https://www.oregon.gov/gov/eo/eo_22-07.pdf

Utah

On April 12, Salt Lake City, Utah announced that it would start the peak season of water demand at Stage 2 of its 5-stage Water Shortage Contingency Plan. The Plan's five water shortage stages are triggered by water supply levels, streamflows, and water demand. Under Stage 2, actions are focused on augmenting current water supplies and saving for prolonged shortages, while water customers are asked to meet a 5% reduction in daily water use, and municipal water users, parks, and city-owned buildings will be required to take specific actions to reduce overall water use and adjust lawn watering frequency. The Department of Salt Lake City Public Utilities (SLCDPU), tasked with monitoring water conditions, noted that Utah remains in severe or extreme drought, with many reservoirs below capacity. The snowpack is below normal, although soil moisture has improved, and forecasts indicate a season of higher temperatures and lower precipitation. See https://www.slc.gov/mayor/2022/04/12/salt-lake-city-starts-peak-demand-season-under-stage-2-of-its-water-shortage-contingency-plan/.

On April 21, Governor Spencer Cox (R-UT) declared a state of emergency due to drought. He said: "We've had a very volatile water year, and unfortunately, recent spring storms are not enough to make up the shortage in our snowpack. Once again, I call on all Utahns – households,

farmers, businesses, governments and other groups – to carefully consider their needs and reduce their water use. We saved billions of gallons last year and we can do it again."

The press release noted that Utah has been in drought eight of the past ten years, and that this year's snowpack is 25% below normal. The Utah Department of Natural Resources reported that: (1) 99.39% of the state is in severe drought or worse, with 43.46% of Utah in extreme drought; (2) statewide snow water equivalent (SWE), or how much water would be in the snowpack if it melted, peaked at 12 inches (75% of the typical median peak of 16 inches for our water year); (3) nineteen of Utah's largest 45 reservoirs are below 55% of available capacity, with overall statewide storage at 59% of capacity (compared to 67% capacity at this time in 2021); (4) soil moisture – critical for effective spring runoff – is 4% higher compared to normal for this time of year; (5) of the 94 measured streams, 59 are flowing below normal despite spring runoff, and two streams are flowing at record low conditions. See: https://governor.utah.gov/2022/04/21/drought-emergency-order/#:~:text=SALT%20LAKE%20CITY%20(April%2021,triggers%20increased%20monitoring%20and%20reporting.

State-Federal Efforts

California Water Projects

On March 18, the Bureau of Reclamation (USBR) and California Department of Water Resources (CDWR) jointly filed a Temporary Urgency Change Petition (TUCP) with the State Water Resources Control Board to modify requirements in water right permits and licenses for the Central Valley Project (CVP) and State Water Project (SWP) between April 1 and June 30. The requested changes are in response to a historically dry January, February, and first half of March, typically California's wettest months, and a third consecutive year of critically dry conditions. The changes are expected to conserve upstream reservoir storage for critical needs later in the year, including public health and safety, and environmental needs.

After a series of strong December storms, USBR and CDWR hoped Folsom and Oroville reservoirs would provide adequate water supplies and a TUCP would not be necessary. However, following the extraordinarily dry January and February, Folsom and Oroville are seeing unprecedented declines in inflow forecasts and cannot support Delta outflows as expected. There is not enough storage in other CVP and SWP reservoirs to meet water supply and environmental needs later in the year.

USBR Regional Director Ernest Conant said: "Reclamation and DWR, along with the federal and state fish agencies, have been coordinating throughout the winter to address increasingly challenging hydrologic conditions for environmental flows and water supply. We all recognize what a difficult year this is going to be for everyone. It's definitely another roll-up-your-sleeves, all-hands-on-deck water year." CDWR Director Karla Nemeth said: "DWR has been planning for conditions to remain dry since the start of the water year on October 1. We are facing tough but important decisions about how to manage the system for a third year of drought." "We are taking critical steps like submitting the [TUCP] in coordination with our federal and state

partners, to balance the needs of endangered species, water supply conservation, and water deliveries to Californians."

Additional projects operational flexibility is needed to: (1) support minimum health and safety water supplies; (2) preserve upstream storage for release later in the summer to control saltwater intrusion into the Sacramento-San Joaquin Delta; (3) preserving cold water in Shasta Lake and other reservoirs to maintain cool river temperatures for Chinook salmon and steelhead; (4) maintain protections for state and federally endangered and threatened species; and (5) meet critical water supply needs. CDWR also plans to refill the notch in the Emergency Drought Salinity Barrier in the Delta to reduce the amount of saltwater intrusion and the need for releases from upstream reservoirs to conserve water storage. https://www.usbr.gov/newsroom/#/news-release/4137

Colorado River

On January 28, the Bureau of Reclamation (USBR) and Colorado River Upper Basin States presented their draft Drought Response Operations Plan for public review and comment. The 2019 Colorado River Drought Contingency Plan (DCP) included a Drought Response Operations Agreement (DROA) between the Department of the Interior and the Upper Basin States to develop a plan to protect critical water elevations at Lake Powell. The DROA establishes a coordinated and collaborative process for considering implementation of two potential strategies: (1) working within the Glen Canyon Dam annual release volume by changing the timing of monthly water releases to temporarily retain more water in Lake Powell; and (2) increasing water releases from the upstream Colorado River Storage Project Act Initial Units of Flaming Gorge, Aspinall, and Navajo to improve the downstream elevation of Lake Powell.

The Drought Response Operations Plan includes: (1) a framework document naming various reservoirs upstream of Lake Powell, with provisions for the development of yearly plans in the event of drought; and (2) attachments with current hydrological information for each reservoir that would be updated annually to inform the drought operations in the yearly plan.

The initial page of the plan noted that it would be ready to implement as early as April 2022 if needed. "It does not contain specific Drought Response Operations for 2022 but instead describes the process and the decision-making framework the DROA Parties intend to follow as they develop a Plan for 2022 and the following years…. The DROA Parties request a review of this draft document now…as an initial opportunity to obtain input regarding the more durable process and decision-making framework provisions." Following consideration of input, they will develop a plan for 2022 if needed. "No Plan can be developed until more information becomes known such as precipitation, snowpack, runoff, reservoir elevations, and other variables during the winter and spring of 2022." https://www.usbr.gov/dcp/droa.html

On March 4, the USBR announced Lake Powell was expected to temporarily decline below a 3,525-foot target elevation, given the abnormally dry winter. The target is part of the 2019 Drought Contingency Plan Agreements, specifically the Drought Response Operations Agreement. Elevation 3,490 feet is the minimum power pool elevation, the lowest point at which Glen Canyon Dam can generate hydropower. The target elevation provides a 35-foot buffer and

allows time for response actions to help prevent Lake Powell from dropping below the minimum power pool.

A very dry January and February led to a drop in projected unregulated inflows into Lake Powell for Water Year 2022 by approximately 2.2 million acre-feet (and 2 to 3 feet below the 3,525-foot target in March). Lake Powell's elevation is expected to recover through the course of the spring runoff season, likely in May. Reclamation, the Upper Colorado River Commission, and the Upper Division States are preparing additional measures to implement later this year to help maintain the elevation above 3,525 feet.

"This year the Colorado River Basin has experienced extremely variable conditions with a record high snowpack one month, followed by weeks without snow," said Reclamation Acting Commissioner David Palumbo. "This variable hydrology and a warmer, drier west have drastically impacted our operations and we are faced with the urgent need to manage in the moment."

Under the Drought Response Operations Agreement, Reclamation, in consultation with the Upper Colorado River Commission, has implemented proactive drought response operations that together have helped protect Lake Powell's target elevation by: (1) sending an additional 161,000 acre-feet (af) of water from Blue Mesa and Flaming Gorge reservoirs downstream to Lake Powell; and (2) temporarily reducing monthly releases from Glen Canyon Dam in order to hold back 350,000 af for release later in the year. These proactive actions ensured that Lake Powell will avoid dropping significantly below 3,525 feet during the Spring of 2022.

"Reclamation is not planning to take further action to address this temporary dip below 3,525 feet because the spring runoff will resolve the deficit in the short term," said Upper Colorado Basin Regional Director Wayne Pullan. "However, our work is not done. Lake Powell is projected to drop below elevation 3,525 feet again later this year. Reclamation and the Upper Division States continue to collaborate with stakeholders and partners to develop and implement additional actions…."

"We appreciate the collaboration among Reclamation and the Upper Basin States at this critical time to develop the 2022 Drought Response Operations Agreement and Operations Plan. We are optimistic these actions will provide additional protection to critical elevations in Lake Powell," said Chuck Cullom, Executive Director of the Upper Colorado River Commission.

Reclamation is closely monitoring basin snowpack and runoff projections, while actively engaging with the Upper Division States, Tribes, and federal agencies such as the National Park Service, U.S. Fish and Wildlife Service and Western Area Power Administration, water users, non-governmental organizations and key stakeholders to protect the elevation of Lake Powell. https://www.usbr.gov/newsroom/#/news-release/4117

On April 8, Tanya Trujillo, Assistant Secretary for Water and Science, Department of the Interior, sent a letter to representatives of the Governors of Arizona, California, Colorado, New Mexico, Nevada, Utah, and Wyoming outlining the most recent impacts of drought and low runoff in the Colorado River Basin, as well as the finalization of the 2022 Drought Response Operations Plan in the coming month. She expressed additional concerns about hydropower operations. The

letter said: "Notwithstanding these robust, ongoing efforts…we believe that additional actions are needed to reduce the risk of Lake Powell dropping to elevations at which Glen Canyon Dam releases could only be accomplished through the river outlet works (i.e., below elevation 3490' mean sea level (msl)), or hydropower operations infrastructure at Glen Canyon Dam would be adversely impacted…. In such circumstances, Glen Canyon Dam facilities face unprecedented operational reliability challenges, water users in the Basin face increased uncertainty, downstream resources could be impacted, the western electrical grid would experience uncertain risk and instability, and water and power supplies to the West and Southwestern United States would be subject to increased operational uncertainty."

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collaborating with all stakeholders to get through another difficult year and keep working toward long-term solutions for the Basin." https://www.usbr.gov/newsroom/#/news-release/4168

Testimony of Dr. Courtney Schultz, Associate Professor of Forest and Natural Resource Policy, Department of Forest and Rangeland Stewardship, Colorado State University

U.S. Senate Committee on Agriculture, Subcommittee on Climate, Conservation, Forestry, and Natural Resources

Hearing on: The Western Water Crisis: Confronting persistent drought and building resilience on our forests and farmland

June 7, 2022

Chairman Bennet, Ranking Member Marshall, and Members of the Subcommittee:

Thank you for the opportunity to speak to you today about maintaining resilient forests and farmland in this era of climate change and increased drought, heat, and fire. I am a professor in the Department of Forest and Rangeland Stewardship at Colorado State University (CSU), specializing in national forest policy and governance. I direct the Public Lands Policy Group,[1] a research group studying policy developments that affect US public lands, and I also lead the university's new Climate Adaptation Partnership,[2] which serves to accelerate innovative research and promote communication with policy makers to support effective and equitable approaches to climate adaptation.

Over the last decade, I have led national-level analyses of many of the primary forest restoration policies, including the Collaborative Forest Landscape Restoration Program and the Joint Chiefs Landscape Restoration Partnership. With funding from the Joint Fire Science Program, in partnership with researchers at the University of Oregon, I completed a four-year study of the policy barriers and opportunities for prescribed fire application. I am part of a team investigating the interactive effects of climate and management across all US forests with funding from the National Science Foundation. In close partnership with the USDA Forest Service, I have also led research on national forest planning, National Environmental Policy Act implementation, climate change vulnerability assessment, and science-based tools for improving fire response. In addition, I work closely with the Colorado Forest Restoration Institute and with a network of thought leaders working on forest management issues from rural and community-based forestry organizations. Through my research and outreach, I have developed a strong understanding of the challenges and opportunities surrounding forest and community resilience in light of climate change, and I have written about the critical importance of collaboration and capacity-building to support effective forest and fire management.[3]

Colorado is facing dramatic impacts from climate change that are expected to increase in frequency and severity. I will discuss some of those impacts and CSU's existing and extensive work addressing climate impacts and transitions. I also will speak to some areas where I see potential for CSU to support activities to promote climate adaptation and comment on progress related to Congress' investments in forest and fire management based on my own scholarly expertise.

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[1] https://sites.warnercnr.colostate.edu/courtneyschultz/
[2] https://www.research.colostate.edu/cip/cap/
[3] Schultz, C.A. and Moseley, C. 2019. Collaborations and capacities to transform US fire management. *Science* 366 (6461), 38-40; doi: 10.1126/science.aay3727

Climate Change Impacts in Colorado

Climate change is affecting Colorado through increased fire, smoke, flooding, and, perhaps most importantly, drought. While I do not aim here to provide an overview of all climate-related impacts to our Colorado ecosystems, communities, and economy, I offer an overview of some of the impacts of drought, heat, and fire for farms and forests.

In late April of this year, the USDA designated the entire state of Colorado as a "primary natural disaster area" due to severe drought conditions.[4] As of May 24, 2022, drought conditions across sixty percent of Colorado were classified as severe, extreme, or exceptional.[5] Scientists anticipate that there is a 94% chance of the drought continuing through 2023 and a 75% chance of it continuing until 2030; the current multi-decadal drought impacting the American Southwest would likely not be of record proportion without anthropogenic climate change.[6]

In the last twenty years, streamflows in the Colorado River Basin have declined as a result of this persistent "hot drought".[7] Major reservoirs including Lakes Powell and Mead are now at record lows. As of May 4, 2022, the Colorado Basin River Forecast Center projects that the most likely inflows to Lake Powell will be 38% below average.[8] As of May 31, 2022, snow water equivalent in the Upper Colorado River Headwaters were at 22% below normal. What is perhaps more shocking is that the San Miguel, Dolores, Animas, and San Juan Rivers in southwestern Colorado were at 99% below normal and the Rio Grande watershed at 92% below normal as of May 31. With the exception of the South Platte and Arkansas Rivers, not a single river basin in Colorado has reached average snow water equivalent for this point in the season.[9]

It is also getting hotter in the region. Colorado's west slope has faced some of the largest increases in average temperature in the southwestern states over the last 30 years, with large areas of the region increasing from 2.5 to 3.0 degrees Fahrenheit compared to the average temperature from 1901-1960 (Fig. 1). By the middle of the next decade, climate-model projections indicate that extreme heat (as determined by the number of days in the year when temperatures exceed 90 degrees Fahrenheit) in Colorado will increase as compared to the period of 1976-2005 (Fig. 2). Days of extreme heat in the western half of Colorado are expected to increase by 10 to 20 days; on the eastern plains, they will increase by 30 to 50 days.[10]

The impacts of drought and heat are significant for Colorado. Agriculture is one of Colorado's major industries, contributing $47 billion annually and supporting nearly 200,000 jobs; drought is projected

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[4] https://www.fsa.usda.gov/news-room/emergency-designations/2022/ed_2022_0426_rel_0020

[5] U.S. Drought Monitor - Colorado, May 24, 2022. (https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?CO)

[6] Williams, A.P., Cook, B.I., and Smerdon, J.E. 2022. Rapid intensification of the emerging southwestern North American megadrought in 2020–2021. *Nature Climate Change* 12, 232-234; doi: 10.1038/s41558-022-01290-z

[7] Udall, B. and Overpeck, J. 2017. The twenty-first century Colorado River hot drought and implications for the future. *Water Resources Research* 53 (3), 2404-2418; doi: 10.1002/2016WR019638

[8] U.S. Bureau of Reclamation. Upper Colorado Region Water Operations Status as of May 17, 2022. (https://www.usbr.gov/uc/water/crsp/cs/gcd.html)

[9] Colorado Climate Center. Colorado SNOTEL Current Snow Water Equivalent Percent of Normal Map. (https://climate.colostate.edu/drought/#gallery-19)

[10] Fourth National Climate Assessment (2018) – Southwest Region. (https://nca2018.globalchange.gov/chapter/25/)

to cost the state more than $500 million in annual agricultural damages by 2050.[11] As climate hazards increase in frequency and severity, Colorado's agricultural community is especially vulnerable to temperature and precipitation extremes that can affect crop yields.[12] Possible low-to-no-snow futures later this century and the timing of water availability will have major impacts on critical aspects of the state's economy, including Colorado's renowned, multi-billion dollar ski industry.[13]

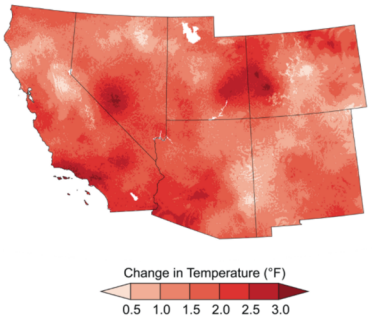

Figure 1: Changes between 1986-2016 and 1901-1960 average temperatures in the southwestern United States (Fourth National Climate Assessment, 2018).

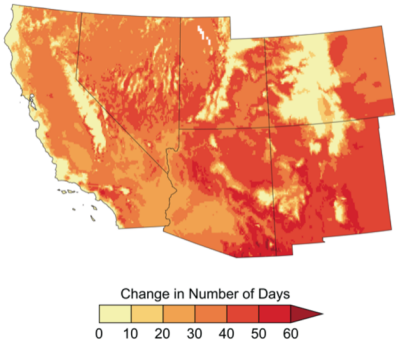

Figure 2: Increase in the number of days with extreme heat (days with high temperatures exceeding 90 degrees) by the mid-2030s as compared to the 1976-2005 average (Fourth National Climate Assessment, 2018).

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[11] Kohler, J. 2021. From Western Slope to Eastern Plains, Colorado agriculture under pressure to adapt to warming world. *The Denver Post*, 22 September. https://www.denverpost.com/2021/09/19/colorado-agriculture-grapples-with-climate-change/#:~:text=Agriculture%20is%20one%20of%20Colorado%27s,of%20that%20occurring%20agriculture%20alone

[12] Walsh, M. K., et al. 2020. *Climate Indicators for Agriculture*. USDA Technical Bulletin 1953. Washington, DC. 70 pages. doi: 10.25675/10217/210930.

[13] Siirila-Woodburn, E.R., et al. 2021. A low-to-no snow future and its impacts on water resources in the western United States. *Nature Reviews Earth and Environment* 2, 800-819; doi: 10.1038/s43017-021-00219-y

For Colorado, curtailment on water use to meet Colorado River Compact requirements could have a profound impact on water users, including municipal needs on the Front Range and junior agricultural water right holders on the Western Slope and in the Arkansas River Basin. Colorado also is a headwaters state for vital rivers that supply 18 other US states and Mexico. Drought and its interaction with disturbances like fire have impacts that extend well beyond our state borders.

Fire has become a prominent aspect of life in Colorado. This summer, again, temperatures statewide are likely to be above average, and precipitation is projected to trend below average across much of the state (Fig. 3). This combination has led to predictions of an "above normal" potential for significant wildfire across most of the state.[14] Four of the five largest wildfires in Colorado history have occurred since 2018, with three of the five in 2020 alone. The largest fire (Cameron Peak in 2020) covered 209,000 acres and was 51 percent larger than the previous largest fire (Hayman) that occurred in 2002. The 20 largest fires in Colorado history have all occurred since 2001 (the beginning of the ongoing megadrought over the southwestern United States).[15] Increasing populations in the wildland-urban interface in Colorado will only face increased risk to wildfire over the coming decades.[16]

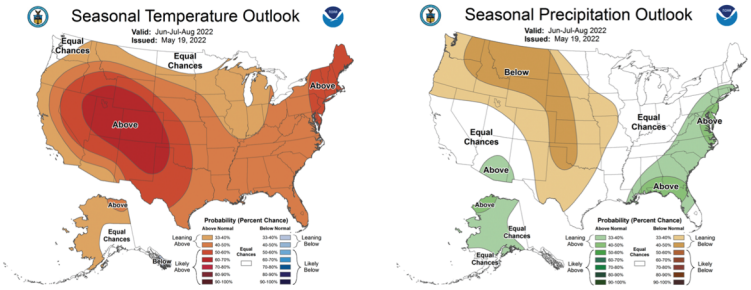

Figure 3: Outlook for seasonal temperature (left) and precipitation (right) effective for June, July, and August 2022 (National Oceanic and Atmospheric Administration).

Wildfire also has become a year-round issue in Colorado. The state witnessed its costliest fire in state history, and the 10th costliest fire in US history, in December of 2021. The Marshall Fire burned 6,000 acres and over 1,000 homes in Boulder County, northwest of Denver. NOAA labeled the fire a "billion

[14] National Interagency Fire Center Predictive Services. Available from the Colorado Climate Center at: https://climate.colostate.edu/drought/#outlook.
[15] Colorado Division of Fire Prevention and Control - Historical Wildfire Information. https://dfpc.colorado.gov/wildfire-information-center/historical-wildfire-information.
[16] Radeloff, V.C., et al. 2018. Rapid growth of the US wildland-urban interface raises wildfire risk. *Proceedings of the National Academy of Sciences, USA* 114:2946-2951. doi: 10.1073/pnas.1718850115 https://www.pnas.org/doi/10.1073/pnas.1718850115

dollar disaster."[17] Due to the cost of materials and insurance policy coverage, most estimates have shown that homeowners in Superior and Louisville attempting to rebuild are considerably underinsured.[18]

Such impacts are being felt across the West. Wildfires in the western United States cost the nation over $10 billion in 2021.[19] Increases in heat, aridity, and earlier snowmelt are adding to the risk of wildfires in the western United States, including the Rocky Mountain ecoregion in Colorado. Moreover, fires are increasing in size, severity, extent and frequency[20] with longer wildfire seasons.[21] Wildfires also are increasing in size and extent specifically in high-elevation landscapes,[22] which could further harm threatened water supplies. And these burned landscapes are often not recovering to their pre-fire structure.[23]

Communities and land managers must assess and manage ever-larger post-fire landscapes for future resilience, dealing with the direct damage caused by wildfires, but also post-fire flooding and erosion, water quality issues, and changing ecosystem services. High sediment loads in rivers following wildfires can fill reservoirs and clog water intakes. Both agricultural and municipal water supplies can be affected by poor water quality and infrastructure damage after wildfires. After the 2002 Hayman Fire, for instance, an estimated $26 million of damage to water infrastructure occured around the Denver metropolitan area. That fire and others prompted a series of watershed partnerships among water utilities, partner organizations, and the US Forest Service to fund forest fuel reduction along the Front Range.[24]

Smoke from these wildfires is increasing in the western United States and is counteracting air quality improvements from cleaner electricity, industry, and transportation[25]. In Colorado, we regularly experience smoke from both local, in-state fires as well as fires from other western US states and

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[17] Smith, A. 2022. Beyond the Data - 2021 billion-dollar weather and climate disasters in historical context. National Oceanic and Atmospheric Administration. https://www.climate.gov/news-features/blogs/beyond-data/2021-us-billion-dollar-weather-and-climate-disasters-historical

[18] Mullholland, S. 2022. For people who lost homes in the Marshall Fire, insurance might not cover everything. *Colorado Public Radio News*, 12 January. https://www.cpr.org/2022/01/12/boulder-county-marshall-fire-homes-insurance/

[19] Smith, *supra* note 17.

[20] Parks, S.A. and Abatzoglou, J.T. 2020. Warmer and drier fire seasons contribute to increases in area burned at high severity in western US forests from 1985 to 2017. *Geophysical Research Letters* 47 (22); doi: 10.1029/2020GL089858

[21] Brey, S.J., et al. 2020. Past variance and future projections of the environmental conditions driving western US summertime wildfire burn area. *Earth's Future* 9 (2); doi: 10.1029/2020EF001645

[22] Higuera, P.E., Shuman, B.N., and Wolf, K.D. 2021. Rocky Mountain subalpine forests now burning more than any time in recent millennia. *Proceedings of the National Academy of Sciences* 118 (25), 1-5; doi: 10.1073/pnas.2103135118 https://www.pnas.org/doi/10.1073/pnas.2103135118

[23] Stevens-Rumann, C., et al. 2018. Evidence for declining forest resilience to wildfires under climate change. *Ecology Letters* 21, 243-252; doi: 10.1111/ele.12889

[24] Huber-Stearns, H.R., Schultz, C.A., and Cheng, A.S. 2019. A multiple streams analysis of institutional innovation in forest watershed governance. *Review of Policy Research* 36 (6), 781-804; doi: 10.1111/ropr.12359

[25] O'Dell, K., Ford, B., Fischer, E.V., and Pierce, J.R. 2019. Contribution of wildland-fire smoke to US PM2.5 and its influence on recent trends. *Environmental Science and Technology* 53 (4), 1797-1804; doi: 10.1021/acs.est.8b05430

Canada[26]. As exposure to smoke is associated with increased respiratory hospitalizations and death rates[27], it is imperative to create smoke-ready communities in Colorado with effective air quality communication and clean-air spaces. These and other effects of fire and other climate-driven disturbances and disasters fall disproportionately on low-income and marginalized populations, who are often left behind in both fire preparedness and recovery efforts.[28] It is essential going forward to ensure the investments in forest and fire management are done in a way that increases social equity and builds collaborative capacity where it is needed.

We also will continue to see compounding effects of various climate-driven disturbances. For example, the increase in area burned by wildfire in recent years has increased the risk of flash floods when heavy rain falls on burn scars. This was highlighted by the debris flows that closed I-70 in summer 2021, and the deadly flash flood in the Poudre Canyon in July 2021. Research indicates this will become more common in the future: thus, not only will extreme fires become more likely, but many more of those will also be followed by extreme rainfall events.[29]

Wind and airborne dust are also likely to increase. Winter and early spring are typically the windiest times of year in Colorado. Although the ground can be snow covered during these seasons, lack of snow and drought will enhance the tendency of exposed soils to be mobilized by wind. This can lead to erosion of arable soils and health-threatening dust storms. Mobilization of dust that is then deposited onto snowpack lowers the reflective capacity (albedo) of snow, causing it to warm more rapidly, leading to earlier snowmelt that affects annual streamflows and water supply for downstream needs. While it is not clear that climate change will lead to stronger winds, land use change and drier conditions during Colorado's windy periods will create vulnerability to increased numbers of episodes of blowing dust and snowpack deposition.[30]

In summary, climate change threatens the resilience of ecosystems and communities in Colorado and in many states for which Colorado forests serve as the headwaters. Evidence suggests conversions from forested areas to shrub or other non-forest systems will continue.[31,32] This further impacts the abilities of natural climate solutions to aid in mitigating further climate change, as loss of forest carbon and

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[26] Magzamen, S., et al. 2021. Differential cardiopulmonary health impacts of local and long-range transport of wildfire smoke. *GeoHealth* 5 (3), 1-18; doi: 10.1029/2020GH000330

[27] Gan, R.W., et al. 2020. The association between wildfire smoke exposure and asthma-specific medical care utilization in Oregon during the 2013 wildfire season. *Journal of Exposure Science and Environmental Epidemiology* 30 (4), 618-628; doi: 10.1038/s41370-020-0210-x

[28] Davies, I.P., Haug, R.D., Robertson, J.C., and Levin, P.S. 2018. The unequal vulnerability of communities of color to wildfire. *PLOS ONE* 13 (11), 1-15; doi: 10.1371/journal.pone.0205825; Anderson, S., Plantinga, A., Wibbenmeyer, M. 2020. Inequality in agency responsiveness: evidence from salient wildfire events. Resources for the Future Working Paper 20-22. Available at: https://media.rff.org/documents/WP_20-22.pdf

[29] Touma, D., et al. 2022. Climate change increases risk of extreme rainfall following wildfire in the western United States. *Science Advances* 8 (13), 1-11; doi: 10.1126/sciadv.abm0320

[30] Lambert, A., et al., 2020. Dust impacts of rapid agricultural expansion on the Great Plains. *Geophysical Research Letters* 47 (20); doi: 10.1029/2020GL090347

[31] Stevens-Rumann, C.S., and Morgan, P. 2019. Tree regeneration following wildfires in the western US: a review. *Fire Ecology* 15 (15), 1-17; doi: 10.1186/s42408-019-0032-1

[32] Coop, J.D., et al. 2020. Wildfire-driven forest conversion in western North American landscapes. *BioScience* 70 (8), 659-673; doi: 10.1093/biosci/biaa061

forest carbon sequestration abilities may accelerate certain feedbacks at large spatial scales.[33] The interaction between climatic stressors, biotic and abiotic disturbances and decreasing resilience at both small and large spatial scales suggest the potential lack of persistence of forested ecosystems.[34] Maintaining the resilience and persistence of our forested watersheds is a critical task for Colorado and one that is important for downstream states both east and west of the Continental Divide. I have written elsewhere about the value of fuel reduction and forest restoration activities, including selective tree thinning and the reintroduction of fire through prescribed and natural wildfire, under certain conditions, to promote the resilience of fire-adapted forests and nearby communities. I have also noted that the science indicates for community protection, home hardening and defensible space in the home ignition and community protection zones are our best chance at protecting homes from fire.[35] There also are other potentially promising avenues to pursue, such as the re-establishment of meadows and riparian corridors within traditionally colder and wetter forests, maintaining sites that serve as refugia to cultivate resistance within these ecosystems, and other potential management actions to support forest persistence, such as assisted migration of tree species from lower, drier elevations to higher sites where conditions are changing. All of this points to the need for reducing carbon emissions, alongside ongoing research on how to promote community resilience and support adaptation to climate change.

Climate Research, Extension, and Education Activities at CSU

At CSU, we are undertaking extensive work to support both climate change mitigation (i.e., reduction of greenhouse gas emissions) and climate adaptation (i.e., adjusting to living with evolving climatic conditions and climate-driven disturbances). I provide here an overview of some of the work we are doing at CSU to convey the vast expertise and capacity housed at our university, in line with our land grant mission to serve our students and the state with research, extension, and education.

We are in the process of developing a new Master's Certificate program that would be available to post-baccalaureate students and professionals around the country and in Colorado who are interested in learning new skills for climate vulnerability assessment, adaptation planning, and climate-smart land management. We also host a Master's Certificate program in greenhouse gas accounting that is utilized by students across colleges, including natural resource and business students. Colleagues are also offering summer camps for Indigenous K-12 youth in the state with an emphasis on science training.

My own scholarship focuses on understanding policy barriers and opportunities to improve forest and fire management to support greater social and ecological resilience, address the risks associated with fire, and adapt to a changing climate. I have been a partner to the USDA Forest Service for over a decade in conducting research on forest restoration policies, fire planning and response, climate adaptation, and, now, post-fire policy, all in an effort to provide a third-party evaluation of policy needs and activities and to bring to bear my expertise in science-policy studies and public administration.

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[33] Griscom, B.W., et al. 2017. Natural climate solutions. *Proceedings of the National Academy of Sciences* 114 (44), 11645-11650; doi: 10.1073/pnas.1710465114 https://www.pnas.org/doi/10.1073/pnas.1710465114

[34] Anderegg, W.R., et al. 2020. Climate-driven risks to the climate mitigation potential of forests. *Science* 368 (6497); doi: 10.1126/science.aaz700

[35] Schultz, C.A. 2021. Testimony to the US House of Representatives Natural Resources Subcommittee on National Parks, Forests, and Public Lands. Hearing on "Wildfire in a Warming World: Opportunities to Improve Community Collaboration, Climate Resilience, and Workforce Capacity." April 29, 2021. Available at: https://sites.warnercnr.colostate.edu/courtneyschultz/wp-content/uploads/sites/23/2021/04/Schultz.Testimony.4.29.21.HNRC_.NPFPL_.pdf

I also partner with the Colorado Forest Restoration Institute at CSU, one of the Southwest Ecological Restoration Institutes authorized by Congress in 2004.[36] CFRI has been at the forefront of integrating best available science into local forest and wildfire risk mitigation collaboratives to generate zones of agreement about landscape resilience goals and management strategies, and to quantify the outcomes of management so that managers, partners, and policy-makers can assess the return on investments. CFRI's work contributes to pre-fire forest restoration and risk mitigation, during-fire decision making, and identifying cost-effective investments for post-fire forest and watershed recovery and restoration. For example, in collaboration with scientists at the Forest Service's Rocky Mountain Research Station, CFRI has organized collaborative workshops to define Potential Operational Delineations for wildfire mitigation and response on fifteen national forests across the West. Following the Cameron Peak Fire, CFRI scientists integrated a customized wildfire erosion and sediment transport tool to inform managers about the geographic areas where erosion control measures would have the greatest benefit to downstream water users. This same tool is used by local forest and wildfire risk mitigation collaboratives to identify areas to treat before a fire occurs to reduce post-fire impacts to water infrastructure, which is already at risk due to prolonged droughts. As we face these unprecedented challenges to our systems, understanding the needs at all stages of fire planning is critical.

Members of the new CSU Climate Adaptation Partnership, which we started in 2021 with internal funding support, are researching how to improve the resilience of the built environment to natural disasters, how to support tree regeneration post-fire, and strategies for climate adaptation in rangeland ecosystems. Through this partnership we are growing our capacity to address climate adaptation, developing new interdisciplinary proposals and partnerships, training scientists in outreach to policymakers, and exploring a possible climate initiative at CSU to expand upon our current work.

To further address fire and drought, CSU is part of the Transformation Network, a $15 million National Science Foundation transdisciplinary research effort representing diverse communities, sectors, disciplines, and backgrounds aimed at improving resilience to wildfire, drought, and other climate change disturbances in the Intermountain West, including Colorado. The Network focuses on how headwaters and headwater-dependent systems, regional food-energy-water systems, and innovative approaches to governance can be integrated to help direct Colorado along trajectories that result in a sustainable future for humans and the environment. This work includes close collaboration with Colorado Extension offices, the Northern Colorado Fireshed Collaborative, and watershed partnerships.

CSU researchers also are engaged in examining wildfire impacts on forest ecosystems, snowpack, streamflow, and sediment yield. CSU faculty and students collaborate with the USDA Forest Service Rocky Mountain Research Station and the USDA Agricultural Research Service to examine how forest structure, streamflow, and water quality change after fire. They are coordinating with water providers (City of Greeley, Northern Colorado Water Conservancy District) and other organizations (Coalition for the Poudre River Watershed) to evaluate whether post-fire mulch treatments are effective at reducing flash flooding and sediment loads in fire-affected streams. CSU faculty and researchers are examining the role of pre-fire treatments on wildfire behavior and effects as well as natural post-fire recovery and how to optimize post-fire reforestation efforts. This is done in conjunction with the nonprofit Trees, Water & People, the National Forest Foundation, the US Forest Service, and many private landowners. At CSU, we are growing partnerships with the USDA Climate Hubs. CSU partners with the USDA Northern Plains, Northern Forests, and Southwest Climate Hubs to support grassland and forest adaptation through workshops utilizing the Northern Institute of Applied Climate Science's (NIACS) Climate Change

[36] Southwest Forest Health and Wildfire Prevention Act of 2004 (P.L. 317-108).

Response Framework and Adaptation Workbook to provide practical, on-the-ground options to help land managers adapt ecosystems to changing conditions. Members of the Climate Adaptation Partnership are developing additional proposals to USDA National Institute for Food and Agriculture–Agriculture and Food Research Initiative (NIFA-AFRI) with CSU Extension and the Climate Hubs to address drought.

Extension staff members, with support from the state, recently led a five-part Drought Leadership Training[37] in partnership with the Rocky Mountain Farmers Union, the Colorado Ag-Water Alliance, the Natural Resources Conservation Service (NRCS), the USDA Northern Plains Climate Hub, and the National Drought Mitigation Center. This was a virtual and in-person training, accessed by 700 individuals, geared to retail agriculture, agricultural services, extension, and those working for agriculture-focused agencies/organizations. Topics covered the use of forecasts in drought planning, risk management in drought, and drought management strategies for livestock, range, and cropping systems. The same group of collaborating individuals and organizations is now working on a drought planning handbook for Colorado agriculture and have formed a network across the state of extension, NRCS, farmers, and other individuals trained in drought planning.

CSU also is home to the Colorado State Forest Service (CSFS), which is a service and outreach agency that provides staffing to the Division of Forestry for the Colorado Department of Natural Resources. The CSFS partners with federal and state agencies, tribes, water providers, and private landowners through 17 field offices located across the state. The CSFS incorporated climate adaptive goals, strategies, and approaches in the 2020 Colorado Forest Action Plan,[38] a ten-year strategic plan to guide improving forest conditions, living with wildfire, watershed protection, wildlife habitat, urban and community forestry, and forest products across all political, jurisdictional, and ecological boundaries. The unique position of the CSFS within CSU promoted collaboration on this plan with the Forest and Rangeland Stewardship Department at CSU and the Northern Institute of Applied Climate Science. The CSFS also undertakes actions related to fire risk assessment and helping communities and homeowners prepare for wildfire.

In addition to the work of the CSFS and the Colorado Forest Restoration Institute, the Center for Collaborative Conservation at CSU recently launched the Colorado Forest Collaboratives Network, designed to support Colorado's 40+ place-based forest collaborative groups, which together contribute to much of the state's on-the-ground forest health, wildfire risk mitigation, and watershed restoration work. The network supports these collaboratives by connecting them to information, resources, and one another, and by sharing their stories to make their value and needs understood.

CSU's School for Global Environmental Sustainability (SoGES) has contributed to scientific assessments of the impact of climate change on agriculture and global food security and recently worked with a group of USDA climate hubs and other universities to define a set of indicators of climate change impacts on agriculture, published in 2020.[39] SoGES is also conducting research on the intersection of climate change with soil biodiversity and the impacts of climate change on the hydrological cycle and rainfall patterns.

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[37] https://drought.extension.colostate.edu/drought-leadership-training/
[38] https://csfs.colostate.edu/forest-action-plan/
[39] *Supra* note 12.

Also housed at CSU is the Soil Carbon Solutions Center,[40] whose mission is to harness the power of soil to restore our climate and support a thriving planet. The Center leverages CSU's world-class scientific expertise to build the tools and approaches needed to accelerate the deployment of credible soil-based climate solutions, measure their impacts, and bring them to scale. The Center serves a diversity of stakeholders, including agricultural producers, policy makers, corporate entities, NGOs advocating for better soil management policy, and the broader land stewardship community that relies on science-based information to guide decision-making.

To address sustainable livestock agriculture, CSU is host to AgNext: Real-World Sustainable Solutions for Animal Agriculture. AgNext leverages a recent university-wide initiative in sustainable livestock systems. One major effort of the group is the quantification of greenhouse gas emissions from ruminant animals, with the goals of exploring scalable solutions to reduce methane emissions, recognizing opportunities for carbon sequestration in animal systems, developing practical solutions to reduce GHG emissions, and measuring progress over time. The effort builds a network of allied partnerships, leverages private investment in equipment and in-kind support, and encourages industry adoption. Our College of Agricultural Sciences is also a leader in agrivoltaics innovation, which promises a high degree of positive spillover for economics development and creation of green jobs. The College also is leading work on regenerative agriculture for climate resiliency, emphasizing the science of regenerative agriculture, defining knowledge gaps, encouraging experimental approaches to cropping systems, and translating this work through on-farm demonstration.

The Colorado Agricultural Experiment Station (CAES) is a center of research and extension excellence and an integral part of CSU's College of Agricultural Sciences. The CAES consists of facilities that span the biogeography of Colorado and its climate systems and is researching and supporting the adoption of climate smart agriculture practices, which are essential for achieving sustainable soil health and productivity by factoring regional variability as one of the main characteristics of CSA. More than 100 CAES supported Faculty are engaged in all aspects of this important topic.

CSU also is home to the Partnership on Air Quality, Climate, and Health, whose members are studying a wide range of topics related to smoke from wildfires, including recent and projected smoke trends,[41] smoke health impacts,[42] and effective smoke-risk communication strategies. Researchers are working to expand monitoring of air quality during fire seasons and collaborating with Colorado cities and health departments on improving community messaging during smoke events to encourage the public to take more protective measures.

Also part of CSU is the Cooperative Institute for Research in the Atmosphere (CIRA, CSU's Cooperative Institute with NOAA), which works with satellite imagery to understand climate change impacts. Such university-federal agency partnerships are critical for generating innovative science, workforce training, and cooperative workshops.

The Colorado Climate Center,[43] our state climate office, is housed at CSU and operates a network of 90 weather stations in Colorado's agricultural areas. Many of these stations have now been operating for

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[40] https://www.research.colostate.edu/cip/scsc/
[41] *Supra* note 25 and Ford, B., et al. 2018. Future fire impacts on smoke concentrations, visibility, and health in the contiguous United States, *GeoHealth* 2 (8), 229-247; doi: 10.1029/2018GH000144.
[42] *Supra* note 26.
[43] https://climate.colostate.edu/

over 30 years. This network measures the usual weather variables (temperature, humidity, wind, rain, etc.), and provides critical information about evaporative demand that is used by farmers and water managers for precise irrigation planning. The Center has advanced the science of drought monitoring over the last 15 years through research and real-time analysis of data statewide, monitoring drought conditions and providing recommendations to the weekly US Drought Monitor and the Governor's Water Availability Task Force. The Center is also the headquarters of the Community Collaborative Rain, Hail, and Snow network (CoCoRaHS), with over 20,000 community members who observe precipitation in their backyards. Data from this network of citizen observers is widely used by researchers and drought monitoring experts to track climate conditions across the state.

The Climate Adaptation Program at the Center for Environmental Management of Military Lands (CEMML CAP), housed at CSU, provides interdisciplinary climate change vulnerability assessments for US Air Force installations around the world. In Colorado, CEMML CAP has assessed climate vulnerabilities for integration into the management plans of Peterson Space Force Base, Schriever Space Force Base, Buckley Space Force Base, Cheyenne Mountain Space Force Station, as well as the US Air Force Academy and its associated properties. Each of these assessments highlight issues of extreme heat, drought and wildland fire as primary concerns for military installations in Colorado and impacts to surrounding communities. CEMML CAP staff are responding to Executive Order 14008 by providing climate literacy training to leadership and managers at installations, a key aspect of the Department of Defense Climate Action Plan.

CSU also houses an Energy Institute that has a 30-year history of global impact through developing at-scale energy and climate solutions . Specifically, the Energy Institute: provides support to over 250 faculty within the University's eight Colleges who are developing interdisciplinary energy and climate solutions; manages a portfolio of experiential learning programs for CSU students; organizes and hosts events including the Colorado Climate Transitions Dialogue; delivers programs to support CSU faculty and students commercialize technologies and start companies; and maintains and operates the Powerhouse Energy Campus, the largest freestanding university-based energy research and entrepreneurship facility in the United States. Examples of impactful solutions emerging from the Energy Institute include: a) improvements in the efficiency of large internal combustion engines that has led to emission reductions equivalent to taking tens of millions of automobiles off the road each year; b) through the development of clean cookstoves and small village micro-grids, the Institute and its commercialization partners have improved the lives of millions of people in the developing world; and c) in collaboration with partners across the CSU system, the Institute has successfully launched and/or led more than two dozen cleantech companies over the past two decades with combined annual revenues approaching $100M.

Finally, the One Health Institute[44] takes a transdisciplinary approach to advance health for humans, animals, and the environment and works to solve complex problems at this intersection through research, training, outreach, and advocacy, recognizing the need for multiple disciplines to work together to achieve optimal health outcomes. Their Climate Change and One Health Pilot program awarded funding to research teams working on communication of air quality information, health impacts from temperature extremes under different solar climate interventions, mitigating climate change impacts through virtual livestock fencing, and urban green spaces for pollinators and human health; these teams have gone on to raise substantial external research funding to pursue these topics.

[44] https://onehealth.colostate.edu/

Potential Future Priorities and Investments

To conclude my testimony, I want to highlight a few areas for potential future attention and investment by Congress and potentially this committee. As I have detailed, land grant universities like CSU bring tremendous capacity and expertise related to climate change mitigation and adaptation.

In addition to the work already occurring through USDA and opportunities through USDA NIFA-AFRI, we see potential for scaling up funding opportunities specific to climate adaptation. CSU plans to work with USDA to help shape such a research agenda in the future. We have submitted a proposal to support a NIFA Climate Change Working Group that will use a systematic Horizon Scanning methodology to develop the NIFA Climate Change RoadMap, including an implementation plan.

We also see potential for augmenting funding for land grant–USDA Climate Hub partnerships, perhaps with multi-year funding in a model similar to the US Geological Survey's Climate Adaptation Science Centers, but in this case with funding to support partnerships for agriculture and forest resilience that leverage the Climate Hubs excellent work with the capacity of land grants to contribute in research, extension, and education. Land grants could partner with minority-serving institutions in the region to serve communities through extension partnerships, and to build educational opportunities across states at different levels and institutions to retrain the existing workforce and train and recruit an inclusive, new generation of land managers, scientists, and community liaisons working in agriculture and forestry. Universities also could augment forecasting capacity related to climate change, provide research on the education and communication techniques to reach different communities and groups of people, and provide added fundraising capacity to augment our collective work in addressing climate change. There are also numerous areas that are in need of additional research to support climate change mitigation and adaptation, and, in particular, to avoid maladaptation. We believe our capacities in research, extension, and education would add value and in turn would benefit from stronger partnerships with the Climate Hubs.

There also may be value in exploring authorizing the Climate Hubs as a separate and important program. The recent five-year review of the Hubs identified that "demand for Hubs programs and products is exceeding current capacity" and that there are multiple areas for growth that would augment their existing and effective work.[45] The implications for USDA and long-term funding, however, are beyond my expertise, and would require further discussion with the Executive Branch.

There are also other funding opportunities we see at CSU. The 2018 farm bill established a novel agricultural research funding program within USDA, the Agriculture Advanced Research and Development Authority (AgARDA). Innovative research funded by AgARDA would not only improve biosecurity, but also advance climate smart technologies and production practices that allow U.S. farmers to address challenges related to climate change. While AgARDA has now received its first appropriation of $1 million, reaching the authorized amount of $50 million would support the full potential of this unique research program.

Wildlife disease, which has significant impacts on human health and agriculture, is also susceptible to the effects of climate change.[46] We see a need for funding to coordinate Federal, State, and university

[45] Steele, R., et al. 2019. *USDA Climate Hubs: Five Year Review.* Report prepared for the USDA Climate Hubs Executive Committee, U.S. Department of Agriculture, Washington D.C.
[46] Hofmeister, E., et al. 2010. Climate change and wildlife health: direct and indirect effects. USGS National Wildlife Health Center. Available at: https://pubs.usgs.gov/fs/2010/3017/pdf/fs2010-3017.pdf

responses and resources to identify risks, integrate surveillance information, develop new diagnostic and surveillance tools, and plan for cost effective mitigation responses for outbreaks posing the highest risk to agriculture and human health and safety. We also are looking for additional investments to scale up the work we are doing in climate-smart and resilience agricultural systems, for instance related to work on agrivoltaics and regenerative agriculture. Likewise, CSU is well-positioned to help facilitate collaboration and learning to engage the global agricultural advisory community through the North American Agricultural Advisory Network (NAAAN), which coalesces existing programs and organizations in the United States, Canada, and Mexico. NAAAN serves as a platform for networking, learning, knowledge sharing, and advocacy for agricultural extension programs and service providers in support of three main thematic areas: biodefense and management of natural disasters; climate change with particular emphasis on water management and soil health; and youth and career empowerment.

Regarding investments in forestry, more funding will be needed on an ongoing basis. Many partners are also seeking greater transparency and engagement around how those funds are allocated. I would recommend ongoing oversight and specific attention to how progress is measured at the national level over the next 5-10 years. For years and across administrations, the US Forest Service and its many partners have acknowledged that traditional performance indicators, such as timber volume sold and acres treated, alone do not convey the quality of work in leading to fire risk reduction. Fire risk reduction and forest restoration require more nuanced approaches to performance measurement and accountability, drawing upon metrics like acres mitigated (i.e., acres on which final treatments to complete fire risk reduction actions have been taken) and considering stakeholder insights on whether treatments occur in priority areas, at large enough scales, and are coupled with work across jurisdictional boundaries. This is a complex challenge, but it is time, given Congress' recent investments, to consider how to design and implement more outcomes-oriented performance assessment.

In addition, despite the challenges associated with implementing prescribed fire and the current moratorium on prescribed fire (in light of the escaped fire in New Mexico that has led to the largest fire in that state's history), prescribed fire, cultural burning by tribes, and generally reintroducing fire under the right conditions will be essential to restoring forest resilience in fire-prone forested ecosystems. The challenges of doing so are significant, but we cannot give up on working to reintroduce fire and must seek ways forward that utilize fire as part of our forest management toolbox if we are to maintain resilient forests and communities into the future.

Considering the impacts of a changing climate, the challenge of managing our connected forests, watersheds, and farmlands is monumental in Colorado and across the American West. We must strive to find ways forward in confronting these predicaments if we are to make these landscapes more resilient to the climate change realities that are already upon us. My colleagues and I are ready to assist in this endeavor and greatly appreciate the opportunity to discuss these issues with the committee.

THE WESTERN WATER CRISIS: CONFRONTING PERSISTENT DROUGHT AND BUILDING RESILIENCE ON OUR FORESTS AND FARMLAND

TESTIMONY

Presented to:

Senate Agriculture Subcommittee on Conservation, Climate Change, Forestry & Natural Resources

Tuesday, June 7, 2022

328A Russell Senate Office Building
Washington, D.C. 20510

Presented by:

Tom Willis
Liberal, Kansas

Thank you Chairman Bennet, Ranking Member Marshall, and Members of this Subcommittee for the opportunity to speak in today's hearing on the Western Water Crisis. My name is Tom Willis and I am a farmer in Southwest Kansas. It is an honor to discuss the ways the agriculture industry on the Southern High Plains is managing, conserving, and extending the life of our water resources, particularly the Ogallala Aquifer, in this important production region. I also want to express my appreciation to Senator Marshall for his leadership for Kansas agriculture throughout his time in Congress.

I own and operate T&O Farms in Seward, Finney, and Meade Counties Southwest Kansas. I farm alongside with my son, Joshua, and we grow primarily corn, wheat, soybeans, sorghum, and triticale as well as a cattle operation on 7,500 acres.

I also serve on the board of the National Sorghum Producers and Growth Energy. I am in the value added business as president and CEO of Conestoga Energy, which operates two ethanol plants currently, one in Garden City, Kansas and one in Liberal, Kansas. Altogether, we produce 180 million gallons of renewable bio-ethanol and high quality alcohol, distillers' grains and feed products produced from 60 million bushels of locally-sourced grain—if possible—adding value to farmers' crops. This growing region is unique and it requires farmers to plan extremely carefully to mitigate enhanced risks due to limited water resources.

The High Plains is a harsh climate with precious little rainfall. Add in the heat of the Southern High Plains above ground, and what little rainfall we are blessed with may not stick around as long as it would in cooler latitudes. We continue to see erratic weather patterns with the variability of precipitation becoming increasingly volatile. This volatility is producing longer and more extreme droughts across the Western United States and when rain events occur, they are fast and heavy.[1] According to the U.S. Drought Monitor, my county in Southwest Kansas has been in the most severe extreme-to-exceptional drought categories since January of this year.[2]

Alternatively, below ground, many farmers throughout the High Plains have had the luxury of using the region's aquifer, specifically the Ogallala, to pull up water resources and irrigate their crops. Unfortunately, the Ogallala underneath the Southern High Plains is on an unsustainable, rapidly depleting trajectory. However, voluntary conservation methods, collaborative conservation partnerships, and resource conserving crop rotations are helping to preserve those water resources for both agricultural and municipal needs.

The truth is we cannot grow high yielding corn with half the water. That is why sorghum is a key tool for enhancing the overall sustainability and profitability of my farm. Sorghum, the Resource Conserving Crop™, is a drought tolerant, non-fragile, high-residue crop that conserves soil moisture and prevents soil erosion. Intensifying typical high input crop rotations with sorghum can even allow the entire rotation system to become resource conserving, according to the USDA.[3] Despite the harsh and fragile nature of the High Plains, this region still produces three-fourths of the entire sorghum crop in the U.S.

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[1] https://kwo.ks.gov/docs/default-source/governor's-water-conference/2021-conference/doug-kluck-presentation.pdf?sfvrsn=59cb8014_4

[2] https://droughtmonitor.unl.edu/

[3] https://www.regulations.gov/document/CCC_FRDOC_0001-0413

As farmers may look to expand crop and ecosystem diversity, we must also look to the future of farming through new technologies and improved practices tailored to the region. In addition to precision planting, chemical, and nutrient application, I employ cutting-edge—and sometimes experimental—precision irrigation technologies to do my part in preserving the life of the Ogallala. When used in tandem with drought tolerant crops like sorghum, these technologies enable my farm to maintain overall profitability while using less water. I have made a commitment to sharing my experience utilizing these water conserving technologies broadly by being one of the first Water Technology Farms above the Ogallala Aquifer in Kansas to showcase what these technologies and the crop can do. These water technologies on my farm were funded in part by the State of Kansas. I took the initiative to adopt water technologies early on, primarily because I want to prove that we can conserve water and still achieve profitable yield. But also, I want to pass this farm onto my son, now that he has returned from active duty military service. I believe that because of these two priorities – economic sustainability and multi-generational ownership - that agriculture producers have an obligation to current and future generations to be the best stewards of our land and water.

The best production decisions are informed decisions, and farmers are not short-handed in advanced technologies to support these informed decisions. My farm has a total of 12 irrigation pivots enrolled in the Water Technology Farm program. I also have an index well operated by the Kansas Geological Survey at the University of Kansas on my ground that monitors the static groundwater level on a real-time basis to help characterize local aquifer conditions, as well as a Mesonet weather station operated by Kansas State University that monitors temperature, precipitation, humidity, and wind velocity. In my fields, we utilize soil moisture probes to indicate when and how much to irrigate the crops to maintain plant health and growth. We have retrofitted our irrigation systems to reduce water loss through evaporation, with technologies such as bubblers and mobile drip irrigation and others In addition we use telemetry technology that allows us look underground in real time to see how our irrigation practices are impacting the aquifer.

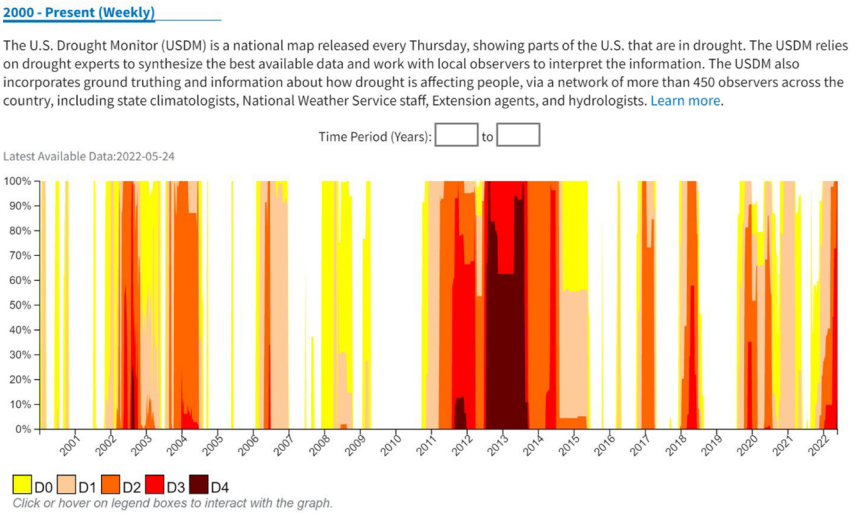
I also participate in the State of Kansas Water Conservation Area, or WCA program, which allows a water right owner in a designated area to develop an approved management plan developed by a with the consent of the Chief Engineer to reduce water withdrawals while maintaining economic value via water right flexibility. Some of the flexibilities WCA participants include the ability to multi-year water usage allocations, the ability to move allocations between enrolled water rights, and allowance for new uses water. I have participated in this Kansas WCA program since 2016, achieving a cumulative water savings of 8,887 acre-feet since my initial enrollment through participation in this program along with utilizing irrigation technologies and relooking at my crop rotations which allow for informed water management resulting in overall water conservation. State programs can offer valuable flexibility that farmers in this region require. As you can see, the agriculture sector has put great time and effort into keeping pace with technology advances, and this data allows farmers to respond to both market and environmental changes.

There is not, however, a federal component to my water conservation efforts. We do not use Environmental Quality Incentives Program (EQIP) or Conservation Stewardship Program (CSP) technical or financial assistance, which have been shown to have a number of regulations and reporting requirements which are not conducive to wide utilization across the High Plains region in Kansas. Increased opportunity for regional input to be accounted for in program implementation guidance could

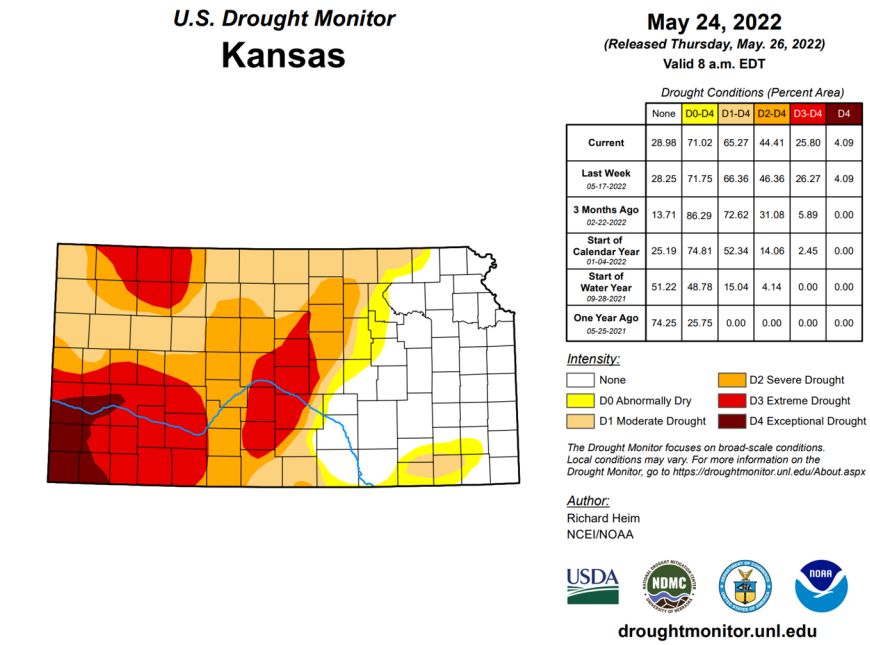
provide an opportunity for increased utilization of these types of federal programs to be utilized while recognizing the regional variability and realities of agricultural production on the High Plains.

These water conservation technologies have come at a cost. These state and local private-public partnerships did help with some of the initial equipment installation – typical of early technology adoption – but I have also been in position to purchase moisture probes and other instruments on my own. At a time when agriculture input costs like fertilizer and machinery are skyrocketing, farmers like myself are scrupulous in considering input costs and reducing those costs to the best of our ability using the best available tool and resources to do so. My experience demonstrates that these technologies help to preserve the Ogallala Aquifer which is necessary to continue my operation into the future.

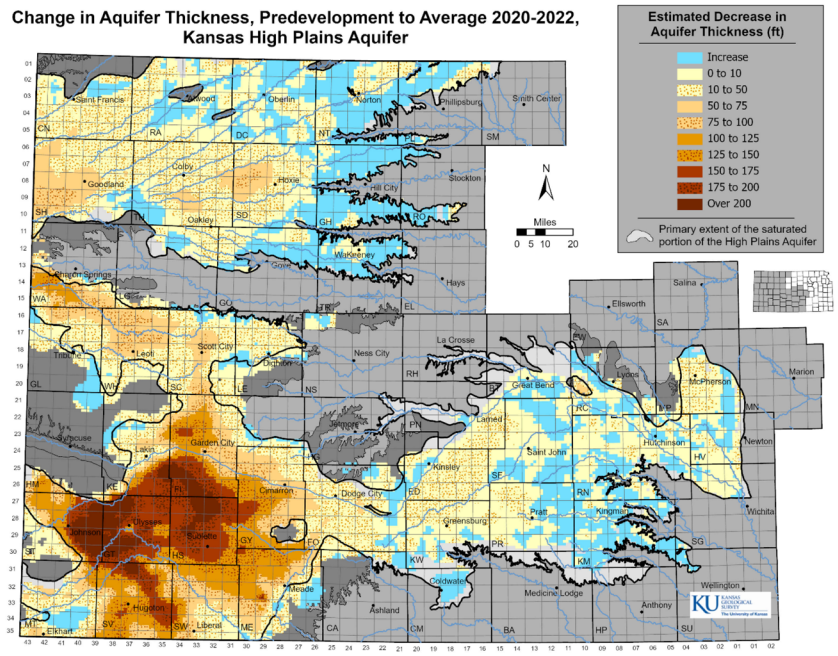
As a farmer on the High Plains, my vision is to make agriculture more sustainable so that future generations can have the same opportunities we have while continuing to do so in a value added and profitable way. The other witnesses on this panel study ground water levels and watersheds. My expertise is agricultural production and commodity markets. But my livelihood and legacy – as are my son's and his son's too, if they decide to stay – are absolutely dependent on a stable water supply. Mr. Chairman, we can do this by adapting new technologies, improving practices and policies, and harnessing the inherent attributes of drought resilient crops, like sorghum. I thank you and the Subcommittee for your time and serious consideration of this critical issue. I am happy to take your questions.



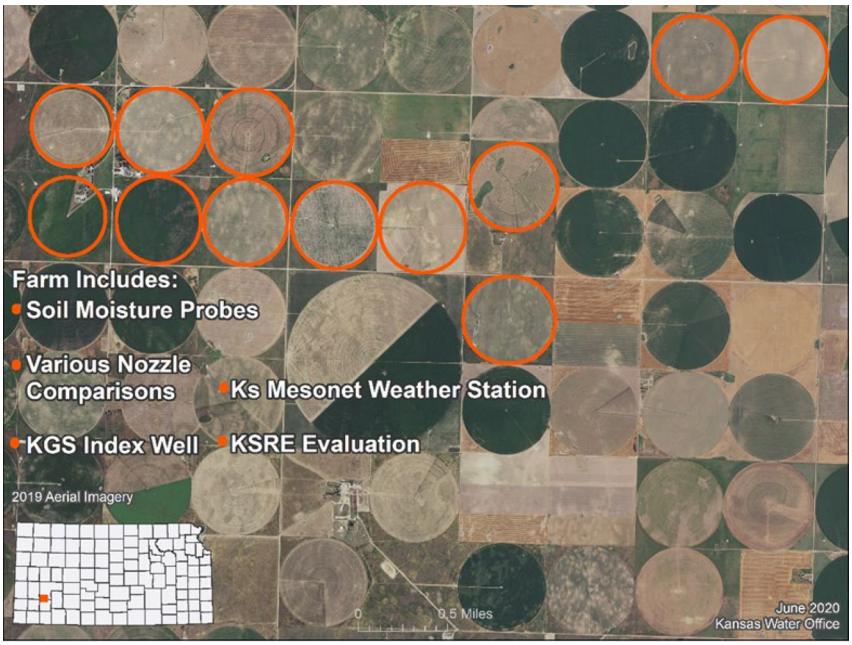
Summary of Drought Conditions, 2000 through 2022 for Finney County, KS. Data from https://www.drought.gov/states/kansas/county/Finney.



U.S. Drought Monitor for Kansas.

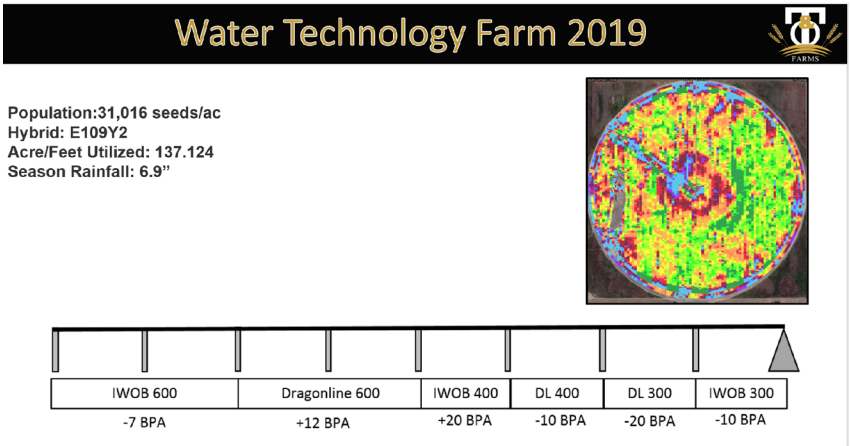


Kansas High Plains Aquifer Changes in Aquifer Thickness. Data downloaded on 5/31/2022 from The Kansas Geological Survey's High Plains Aquifer Atlas, https://www.kgs.ku.edu/HighPlains/HPA_Atlas/index.html.



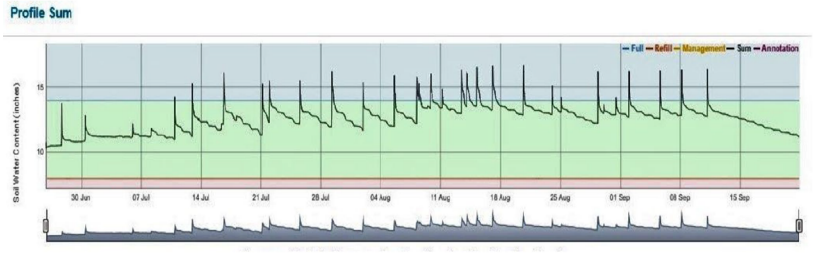
Overview Map: T&O Farms Water Technology Farm

T&O Farms Water Technology Farm Partners Sign



T&O Farms Water Technology Farm: 2019 Growing Season Overview Example

Span 7 600 GPM iWob



T&O Farms Water Technology Farm: Soil Moisture Probe Information

STATEMENT OF DR. ELLEN HERBERT, SENIOR SCIENTIST, DUCKS UNLIMITED, INC.

BEFORE THE UNITED STATES SENATE COMMITTEE ON AGRICULTURE, NUTRITION, & FORESTRY, SUBCOMMITTEE ON CONSERVATION, CLIMATE, FORESTRY, AND NATURAL RESOURCES

CONCERNING:

"THE WESTERN WATER CRISIS: CONFRONTING PERSISTENT DROUGHT AND BUILDING RESILIENCE ON OUR FORESTS AND FARMLAND."

JUNE 7, 2022

Mr. Chairman, Ranking Member, and members of the subcommittee, thank you for having me today. I am Dr. Ellen Herbert, Senior Scientist for Ducks Unlimited. I appreciate the opportunity to testify today on behalf of Ducks Unlimited (DU) regarding the "Western Water Crisis: Confronting Persistent Drought and Building Resilience on our Forests and Farmland." Water is at the center of what we do as an organization.

Ducks Unlimited conserves, restores, and manages wetlands and associated habitats for North America's waterfowl. These habitats also benefit other wildlife and people. We work in Canada, Mexico, and every state of the United States. DU got its start in 1937 during the Dust Bowl when North America's drought-plagued waterfowl populations had plunged to unprecedented lows. Since then, DU has conserved over 15 million acres of important wetland and waterfowl habitat.

With more than a million members and supporters, Ducks Unlimited represents a significant conservation voice for wildlife and the wetlands and habitat that support them. Our work is science-based. We use reliable data from multiple disciplines including wetland ecology, waterfowl biology, hydrology, civil engineering, and landscape ecology to develop, implement and adapt waterfowl conservation actions. We work in partnership with agencies, organizations, farmers, ranchers, and private landowners in the most important landscapes used throughout the lifecycle including breeding migration, and wintering habitats. These kinds of partnerships are essential for efficient and effective conservation, and we support legislation and policy that advances these efforts.

Wetlands can clean water by naturally filtering out sediments, excess nutrients, and other pollutants. Wetlands also capture and hold floodwater and play a vital role in groundwater recharge. Water from wetlands can help replenish underlying aquifers as it slowly seeps into the ground, contributing to deep aquifer storage and maintaining baseflow.

Wetlands are also a great resource for carbon sequestration. More carbon dioxide is removed from the atmosphere and incorporated into vegetation and soil than in either a forest or an upland prairie. A study by The Conservation Fund found that wetlands store 81 to 216 metric tons of carbon per acre, depending on their type and location.

The idea for Ducks Unlimited was born by the winds of the Dust Bowl, in 1937 during a time of unprecedented drought. Initially motivated by sportsmen recognizing a need to address dwindling waterfowl habitat, 85 years later our work continues to benefit wildlife, agriculture, communities, and people in critical landscapes across the continent. Water quality and quantity, agricultural resilience, drought and flood mitigation are among the societal benefits of Ducks Unlimited's wetland efforts.

But the drought issues facing the western United States today are having similar effects on wetlands as in the 1930s. It's clear the current water crisis is contributing to a dramatic decline in wetlands and waterfowl habitat in the Pacific Flyway. The current trend is potentially catastrophic for ducks, but it's also bad news for everything that relies on the multitude of benefits wetlands provide to ecosystems and out communities.

Multi-tasking Wetlands in Colorado

DU's work in Colorado is an excellent example of how wetlands provide value to a wide range of constituencies and sectors of the economy, including wildlife, agriculture, and local communities. Colorado's robust recreation economy accounts for $9.6 billion in value-added GDP annually and generated over 120,000 direct jobs in 2020. More specifically, Colorado has 919,000 hunters and anglers who spend $1.3 billion annually and support 18,693 jobs.

Colorado is part of the Central and Pacific flyways and provides important migration habitat for waterfowl produced in the Prairie Pothole Region. The South Platte River corridor, the San Luis Valley and North Park are key stopover sites that provide foraging and resting areas for migrating waterfowl, sandhill cranes, water birds and shorebirds. In a growing state that is increasingly plagued by drought, these stressed landscapes are under immense pressure from agricultural, municipal and industrial water uses. Ducks Unlimited's wetland augmentation and groundwater recharge efforts along the South Platte have been critical for agriculture, wildlife and local communities. Wetland augmentation projects deliver water to wetlands that provide recharge credits, hunting opportunities and wildlife habitat. Water in the wetlands infiltrates the alluvial aquifer where it returns to the South Platte River over time. Credits are used to cover municipal, industrial and agricultural needs. These recharge credits are important for supporting local economies.

More recently, as water continues to be a precious resource in Colorado, DU is working with NRCS to assist ranchers and other private landowners to restore and improve aging infrastructure on older Wetland Reserve Easements to allow for more efficient uses of water. DU provides technical biological and engineering expertise to help landowners improve and upgrade the management of wetlands in anticipation of less water. It is increasingly important to identify project opportunities where water resources can be used efficiently to benefit many, including waterfowl. The Bijou Ranch project is a great example of DU's multi-tasking work

Located in the South Platte River Basin, the Bijou Ranch project restored more than 200 moist-soil wetland acres that will provide ideal habitat conditions for migrating birds. These wetlands are also used for groundwater recharge, administered through a local irrigation company. The resulting recharge water is then used by nearby farmers to offset pumping of their irrigation wells. The existing WRE site had become degraded over the years from a lack of water control and a major flood. Working with a wide range of partners including NRCS, DU engineered new embankments, water control structures, and rebalanced over 30,000 cubic yards of dirt to achieve the desired outcomes.

Playas Provide Water for Kansas Communities

As the Ranking Member knows too well, the Ogallala Aquifer is being depleted at alarming rates, and drought conditions in western Kansas will only exacerbate this already concerning situation. The communities that rely on the Ogallala are experiencing a decline in groundwater availability to the point

that their future water supply may be limited. Playas are small, round seasonal wetlands found in western Kansas and across the Southern High plains. They are a primary source of groundwater recharge and provide important, year-round habitat for birds and other wildlife. In Kansas, playas contribute 95% of the water flowing to the Ogallala aquifer, the largest aquifer and the United States and the single most important source of water in the High Plains region.

Because the playas of western Kansas are primarily located on private lands, USDA voluntary conservation programs are critical to maintaining this important resource. For the past several years, DU has partnered with NRCS and other public and private partners to provide a series of free workshops to educate and inform agricultural producers of USDA programs available for playa conservation.

The most recent and significant of these programs is the Groundwater Recharge and Sustainability Project (GRASP). NRCS has invested $1.4 million in this project through its Regional Conservation Partnership Program, with an additional $1.5 million in contributions from a diverse group of partners all concerned about the aquifer, including Ducks Unlimited, Greeley and Wichita County Conservation Districts, Kansas Water Office, and local county and municipal governments. GRASP will help producers with voluntary irrigation conservation and efficiency efforts and playa restoration to increase groundwater recharge. Financial and technical assistance will be available for managing irrigation water, implementing alternative crop rotations, converting to dryland systems, and restoring playa wetlands. Short term annual rental payments will also be available for lands devoted to playa restoration activities. Healthy, functioning playas improve the quantity and quality of water flow into aquifers. In dry landscapes such as these, playas are also the main source of water for migrating waterfowl and shorebirds as well as resident prairie birds. These playas support 185 bird species as well as other wildlife. Based on available data, there are approximately 2,690 acres of playas in Wichita County and 2,360 acres of playas in Greeley County. GRASP will focus on playa conservation and restoration efforts near municipal and domestic water wells, supporting recharge where it is needed most. As a result, high quality water will reach the aquifer that can be used by Kansans for generations to come.

Another win-win program for wildlife and producers in Kansas is the Conservation Reserve Program (CRP) Migratory Birds, Butterflies and Pollinators State Acres for Wildlife Enhancement (SAFE) practice. The Migratory Birds SAFE program uses a competitive bid process where landowners submit an offer to enroll their playa acres into the program for an amount, they are willing to accept. Offers compete within one of the three designated areas of Western Kansas, and no more than half of the offers from one area will be accepted during each ranking period.

The purpose of CRP SAFE is to restore playas to their proper function, providing benefits that include improved water quality, water recharge for the Ogallala Aquifer and habitat for migrating waterfowl, cranes, and shorebirds. Playa restoration is reversing past modifications to playas by removing accumulated sediment, filling drainage features, redirecting water back into the playa, and protecting the playa with a buffer composed of native vegetation. The response from private landowners has been positive – in less than two years, over 11,000 acres of playas and buffers have been restored with Migratory Bird SAFE. DU has cost-shared on over 2000 acres of playa restoration to date, with more to come.

Importance of Working Agriculture to the Pacific Flyway

With the continuing drought in California, there is expected to be a drastic decrease in planted rice acres in the Central Valley of California. Nearly 250,000 acres are expected to go fallow this growing season, cutting rice acres in half. Outside of the obvious devastation this will cause for producers, this drop in planted rice acres and subsequent lack of flooding fields post-harvest will greatly reduce the habitat options for migratory birds that have come to rely on water made available through these practices. These flooded rice fields provide nearly 50% of the food resources for waterfowl. As the saying goes, what's good for rice is good for ducks, and in this instance what's bad for rice is certainly going to be bad news for ducks as well.

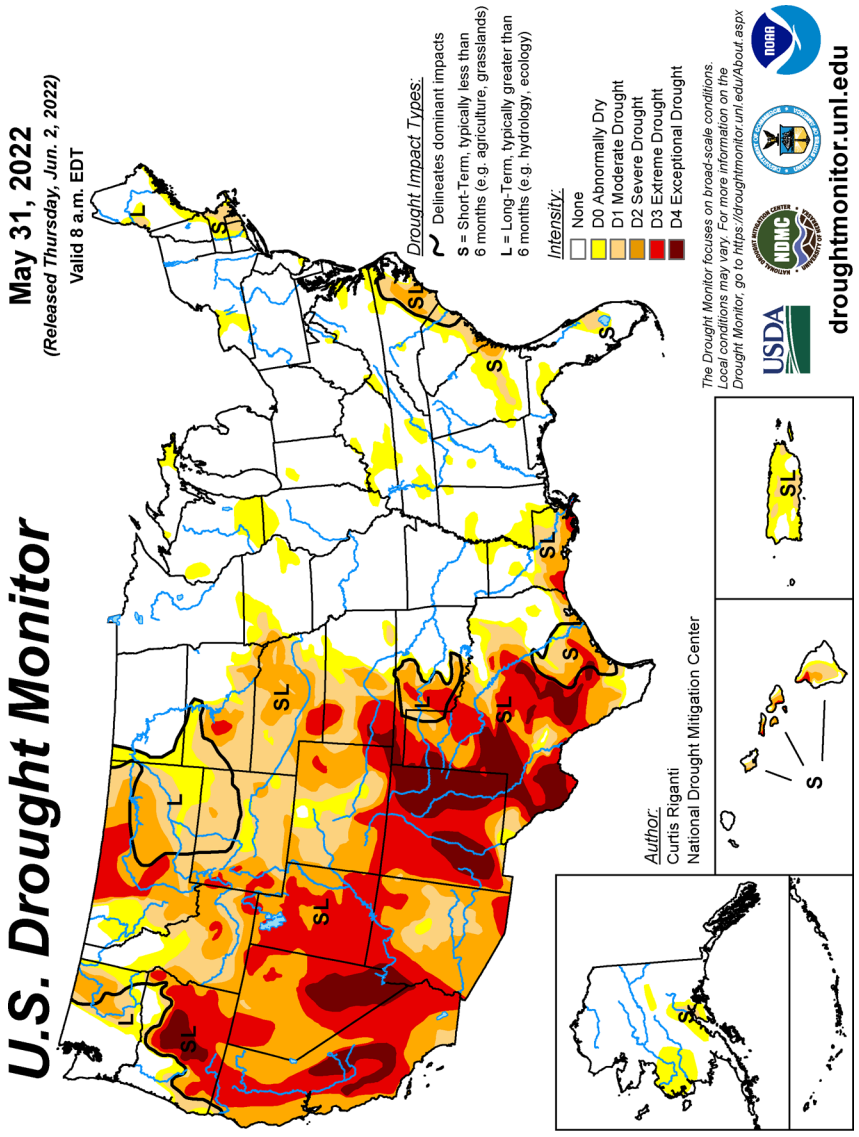
As water problems increase in California and elsewhere producers are having to come up with innovative ideas to help solve this problem. One such project is California Rice Commission's salmon habitat pilot project where techniques are being developed to use winter-flooded rice fields to help grow stronger salmon. Great results from 2020 field work showed a four-fold increase of rice-field reared salmon making it safely to the ocean over control (river/no rice field rearing) salmon. Working collaboratively will be paramount as water quantity and quality issues persist.

Llano Seco Ranch, the last intact Mexican land grant in California, is in Butte County and consists of 18,434 acres of public lands and privately owned ranchlands, crop lands, wetlands, oak woodlands, grasslands and riparian habitats that provide multi-benefit habitat to waterfowl, shorebirds, and at least 38 special-status fish and wildlife species, such as greater sandhill crane and the state and federally threatened giant garter snake. The project will replace a dysfunctional water conveyance system (including two 60-inch redwood siphons and 11.2 miles of canals) to restore water delivery to 2700 acres of ag lands and 4500 acres of wetlands. The system is currently wasting over 40% of the water funneled through it.

Thank you for giving us the opportunity to provide information on Ducks Unlimited's work in drought-stressed landscapes. We look forward to continued collaboration with diverse partners as we all seek innovative solutions to the impacts of drought on agriculture, wildlife, recreation, and communities across the country.

DOCUMENTS SUBMITTED FOR THE RECORD

JUNE 7, 2022


U.S. Drought Monitor
May 31, 2022
(Released Thursday, Jun. 2, 2022)
Valid 8 a.m. EDT
Drought Impact Types:
Delineates dominant impacts
S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)
Intensity:
None
D0 Abnormally Dry
D1 Moderate Drought
D2 Severe Drought
D3 Extreme Drought
D4 Exceptional Drought
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to https://droughtmonitor.unl.edu/About.aspx
Author:
Curtis Riganti
National Drought Mitigation Center
USDA
droughtmonitor.unl.edu

Colorado Association of Wheat Growers

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The Colorado Association of Wheat Growers (CAWG) welcomes the opportunity to comment on the ongoing water crisis in the West. Colorado wheat farmers plant over 2 million acres of wheat each year, much of it on land that is more productive than rangeland but less productive and more erodible than the land used for corn and other row crops. From 1981 – 2001, Colorado averaged 91 million bushels of wheat production annually; from 2002 – 2022 that has dropped to 71 million bushels of annual production. Several factors are at play in this trend, but severe drought years encountered in 2002, 2004, 2013, 2020, and now again in 2022 certainly contribute to the lower production.

Over the past 20 years, Colorado wheat farmers have embraced no-till or minimum-till farming across many acres. The ability to use pesticides such as glyphosate to control weeds, rather than tillage, has enabled them to save more water and plant more intense crop rotations. This has included switching from wheat-fallow rotations to wheat-millet-fallow and wheat-corn-fallow rotations. More intense rotations not only provide the opportunity for better farm income, they also increase surface residue. Getting more residue onto the soil surface, and preserving it by avoiding tillage, has many benefits, including less runoff, less wind erosion, and greater soil shading.

The other major factor affecting soil health on Colorado wheat farms is the wheat stem sawfly. This insect pest cuts the stem of the wheat plant just prior to harvest, causing the plants to fall over. In order to harvest the wheat, farmers are forced to set their combine headers very low to the ground. This practice has reversed decades of maintaining taller wheat stubble that was beneficial for soil organic carbon levels and preventing wind erosion. Fields that have been hit by wheat stem sawfly often are left with little to no cover after harvest, leading to a vicious cycle of less snow capture, lower soil moisture levels, and smaller succeeding crops.

It may sound odd to those not intimately involved with wheat, but the two biggest factors for Colorado wheat farmers to mitigate the water crisis are maintaining the use of safe, approved pesticide like glyphosate, and finding a way to fight wheat stem sawfly. We could use help on both at the Federal level. Every year it seems safe pesticides come under attack to be removed from the market. Recently, on May 10 the Solicitor General submitted a brief to the U.S. Supreme Court advising the Court against hearing a case, arguing that federal pesticide registration and labeling requirements do not preclude states from imposing additional labeling requirements, even if those requirements run counter to federal findings. The Solicitor General's brief adopts a position that permits states to mislabel glyphosate, or any pesticide, with cancer warnings despite overwhelming scientific evidence that it does not pose a cancer risk. A pesticide bill proposed in the Colorado legislature this past session (but eventually not passed) also attempted to do away with state preemption, which would have allowed a patchwork of county-by-county regulations. Actions such as these threaten our ability to maintain no-till systems that preserve water in dryland settings. For wheat stem sawfly, we are actively investing in research that will address the pest from a genetics standpoint. However we could use some help in the form of additional research dollars at the Federal level to bolster our efforts, which we fear will not be enough over the long term to defeat the pest on our own.

Wheat farmers in Colorado know better than anyone that rain or snow is the best prescription for an ailing crop. We can't make it rain, but we can preserve the rain that does fall to the best of our ability if we can continue to use the tools we've developed over the past two decades.
Thank you for your consideration.

Senator Michael Bennet
United States Senate Committee on
Agriculture, Nutrition & Forestry
562 Dirksen Senate Office Building
Washington D.C. 20515

Re: The Western Water Crisis – Confronting Persistent Drought and Building Resilience on our Forests and Farmland

The drought in the American West extends far beyond the nationally covered stories of low water levels at Lake Powell and Lake Mead. While those storage and power production facilities are of huge import to the Colorado River Basin States, drought in the West has a much broader reach.

The Colorado Water Congress appreciates the convening of this hearing, Senator Bennet, and is grateful for the strong working relationship we have with you and your staff both in Washington, D.C. and here in your home state. We ask that you include our statement in the hearing record.

Colorado is a headwaters state. All streams and rivers flowing in Colorado ultimately leave our state to neighboring states. The public impression may be that we are all mountains, with ample snowpack to supply our state and to 18 other states and Mexico through nine interstate compacts, an international treaty, and two Supreme Court equitable apportionment decrees requiring us to share resources which have their origin here.

But we are also a plains state. Eastern Colorado is not mountainous, but high plains. It is home to a tremendous amount of agricultural production, some irrigated and some dry land, as well as ranching.

Whether in the headwaters, on the plains, or in high valleys like the San Luis, drought exists, and has immediate impact and poses future threats. In 2020, 400,000 acres burned in the Arapahoe Roosevelt National Forest, and more burned in other high elevation forest lands. Just a month ago, an 8,000-acre grassland wildfire swept across a ranch in the high plains of southeastern Colorado in a matter of hours, taking an enormous toll on a ranch which strived to integrate sustainable ranching with sustainable wildlife habitat, particularly for birds. And on the eve of this new year, a fast-moving fire in the urban corridor in Denver burned 1,000 homes. All these fires in diverse locations are related to drought.

A changing climate has a clear role in all these fires, high in the Rockies or on the plains. It is critical that Congress work with the forest service, states and with local stakeholders to develop better policies and practices to mitigate catastrophic fire and to quickly restore the devastated landscapes and communities.

Your subcommittee can be the agent of change. It can inspire legislative proposals which will simplify and streamline processes for dealing with all three aspects of fire related to ongoing drought conditions. Fires often cross federal and state jurisdiction. They often cross public *and* private lands. While the fire may occur in a national forest or on a national grassland, the post-fire impacts on water and soil quality must be recognized and addressed with stronger financial investment at the federal level, and with more robust partnerships with state natural resource agencies and with local water providers. Delivery of funds and services to address all aspects of drought-related fire (even those events caused by human activity or lightning in overly dry areas) must be faster and predetermined. State and local entities must be able to work across agencies with a process that works for all agencies to achieve common-sense efficiencies.

Partnerships to employ small, medium, and large forest and watershed projects must be expanded and encouraged.

As you consider the upcoming farm bill, we urge you to continue to support the Collaborative Forest Landscape Restoration Program (CFLRP) and the Water Source Protection Program. As communities across the country struggle with the impact of severe fire seasons, now is the time to fully fund these programs.
The CFLRP has a proven track record in improving forest health, mitigation wildfires, and supporting rural economies. The CFLRP has reduced the risk of megafires on more than 2.9 million acres. In Colorado, collaborative forest projects support local jobs, improve wildlife habitat, and reduce hazardous fuels in critical watersheds. These projects bring together local governments, timber and utility stakeholders, and conservation groups. This community-based approach recognizes the importance of local knowledge when it comes to forest management.

The U.S. Forest Service Water Source Protection program builds on partnerships between cities, businesses, water utilities, farmers and ranchers, and the Forest Service to provide matching funds for forest health projects on lands that provide water resources for downstream users and calls for USDA Forest Service to carry out watershed protection and restoration projects on NFS lands through water source investment partnership agreements with water users.

Let's turn now to agricultural conservation programs which are intended to assist producers and state and local water agencies to address what has become an almost constant shortage of water supply.

We have two major agricultural producing regions in Colorado which have Conservation Reserve Enhancement Programs (CREP) with the U.S. Department of Agriculture, and other areas utilize programs like the Environmental Quality Incentives Program (EQIP) and Regional Conservation Partnership Program (RCPP). These programs serve our producers and our environment well and should be maintained and enhanced in the upcoming farm bill. All three require a financial partnership between producers and local stakeholders and the USDA, and that partnership includes self-assessment, state support, and reliable federal investment.

It is critical, as drought drives further interest and enrollment in these conservation programs, that the establishment of rental rates paid by the federal government be prompt and consistent in their criteria. Without knowledge of the federal share to be paid it is difficult for producers to determine the wisdom of enrollment. And without certainty that the rental rate will be consistently applied, the usefulness and effectiveness of the programs as a tool in addressing water shortages and drought is significantly diminished.

Colorado cannot manage what it cannot measure, particularly as the hotter and drier climate is shifting rain and snow patterns, aquifer sustainability, and runoff timing and volumes. There is no room for waste in these dry times. Federal investments in emerging technologies for water measurement and water supply forecasting, including high-tech and comprehensive soil moisture monitoring, airborne snoe observation, and expanded stream gauging will aid in the optimization of water use as persistent drought undermines the security of our water supplies and the health of our streams.

The Colorado Water Congress and its members understand that this hearing is just one step in the effort by you and the Committee to identify the many challenges of ongoing drought, and to meet those challenges with immediately effective, cost-efficient, and long-term, uninterrupted programs and policies which the federal agencies, state and local entities and public stakeholders can count on.

We look forward to working with you and to providing you and the Committee with any resources our membership can provide to meet those challenges.

Sincerely,

Douglas Kemper
Executive Director

Andy Colosimo
Federal Affairs Committee Chair

Testimony of Dan Keppen
Executive Director
Family Farm Alliance

Before the
Committee on Agriculture, Nutrition and Forestry
Subcommittee on Conservation, Climate, Forestry and Natural Resources
United States Senate
Washington, D.C.

"The Western Water Crisis: Confronting Persistent Drought and Building Resilience on our Forests and Farmland"

June 7, 2022

Good morning, Chairman Bennet, Ranking Member Marshall and Members of the Subcommittee.

My name is Dan Keppen, and I am executive director of the Family Farm Alliance (Alliance). I thank you for this opportunity to share this testimony on the current drought conditions in the Western U.S. 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.

Today's hearing could not come at a better time. Americans are facing rising food costs and global famine looms on the horizon. Amid concerns of higher food prices and growing concerns of a looming global wheat shortage, the recent national infant formula shortage has further underscored the importance of a strong national domestic food supply system.

Meanwhile, our own government has voluntarily withheld water from producers in places like the Central Valley, Central Oregon and the Klamath Basin. Many Family Farm Alliance members are bracing for the second straight year of severe drought and unprecedented water shortages.

The Western drought continues, with no real federal policy action other than to limit irrigation supplies to farmers and residents. Major reservoirs in California and along the Colorado River have reached or are approaching historic lows, threatening the ability to generate hydropower, particularly at Lake Powell, behind Glen Canyon Dam. In the Rio Grande Basin, New Mexico's Elephant Butte Reservoir is less than 13% full. Our farmers and ranchers that are largely responsible for keeping the nation's grocery store aisles stocked are being forced to leave fields fallow or reduce livestock herds.

At this critical juncture, I truly appreciate this opportunity to share my observations and recommendations to help our communities in the face of this crisis.

Overview of the Western Drought

This testimony focuses on this year's drought – an unprecedented disaster for many farmers and ranchers, their families and rural communities across the West. At a time when Western water projects are typically operating at full strength, with delivery canals charged, bringing essential water supplies to the headgates of thousands of Western farmers and ranchers, crushing drought conditions are once again leaving millions of acres of productive farm and ranch land without water this spring. Many of our farmers and ranchers this year are going to be hit hard by this "unprecedented" drought, the second straight year we've used the term "unprecedented" when describing the Western drought.

Some of our producers in the Great Plains and the northern Rocky Mountains saw some recent relief when heavy precipitation fell across much of the contiguous U.S. in late May. Improvements to drought conditions were widespread in the Great Plains, with parts of central Kansas seeing two-category improvements to conditions, according to the U.S. Drought Monitor.

Despite the improving drought conditions, agricultural problems continued in the region. Winter wheat harvest potential in Kansas was reduced by over 25%, while conditions are too wet in parts of Montana and the Dakotas for planting spring wheat. Impacts from the widespread drought include reduced grazing for cattle in New Mexico due to wildfire closures in national forests and hydropower production concerns at reservoirs in Nevada and California due to very low water levels.

In California, the state's two largest reservoirs are at critically low levels moving into the dry season with Shasta Lake currently at 40% of total capacity on June 2 and Lake Oroville at 46% of capacity on May 26. In the Rio Grande Basin, New Mexico's Elephant Butte Reservoir is less than 13% full.

The Colorado River Basin is in its 21st year of drought and its reservoirs will end up at their lowest levels since they were initially filled. Central Arizona farmers are facing water cuts resulting from the first ever shortage declaration, and the most recent modeling shows increasing risk of reaching additional critical levels at Lakes Powell and Mead. The drought impact on Western irrigated

agriculture is not limited to the water, either. Reduced hydropower generation and the high cost of replacement power is threatening to cause double digit percentage power cost increases to millions, including many farmers and non-agricultural users. In the midst of the numerous challenges caused by the ongoing drought, efforts are underway to renegotiate new interim operating guidelines in advance of the expiration of the "Interim Guidelines for the Lower Basin Shortages and the Coordinated Operation for Lake Power and Lake Mead (Interim Guidelines)" in 2026.

Dire challenges are being faced by agricultural water users in California's Central Valley, the Klamath River Basin in California and Oregon, the Columbia River Basin and its tributaries in Idaho, Oregon and Washington, the Rogue River Basin in southern Oregon, the Colorado River watershed, and the Great Basin.

Water users in nearly every region of the West are scrambling, looking for creative ways to stretch scant water supplies. In mountain watershed areas from the Sierra Nevada to the Rocky Mountains, the driest of conditions have prevailed. Water supply forecasting has been an incredible challenge, and much of the meager runoff has been consumed by dry upstream soils. These severe drought conditions, coupled with the arid nature of many parts of the West, again make for a trying, shortened water year.

Drought Challenges

The current drought crisis underscores some key concerns:

1. **Water infrastructure is needed to protect future water supply reliability.** A national coalition of over 220 organizations last year urged Congress to include Western water infrastructure provisions in any potential infrastructure or economic recovery package. Congress has clearly heard and acted on our coalition's request.

2. **Water management in the West is becoming too inflexible.** Water users served by Western federal water projects – including but not limited to – California's Central Valley Project, the Klamath Project, and Oregon's Deschutes River Basin - are facing "regulatory droughts" as well. We need a new way of looking at how we manage environmental demands for our limited water resources. We need a broader view of how water is used and managed to meet environmental needs, one that considers state water laws, population growth, food production and habitat needs.

3. **Fierce Western wildfire disasters are becoming an annual occurrence.** This underscores the importance of improving on-the-ground management and restoration actions that can lead to improved forest health, which benefits every Western watershed's water supply capability.

4. **Now is the time for collaboration, not confrontation.** Now more than ever, ag producers, tribes and conservation groups need to come together to provide locally driven solutions.

> If we don't, the public policies and resource management strategies that we need to maintain a viable and sustainable rural West will be impossible to achieve.

Western farmers and ranchers faced a brutal growing season in 2021 as drought conditions drastically reduced water deliveries. Many were forced to make difficult decisions about the future of their operations. Cattle ranches and dairy farms liquidated their herds as they ran short of feed and water. Some farmers were forced to tear out certain crops to plant less water-intensive ones. Others let their fields lie fallow.

There are many other impacts that crop up when once-reliable surface water supplies are no longer available. Most importantly, no water for a farmer means no crops, no food, and a very limited ability to take care of his/her family. Farmers have mortgage payments, property taxes, irrigation district assessments and equipment payments. Many producers have production contracts that they have worked years to achieve and retain. If producers cannot deliver on those contracts, those contracts are lost.

We're losing farm workers, who are not only great employees but are long-time, valued members of our rural communities. The impacts of shutting down agriculture further causes harm to ag supply businesses. The drought also hits businesses on Main Street in the rural West.

We're seeing devastating impacts to the environment. In some agricultural areas, the wildlife – particularly the waterfowl - that rely on the canal system, ditch banks, and irrigated fields are simply not there anymore. Dust storms – coupled with the horrific air quality we are seeing from our burning forests – pose health risks to farmers, workers and the general public.

When surface water supplies diminish or disappear, farmers sometimes turn to groundwater, if they have access to it. In some areas, canal water is a prime source of clean recharge for shallow domestic wells. That's not happening this year where the canals have been left bone dry. Increased groundwater pumping to replace lost surface water will continue to draw down groundwater levels. Thousands of domestic wells in the San Joaquin Valley, the Klamath Basin, and elsewhere dried up last summer. Many households continue to rely on bottled water to drink. Rural residents who don't even farm are having to stay with family and friends to shower and wash clothes.

Drought Solutions

There are things that Congress and this subcommittee can do to alleviate this disaster and better prepare and manage for future droughts. Federal investments in improving and building new water supply infrastructure - partnering with the Western states and non-federal water users - can help prevent or reduce the impacts of future droughts. Moving away from knee-jerk single species management to collaborative watershed-based approaches that respect all uses will help prepare Western water stakeholders for a more predictable and secure future. We need to act, and act now to accomplish these tasks.

Perhaps the only silver lining is that this unprecedented drought crisis will hopefully draw public and political attention to Western agriculture's critical role to provide a quality food supply, boost the national economy, and continue the country's stature as the world's premier food basket. We can only hope that this leads to necessary, reasonable policies that support farmers and investment in rural communities, including water infrastructure and increased water-storage capacity. The Family Farm Alliance and other Western agriculture and water organizations believe the drought underscores the urgent need to take immediate action to help better manage impacts to water resources from drought in the West.

Western irrigated agriculture has been dealing with changes in climate and hydrology for over a century. But the prognosis for our water supplies in the future is not positive and will continue to negatively impact this important source of our Nation's food supply, the economic engine for most of our rural Western communities. Coupled with the growing demand for existing water supplies from burgeoning cities and the environment, irrigated agriculture is fast becoming a target for one thing – water. The Alliance believes we must look to several solutions in order to maintain food security for the nation and economic wellbeing of the Western landscape:

- Invest in Western water infrastructure – new water storage and improved conveyance facilities, groundwater recharge, water conservation, water management improvements, water reuse and desalination can all help alleviate the stress on our existing water supplies, especially for agriculture in the growing West;
- Invest in technology – we must manage our water supplies better – more efficiently and effectively use technology to improve the modeling and predicting weather patterns, snowpack, and runoff forecasting, as well as using technology to manage our water storage and distribution to improve efficiencies in utilizing our precious water resources; and,
- Improve regulatory processes at the federal level to expedite permitting and get projects to construction within a reasonable period of time at a reasonable cost, as well as create collaborative partnerships between federal, state and local entities interested in finding solutions to our water-climate problems through adaptive strategies that can work on the ground.

Congress has helped this past year by passing the *Infrastructure Investment and Jobs Act* (IIJA), which includes more than $8 billion for projects that will enhance water supply reliability across the West, including repairing aging dams and canals, building new surface and groundwater storage and conveyance facilities, funding water conservation and recycling projects, and improving watershed and ecosystem management. The Western water provisions included in this legislation represent a once-in-a-generation federal investment that will bolster our aging water infrastructure and keep water flowing to our nation's farms and ranches. It will also improve our ability to provide water supply reliability for cities and the environment in future droughts. The package both aligns with the solutions water managers across the Western United States have requested for years and provides a balanced package of tools that local and regional managers may select from to best resolve the water needs and challenges in their local communities.

There is a need for short-term action, as well. We are just moving into the dry portion of another serious unprecedented West-wide drought year. Preparing for this requires a level of reaction that is immediate and sustainable. We recommend a fast-track response capability from the U.S. Department of Agriculture (USDA) and Interior Department that enables a localized response by farmers and ranchers. Farmers and ranchers need programs through their local Natural Resources Conservation Service (NRCS) offices to assist with the purchase of infrastructure including solar panels, pipeline materials, well-drilling, tanks, gated pipe and projects to develop water. Such projects can benefit wildlife and wetlands as well as food production. An immediate and local response is imperative.

The State of Western Forests

Wildfires have already burned more than a million acres of land in the U.S. this year and the months ahead present significant fire potential to all or parts of more than a dozen states. Areas where multiple large wildfires are already burning – including parts of the Southwest, Rocky Mountains and Plains – remain at the greatest risk heading into summer due to ongoing drought and abundant fire fuels such as dried out vegetation, according to the latest wildfire outlook released last month by the National Interagency Fire Center.

Increasingly fierce Western wildfire disasters are becoming an annual occurrence and underscore the importance of improving on-the-ground vegetation management actions that can lead to improved forest health. Improving the condition of our nation's forested lands is of primary importance to water providers. National Forest lands are overwhelmingly the largest, single source of water in the U.S. and, in most regions of the West, contributing nearly all the water that supplies our farms and cities. In addition, our already fragile water infrastructure can be severely damaged or rendered useless by fire and post-fire flooding and debris flows. Burned areas hold no water at all, leading to floods, erosion, and mudslides. It also increases turbidity in the streams flowing through our watersheds. The unhealthy state of our national forests, which were initially reserved specifically to protect water resources, has led to catastrophic wildfires that threaten the reliability, volume, and quality of water for tens of millions of Americans, along with the wildlife, recreational, and multi-purpose values of these lands.

Our great Western forests are damaged and diseased. This came about through a perfect storm of neglect, misguided litigation, lack of use of science, strained management budgets, and, of course, climate change. We can have no doubt that the West is warming, and some places are warming more rapidly than past modeling has predicted. Insect outbreaks have weakened and killed trees. Violent winds have brought these trees down providing an abundant source of fuel. Drought and forests cluttered with dead fall timber serve as a tinderbox for increasingly intense and devastating fires. Our National Forests in the Rocky Mountain Region are suffering from climate-driven lack of function. The inability to develop a logical management strategy has led to these consequences: catastrophic fires, lack of wildlife habitat and critical interruption of our water supply.

Western Wildfire and Forest Health Challenges

Today's wildfires are often larger and more catastrophic than in the past. Some of the blame can be attributed to climatic conditions, like reduced snowpack in alpine forests, prolonged droughts and longer fire seasons. Western population growth has also played a role, since we now have more homes within or adjacent to forests and grasslands. However, decades of fire suppression and inability to manage our forests through controlled burns, thinning, and pest/insect control probably play an even bigger role. Where California now has about 100 trees per acre, it once had about 40 trees / acre.

Much of last year's media coverage on the fires raging in Northern California featured commentary from politicians, environmental activists and academics who point to climate change as the driving factor behind the fires that have forced tens of thousands of Westerners to flee their homes. Climate change concerns may certainly be shared by some rural Westerners who live in once-thriving timber dependent communities. However, there is also a growing frustration that forest management – or rather, the perceived lack of management by federal agencies, driven in part by environmental litigation – fails to get the attention it deserves in many media accounts of the current Western wildfire infernos.

Some of us who live in rural Western communities who have watched the condition of federal forests deteriorate in recent decades have a different perspective. We have witnessed how federal forest management actions have been hampered in recent decades, in part due to environmental lawsuits initiated by certain activist groups. We encourage the Subcommittee to listen to the men and women on the ground regarding the urgency of implementing forest restoration and management.

1. National Environmental Policy Act (NEPA) Processes Associated with Forest Health

The U.S. Forest Service (Forest Service) is not fully meeting agency expectations, nor the expectations of the public, partners, and stakeholders, to improve the health and resilience of forests and grasslands, create jobs, and provide economic and recreational benefits. The Forest Service spends considerable financial and personnel resources on NEPA analyses and documentation, as well as environmental litigation.

In recent years – catalyzed by the ominous increase in Western wildfire activity – we have worked with other organizations, seeking ways to discourage litigation against the Forest Service relating to land management projects. We have supported efforts to develop a categorical exclusion (CE) under NEPA for covered vegetative management activities carried out to establish or improve habitat for economically and ecologically important Western species like elk, mule deer, and black bear. Thus, we have advocated for expediting and prioritizing forest management activities that achieve ecosystem restoration objectives.

Reforming the Forest Service's NEPA procedures is needed at this time for a variety of reasons. An increasing percentage of the Forest Service's resources have been spent each year to provide for wildfire suppression, resulting in fewer resources available for other management activities, such as restoration. In 1995, wildland fire management funding made up 16 percent of the Forest Service's annual spending, compared to 57 percent in 2018. Along with a shift in funding, there has also been a corresponding shift in staff from non-fire to fire programs, with a 39 percent reduction in all non-fire personnel since 1995.

Additionally, the Forest Service in 2019 had a backlog of more than 5,000 applications for new special use permits and renewals of existing special use permits that are awaiting environmental analysis and decision. On average, the Forest Service annually receives 3,000 applications for new special use permits. Over 80 million acres of National Forest System land need restoration to reduce the risk of wildfire, insect epidemics, and forest diseases[1].

2. <u>Forest Management Impacts on Upper Watershed Water Supplies</u>

It is hard to overstate the importance of snowmelt as a source of fresh water in parts of the Rocky Mountain West, and great attention is paid to ecosystem water cycles in this region. Some of the snow that falls in the mountains goes directly from crystalline snow to water vapor, bypassing the liquid water phase. This phenomenon – sublimation – accounts for the loss of a large portion of the snowfall during the winter months in the Rocky Mountains. Snow intercepted by tree branches sublimates the fastest, often disappearing within a few days of a snowfall. Recently published work by the Rocky Mountain Research Station[2] (RMRS) teases apart how the loss of spruce canopy affects the sublimation rates for snow both in the canopy and on the ground in these ecosystems. These findings have some important implications to snow interception and retention.

Two years ago, Family Farm Alliance President Pat O'Toole, whose family owns and operates a cattle and sheep ranch on the Colorado-Wyoming border, testified before the Senate Energy and Natural Resources Committee. President O'Toole referenced the Forest Service's figure that 160,000 acre-feet (AF) of water was not going into the Platte River system because of invasive species such as the pine beetle. The study he referenced relates to research[3] conducted by the Forest Service on the Upper North Platte River in 2000 and 2003. It shows that management restricting timber harvest had already severely impacted the watershed and water yield to the tune of a minimum of 160,000 AF[4] per year. The Forest Service uses Equivalent Clear-cut Acres modeling to predict water yield associated with vegetation disturbance, primarily associated with

[1] Federal Register Doc. 2019-12195 Filed 6-12-19

[2] Beetle Outbreaks in Subalpine Forests and What They Mean for Snowmelt, May 2021. Rocky Mountain Research Station, U.S. Forest Service.

[3] Estimating Additional Water Yield From Changes in Management of National Forests in the North Platte Basin, May 12, 2000, C.A. Troendle & J.M. Nankervis (Note: This is an independent report prepared for the Platte River EIS Office)

[4] 160,000 AF of water would cover all of Chicago, Illinois with over one foot water.

timber harvest and wildfire. The literature and research show that implementing a 100-year rotation on all eligible timber lands would sustain an increase of 50-55,000 AF of water per year – for just one part of one forest in the state of Wyoming.

In focusing on opportunities in Wyoming, it is important to provide context for what is happening in the West because lessons learned across the region has application in Wyoming. For example, across the West, federal laws, regulations and environmental litigators have greatly restricted our ability to thin forests and take other actions to aggressively combat invasive insects like the pine beetle. As a result, large swaths of national forest lands essentially remain "un-managed". In some places, all you can see for miles is a sea of dead trees, victims of the pine and spruce beetles.

Overgrown Western forests also means forests are using more water than they did historically. Because the moisture content of the trees and brush is so low, it makes them more vulnerable to fire and parasites, such as the bark beetle, which has ravaged millions of acres throughout the West. The Western wildfire disasters have underscored the importance of improving on-the-ground management that can lead to improved forest health. Thinning out trees can reduce water stress in forests and ease water shortages during droughts. By reducing the water used by plants, more rainfall flows into rivers and accumulates in groundwater. If we could calculate potential water yield impacts with even more confidence, we could determine how much water could be freed up by thinning forests and controlling pests and invasive insects like the pine and spruce beetle. Fortunately, we are seeing more recent, positive developments towards this end.

Examples described below provide additional models for ways of quantifying the amount of water removed from Wyoming's water supply by dying forests and invasive species like the bark beetle.

Scientists affiliated with the National Science Foundation (NSF) Southern Sierra Critical Zone Observatory (CZO) in 2018 conducted a study in the forests of California's Sierra Nevada mountains. The team of scientists from the University of California and the National Park Service combined sensors that measure evapotranspiration with satellite images of "greenness" on the landscape to estimate the additional freshwater runoff that could be created by thinning overgrown forests. Their research, published in 2018 in the journal *Ecohydrology,* shows that water loss from evapotranspiration has decreased significantly over the past three decades, due in large part to wildfire-driven forest thinning. Forest thinning has increased in recent decades to stave off disastrous wildfires fueled by dense forests. This study shows that restoring forests through mechanical thinning or prescribed burning can also save California billions of gallons of water each year. The total effect of wildfires over a 20-year period suggests that forest thinning could increase water flow from Sierra Nevada watersheds by as much as 10 percent.

We have also heard numerous other anecdotal reports from around the West of water yield increases resulting from clearing pinon and juniper stands in northwestern Utah, arid communities in the high desert of Oregon and Northern California, the Pecos River watershed in New Mexico and the upper Purgatoire River in eastern Colorado. Pinon and juniper reduction in the Gallup,

New Mexico area triggered the reappearance of flowing water in once dry arroyos that had not been there for decades. A 2016 study[5] conducted on the San Carlos Apache Reservation showed that different vegetation types displayed various responses to water availability. This further highlights the need for individual management plans for forest and woodland, especially considering the projected drier conditions in the Western U.S.

Forest Health Solutions

Regardless of the causes behind the sad state of our forests, it is our job now to look for solutions. These solutions will be applied through specific and thoughtful management. The problem involves a natural landscape, so some of the solutions will be time-tested natural processes. Others will be driven by landowners and forest managers through proactive, aggressive actions. The neglect and deterioration of our forests cannot continue. We must act now to heal them. We offer below the recipe for success.

1. **Actively Manage and Restore our Federal Forests**

Drought brings less snowfall in many areas. The snow that falls melts off up to 45 days earlier and runs off downstream on frozen ground. Therefore, the snowpack no longer functions as a reservoir delaying the release of water in a timely manner. However, the forest floor can be restored through thoughtful management. A responsible level of continuous fuels reduction includes a combination of robust mechanical thinning and prescribed fire. This can be employed to significantly reduce evapotranspiration, tree stress, disease, and pest infestation, preserve forest health conditions, and protect species and habitats.

This is not only good stewardship – it is good economics.

Failure to employ this approach will continue the downward, accelerating spiral of fuel accumulation, drought, disease, and invasive insects. This will lead, inevitably, to additional high-intensity and costly fire events in the future.

We believe active forest management can increase water yield, improve water quality, provide for jobs, and reduce the cost of firefighting, while increasing forest resiliency. This can be done, in part, by increasing the productivity of national forests and grasslands; employing grazing as an effective, affordable forest and grassland management tool; increasing access to national forest system lands; expediting environmental reviews to support active management; and designing West-wide studies to quantify water yield.

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[5] Vegetative response to water availability on the San Carlos Apache Reservation, Roy Petrakis, Zhuoting Wu, Jason McVay, Barry Middleton, Dennis Dyem, JohnVogel. July 2016. U.S. Geological Survey, Western Geographic Science Center, 255 North Gemini Drive, Flagstaff, AZ 86001, USA.

a. Use Controlled Fire and Grazing as Management Tools to Restore Forests

Wildlife habitat has suffered profoundly from the "pick-up-sticks" of dead trees on the forest floor, from disruption in water function, and most dramatically, from widespread hot fires. These large catastrophic fires not only eliminate habitat, but kill millions of animals, birds and insects. Controlled fire is one of the tools that can be used to improve forest grounds. However, it is not the only tool. A 2021 article in the Sacramento Bee ("'Self-serving garbage.' Wildfire experts escalate fight over saving California forests") does a nice job explaining this. We are seeing a major shift happening; the people who love the forest are coming together.

The Organic Administration Act of 1897 (Organic Act) addresses the role of the forests as part of a larger community—a larger and complex landscape. They do not exist in a vacuum. Forest grounds were intended to produce timber for Americans. We have seen the terrible effects of the near halting of the timber industry. Foresters know how to log in a responsible and sustainable manner. When done properly, it is one of the most effective tools to restore forest health. The alternatives are unregulated logging in other parts of the world and sky-high lumber prices. Sustainable timber management is a practice that must be encouraged and facilitated.

Likewise, the forests are part of our food production system. The grasslands existing in forest lands sustain not only grazing wildlife like deer, elk, big horn sheep, and antelope, but also forage for domestic livestock like cattle and sheep. Proper grazing improves soil through hoof actions and fertilization from manure. Grazing returns carbon to the soils and is a tool, indeed almost the only tool, for improving and restoring soils. Again, it must be properly managed, but many grazers are experts in just those practices. Narrow policy proposals that disconnect the role of responsible grazing, or even seek to eliminate this practice, from grassland function will result in cascading impacts to habitat connectivity, soil health, wildlife habitat, and carbon sequestration. These actions will also create added strain on rural communities.

b. Secure Long-Term Conditions of Water Flows

"Securing long-term conditions of water flows" is named as a top priority in the Organic Act, yet it is perhaps the most severely impacted by the deteriorated forests. The forests act as a sponge. Winter snowfall settles among the trees, and snowmelt and rainfall alike traditionally soak into the humus and healthy soils on the forest floor. Climate change and human mismanagement have disrupted this crucial cycle.

In the Intermountain West, flood-irrigated wet meadows provided by ranchers as part of their agricultural operations comprise the bulk of the wetland habitat in snowpack-driven systems. These hay meadows and irrigated pastures provide important habitat for sandhill cranes, white-faced ibis, northern pintails, and other priority waterbirds, as well as an array of ecosystem benefits. Flood irrigation naturally maintains underlying groundwater that is less vulnerable to a warming climate and key to supporting seasonally flooded wetlands on the surface. Filling these "sponges" through flood irrigation is critical to slowing the movement of water through the system

and thus increasing resiliency in the face of drought. Likewise, upland watershed and forest management activities can help increase water quality and quantity, as well as mitigating the risk of catastrophic wildfire.

Restoration – utilizing what we refer to as "AgroForestry" - is very doable. It will require planning, resources, commitment and will. All of these things exist.

c. Improve Watershed Yield Through Better Forest Management

As previously discussed, there is a significant gain in water supply to streams because the consumptive use of water is reduced when the number of trees growing as forests are managed to avoid the conditions that result in catastrophic insect infestation or wildfires. We believe the North Platte River example noted above should be used as a solid starting point for a case study because of the abundance of available scientific literature, including the work already developed by the Forest Service. Improved water yields also have positive implications for downstream Platte River species protected by the Species Act. Congress could help initiate a pilot project that builds upon this work. In addition to underscoring the positive aspects of active forest management noted above, such a study could also underscore the importance of appropriately measuring any new water gained through this and other water enhancement approaches. Generating new water through landscape management practices should become a new priority in the Colorado River watershed and other parts of the American West.

d. Improve Invasive Species Management

Addressing the harmful impacts of invasive species should also be a priority. Water users confront challenges associated with invasive species across the West, where salt cedar (Tamarix), quagga mussels, and cheatgrass – just to name a few- all proliferate. For example, Tamarix species along riparian corridors or around desert springs can seriously reduce underground water tables and surface water availability, drying up wetlands, and reducing flows. Tamarix species can increase flooding in riparian areas by narrowing channel width. In addition, the plants are flammable and can introduce fire into wetland and riparian communities that are not adapted to periodic burning. While millions of dollars have already been spent on efforts to reduce the impacts of these and other non-native pests, it hasn't been enough. And more invasive species will continue to arrive.

2. Engage the U.S. Forest Service

Since the Forest Service is responsible for much of the forestland in the West, it's engagement will be critical. Bold action is required. Decision-makers must be empowered to act, rather than get bogged down in bureaucratic morass. Unfortunately, current bureaucratic practices are not equipped to fulfill the need. Upper-level policy makers and managers will need to create a plan and set an agenda that will lead to success. We must "empower the competent" to achieve scale. The areas in need of restoration encompass millions of acres; 100-acre solutions will not suffice. Legislation may be required.

Experts from the Forest Service and various affected interests must be part of the planning process. These interests would necessarily include area and state foresters, private sector forest managers, watershed experts, wildlife scientists, grazers, and local community representatives. This group should be broad enough to cover areas of concern, but nimble enough to plan quickly and set the wheels in motion. The multi-level strategy includes solutions to sustainably manage our water, which largely originates on forest landscapes and watersheds. It must consider the habitat provided, or formerly provided, by the affected forest lands, and the needs of those species whose lives depend upon those lands. Likewise, traditional forest uses that have sustained local communities must be considered both as a tool to bring about needed change, and as a part of the holistic system which includes trees, wildlife, water and people. These tools include targeted logging, particularly of dead standing trees, and grazing to restore soils and reduce fire danger.

Healthy forests provide multiple recreation, agricultural, ecological and economic benefits, and indeed the legislation that created the Forest Service, mandates this. A successful plan must direct the effective transition from the forests' present non-functioning state to a functioning state. This will take time, but a commitment to action is required to ensure long-term success.

3. Improve federal funding programs and delivery

To increase stakeholder confidence and ensure effective funding delivery, federal agencies should invite outside guidance and clearly state to the maximum extent practical, the intended impact of funds, method of distribution, and other discretionary factors. We understand that these agencies have limited influence over specific legislative prescriptions and that further direction may be provided as the legislative process unfolds. We also believe that a certain amount of discretion based on agency expertise is necessary to ensure proper allocation of funds. However, we submit that our collective on-the-ground experience can serve as a guide to ensure that such funds broadly dedicated to conservation and restoration are best utilized to the benefit of ecosystem function, local community vitality, and working lands health.

4. Remove regulatory barriers to conservation

From our decades of collective expertise, we are aware of numerous barriers that prevent interested landowners and other entities from participating in programs administered by federal agencies, and ultimately, prevent funding from reaching the ground in a meaningful way. Statutory limitations such as program payment caps can create misalignment between program eligibility and conservation objectives. Regulatory hurdles, for example presented through interpretation of NEPA, can prolong agency action.

a. NEPA Concerns

The current implementation of the NEPA is reactive, cumbersome, time consuming and does not enable the Forest Service to implement forest management strategies in a timely manner. We have

advocated for some key general recommendations to improve the Forest Service application of environmental laws: 1) Allow landscape-level land management plans to guide individual actions on the ground without duplicative administrative process under federal environmental laws; 2) Direct the creation and use of CEs already allowed under NEPA in preventing catastrophic wildfires and restoring forest habitat and ecosystems more effectively and on a timely basis; and 3) Use the NEPA process to consider how a robust vegetative management program could improve forest health, improve water quality and lead to increased available water supply by reducing demand from overly dense tree and vegetative cover.

We do not seek changes that waive or ignore existing federal environmental laws. Instead, we call for improvements to make those laws work for the benefit of the nation as intended. By eliminating duplicative or unnecessary processes and using streamlining tools already allowed under the law - and promoting action instead of litigation - the status quo could be changed. The proposed changes could help government agencies to use their limited resources to expeditiously implement land management actions designed to prevent wildfires and improve habitat for priority, endangered and/or threatened species. Surely that would be a dramatic improvement over spending precious time and resources on bureaucratic process and litigation. These types of critically needed procedural changes to NEPA implementation will improve our Western landscapes and protect our valuable water supplies from the devastating effects of wildfires. They will also allow agencies to improve habitat, restore ecosystems for the benefit of federally important species and allow continued agricultural use of our public lands.

The Forest Service two years ago proposed revisions to its NEPA procedures with the goal of increasing efficiency of environmental analysis while meeting NEPA's requirements. We supported these proposed changes to NEPA, many of which were based on adding or expanding existing CEs. At the time, it was estimated that on average, an environmental assessment took 687 days to complete. Average time to complete a CE was just 206 days. By using the new CEs in the proposed rule, the Forest Service could potentially complete NEPA analyses between 30 and 480 days earlier on applicable projects.

One of the ways to protect agency credibility in the use of CE's is to include an explicit provision that the agency will reopen the CE decision if changed circumstances or new information militate such an action. The Federal Energy Regulatory Commission (FERC) has had such a provision (called a "reopener" by FERC) for many years in its NEPA regulations and this has aided FERC in its administration of NEPA. Such a "reopener" provision is so attractive that the Bureau of Reclamation's similar provision prompted Congress to direct Reclamation to use its CE process in administering the 2013 *Reclamation Small Conduit Hydropower Development and Rural Jobs Act*, P.L. 113-24.

Increasing the efficiency of environmental analysis would enable the Forest Service to do more to increase the health and productivity of our national forests and grasslands and be more responsive to requests for goods and services. The Forest Service's goal should be to complete project decision making in a timelier manner, improve or eliminate inefficient processes and steps, and, where

appropriate, increase the scale of analysis and the number of activities in a single analysis and decision. Improving the efficiency of environmental analysis and decision making will ensure that lands and watersheds are sustainable, healthy, and productive; mitigate wildfire risk; and contribute to the economic health of rural communities through use and access opportunities.

b. Candidate Conservation Agreements with Assurances and Safe Harbor Agreement

Federal agency staff capacity and siloed communication structures also present very tangible hindrances to effective program implementation on the ground and further complicate already complex processes. For example, Candidate Conservation Agreements with Assurances and Safe Harbor Agreements can serve as useful tools to ensure that landowners' efforts to conserve and recover at-risk and listed species do not put them in jeopardy of further regulatory restrictions as a result of their conservation actions. However, these agreements are time consuming and sometimes costly to landowners to develop. Beyond agreement development though, the cost of ongoing implementation, monitoring and reporting is largely unaccounted for and often falls on landowners, the state or other agreement holders. There are certain funds that can provide cost-share assistance in developing these agreements, but ongoing support for implementation, monitoring, management and stewardship remains a gap and presents a hurdle to the long-term success of conservation objectives.

5. Real World Success Stories

We know there's much more that needs to be done to accelerate the pace and scale of forest health and watershed resilience projects, but we're pleased that our members are on the leading edge of successful, scalable efforts in the West.

a. North Yuba Forest Partnership

Last month, USDA announced that the North Yuba River watershed in Northern California will be one of the first 10 landscape investments to be funded nationally through the U.S. Forest Service's Wildfire Crisis Strategy. The North Yuba landscape stretches from New Bullards Bar Reservoir in Yuba County up to the Sierra Crest along Highway 49 in Sierra County. The anticipated resilience work builds upon and scales up previously successful and innovative efforts in the North Yuba River watershed, including the utilization of a groundbreaking, public-private financing tool called the Forest Resilience Bond (FRB).

Launched earlier this year, the strategy outlines the need to treat up to an additional 20 million acres on national forest lands and up to an additional 30 million acres of other federal, state, Tribal, private and family lands over the next decade. The partnership is using the latest science to integrate multiple stakeholder priorities into projects with the objective of accomplishing forest restoration and wildfire risk reduction at a landscape scale. Planned activities include meadow restoration, ecological thinning of forest density and prescribed fire.

The North Yuba Forest Partnership (NYFP), of which Yuba Water (a Family Farm Alliance member) is a founding member, is a diverse group of nine organizations passionate about forest health and the resilience of the North Yuba River that shares the ambitious goal of implementing forest restoration across 275,000 acres of the watershed. Founded in 2019, members of the NYFP include Blue Forest Conservation, the National Forest Foundation, the Tahoe National Forest, Yuba Water Agency, the South Yuba River Citizens League, Sierra County, the Camptonville Community Partnership, Nevada City Rancheria, and The Nature Conservancy. By mitigating the risk of high-intensity wildfire and restoring forest health, the NYFP will protect a variety of vital resources, including wildlife habitat, water supply, opportunities for recreation, as well as multiple communities.

The USDA investment will result in over $25 million in additional federal IIJA funding for the Partnership's work over the next three fiscal years and almost 17,000 additional acres of forested watershed lands treated. Moreover, last week, Yuba Water learned that USDA awarded the Partnership an additional $3 million for this year as one of 15 projects selected nationwide under the Collaborative Forest Landscape Restoration Program. The Partnership's work demonstrates that comprehensive and collaborative approaches can help us tackle even the toughest natural resource issues.

a. Headwaters of the Colorado River Project

Family Farm Alliance President Patrick O'Toole is helping to lead an effort to design a comprehensive, multistakeholder, large landscape initiative to restore two severely degraded (non-functioning) 50,000-acre watersheds; one in the Medicine Bow National Forest in Wyoming and a second in the Routt National Forest in Colorado. The vision is to restore two forested rangelands to a resilient state that filters and stores water, produces protein, sustains wildlife and fisheries, sinks carbon, produces renewable energy feedstocks and enables economically viable rural communities to thrive.

The Little Snake River Watershed is a fascinating combination of a functioning conservation district that has a 30-year record of nationally recognized river restoration, grazing habitat enhancement, fish passage, and migratory bird habitat enhancement projects. Mr. O'Toole and his team are designing a plan to implement an integrated, multidisciplined and multilevel watershed enhancement project that will demonstrate how collaborative and cooperative restoration efforts can be carried out at scale and replicated in watersheds across the West.

Men and women like the O'Toole family who live and work in the forests have up-close and personal experiences and observations upon which they formulate their assessment of the conditions in these forests. They view the watersheds and assess their functionality as intact, interconnected ecosystems. In their view, the forested watersheds are in a state of dramatic decline as a result of decades of siloed, top-down management, litigation that has prevented many pragmatic enhancement and restoration initiatives from moving forward. Climate change has further taken a major toll on the health and functionality of the watersheds.

Mr. O'Toole and other local interests believe it is time for a new way forward, one that would be characterized by large landscape scale, integrated and multidisciplinary enhancement projects guided by multistakeholder collaboration.

6. Action in Congress

We are pleased that there appears to be growing recognition in Congress of the importance of active forest management. There are several bills that have been introduced in this Congress, intended to facilitate responsible forest management.

One of those is the *Outdoor Restoration Partnership Act*, sponsored by Senator Michael Bennet (D-CO), and supported by the Family Farm Alliance. To date, Congress has failed to invest in our Western lands, undermining our economy and way of life. As a result, local governments are often left to foot the bill for conservation, restoration, and wildfire mitigation. Senator Bennet's bill would establish an Outdoor Restoration Fund to increase support for local collaborative efforts to restore forests and watersheds, reduce wildfire risk, clean up public lands, enhance wildlife habitat, remove invasive species, and expand outdoor access. It would empower local leaders by making $20 billion directly available to state and local governments, tribes, special districts, and non-profits to support restoration, resilience, and mitigation projects across public, private, and tribal lands. The bill would invest another $40 billion in targeted projects to restore wildlife.

Another bipartisan bill would provide carbon credits to companies and other non-federal partners in exchange for thinning trees on fire-prone forests. *America's Revegetation and Carbon Sequestration Act*, co-sponsored by Senators John Barrasso (R-WY) and Joe Manchin (D-WV) would encourage more intensive forest management — and reforestation — through a variety of initiatives. The carbon credit idea would allow non-federal entities to be awarded carbon credits through voluntary markets in exchange for money they provide the Forest Service for projects that increase carbon sequestration.

One more important piece of legislation is the *Resilient Federal Forests Act,* introduced by Rep. Bruce Westerman (R-AR). This bill – supported by 85 organizations, including the Family Farm Alliance – would help address the environmental and economic threats of catastrophic wildfires.

Each of these bills is important. We hope that efforts like these will build momentum towards larger forest management reforms in subsequent bipartisan legislation.

Looking Ahead to the New Farm Bill

While the actual "brass tacks" work on drafting the next Farm Bill may not occur until 2023, farm and conservation groups are beginning to advance their own policies to take to Congress. Engaging in the development of the 2023 Farm Bill is a top priority for the Family Farm Alliance, both

internally and through our association with the Western Agriculture and Conservation Coalition (WACC).

1. **Farm Bill Engagement with the WACC**

The Alliance is a member of the steering committee of the WACC, a coalition of constructive agriculture and conservation groups who have engaged in recent years on the farm bill, environmental appropriations, climate-smart agriculture, forestry, wildfire and Endangered Species Act issues. Created twelve years ago, the WACC now includes nearly twenty national, regional and state water, ag and conservation organizations. The 2018 Farm Bill conservation title contains many provisions the WACC advocated for. Now, the WACC is preparing to engage in the 2023 Farm Bill.

There is always competition between the proponents of the various titles in Farm Bill authorization. The WACC plans to put together the story of how the NRCS is using its current Farm Bill conservation title dollars, and construct a rationale based on facts for why they should keep the baseline in the upcoming round of negotiations.

The conservation title of the last farm bill was a good thing, and parts of that title are due to the direct work of the WACC Alliance and its agricultural and conservation allies. The 2018 conservation title reflects the growing trend in the West, where individual producers – working with irrigation districts, non-governmental organizations and state and federal partners – are performing large-scale projects that benefit the environment, improve on-farm water management, and provide a new cash stream that helps rural communities.

2. **Farm Bill Conservation Program Implementation Concerns**

Our overall goal when we engage in Farm Bill negotiations is to increase opportunities for Western farmers and their related water management entities to invest in improved water management and efficient irrigation technologies, leading to more and more reliable water supplies, increased conservation, increased crop yield and environmental benefits. Of course, benefits realized by farmers and ranchers translate to benefits enjoyed by American consumers, as well as protecting and enhancing our food security for the Nation and the world.

Several of our members over the past two decades have noted diminished efficiencies associated with NRCS delivery of conservation programs to on-the-ground applications. They have observed that the "evolutionary process" which began to occur at that time has weakened NRCS' ability to provide technical assistance. Currently approximately 20 percent of the NRCS budget is spent on financial/contractual administration matters. This is likely one of the key reasons that only 16% of American farmers are involved with federal farm programs. This issue, and the need to put priority on local input, must be addressed in the new farm bill. We'd like to see less paperwork and more applied conservation.

One means of improving local input would be to dedicate more dollars to educating farmers on available programs and opportunities. The once strong role of watershed teams needs to be revived. There are also opportunities to leverage personnel at the local level, where local professionals can take on some of the technical duties once provided by NRCS staff. Many producers in the West use irrigation water delivery systems that are shared among multiple producers, such as irrigation districts, canal companies, or mutual ditch companies. Thus, flexibility is needed to work directly with these multi-producer, water-delivery entities to best deliver the Farm Bill's conservation title benefits to western producers. Greater focus on the part of NRCS to work with these agencies - both in terms of education and program implementation - is needed.

3. Initial Recommendations for the 2023 Farm Bill

The specific recommendations presented below would remove some of the existing contracting barriers for Western producers and make the Farm Bill's conservation title programs more accessible and relevant to western producers. We also offer recommendations on Farm Bill provisions that would protect our valuable Western watersheds and incentivize young farmers to enter and stay in the industry.

1. **Regional Conservation Partnership Program (RCPP), Environmental Quality Incentives Program (EQIP), and the Agricultural Conservation Easement Program (ACEP) are particularly important to achieving conservation and rural economic and social goals in the West.** These programs in Title II must be funded at no less than current funding levels to provide for on-farm and on-ranch operational and resource conservation needs. The RCPP derives, in part, from the Agricultural Watershed Enhancement Program (AWEP), a program whose conceptual idea was originally driven by the Alliance and other Western U.S. ranching and conservation interests in past Farm Bill negotiations. This excellent program allowed agencies such as irrigation districts to partner with local NRCS offices on worthwhile conservation projects, often in partnership with the Bureau of Reclamation. In these cases, Reclamation funded the irrigation district providing the water to the farms, and the NRCS funded on-farm projects associated with that district system. This proved to be an effective way to leverage funds.

2. **Ensure that EQIP remains available for use across all land ownerships and increase funding for farmers. Appropriately fund EQIP, specifically increase funding programs for farmers to invest in efficient irrigation technologies and services.**

    - Increase investment in private sector consulting services, including technical service providers and irrigation district staff.
    - In accordance with state water law, allow farmers to decide what happens to the saved water, rather than requiring water be returned to the environment.
    - Assign priority to those areas where federal regulations and laws have diminished once-reliable surface water supplies.

- Include improved water quality as justification for farmers to invest in efficient irrigation technologies (rather than just water savings).

NRCS should also look for opportunities to improve efficiency of water utilization in other sectors, including the riparian and forest environments.

3. **Remove RCPP Contracting Barriers and Streamline Implementation.**

   - Encourage the use of a grants program for eligible partners to deliver conservation benefits.
   - Eliminate the unnecessary administrative burden and complexity of fund tracking.
   - Streamline RCPP applications.
   - Ensure that agriculture producers will be beneficiaries of each RCPP proposal.
   - Allow local partners to use in-kind services – such as in-house engineering, marketing and administration – as a means of satisfying the RCPP requirement to leverage one local dollar for every federal dollar spent.

4. **Maintain priority funding and allow more flexible utilization of the Watershed and Flood Prevention Operations Program (WFPO), for watershed enhancements.** This funding could be used for a variety of critical drought response and resilience projects including irrigation modernization, development of rural water supply sources, erosion and sediment control, and fish and wildlife habitat enhancement. It is also critical for supporting the modernization of irrigation water delivery infrastructure at scale. This is a program that Family Farm Alliance members have put to use to replace leaking, open canals with pressurized pipes, and overall improving agricultural water security. The program's funding is becoming increasingly competitive because of the scale of need in modernizing agricultural infrastructure.

   The NRCS awarded all $500 million that the IIJA allocated to WFPO in two rounds of announcements in March and April of 2022. The NRCS' announcement recognized that "[t]he amount provided to protect our watersheds is historic and highlights the priorities set by Secretary Vilsack to address the effects of climate change, ensure equity, and create a path toward climate resiliency." Unfortunately, the "path toward climate resiliency" created by the funding awards is overwhelmingly dedicated to feasibility studies (94% of awards) for small dam construction (59% of feasibility studies) to address flooding concerns in the eastern United States.

   This recent decision raises three concerns: 1) Several Western irrigation modernization projects which have already developed watershed plans and are in the cue, moving towards implementation, were not funded; 2) It is uncertain how many of the feasibility studies for the new projects will ultimately be implemented. If the recently funded feasibility studies ultimately support implementation of small new dam projects, the available funding for a program that is already oversubscribed and underfunded will become even more strained.

5. **Strengthen NRCS Technical Assistance capacity for both program implementation and non-Farm Bill conservation planning.**

6. **Better define inter-agency cooperation to improve conservation program delivery and yield broader positive impacts.**

7. **Encourage local, regional and state land managers to lead watershed enhancement efforts and provide them with the tools to do so.**

8. **Encourage development of Payment for Ecosystems Services (PES) programs.** Approaches like that advocated for through Senator Wyden's *Watershed Results Act* would provide a predictable source of federal funding for up to five pilot watersheds to compensate for ecological services provided by farmers – either water conservation and nutrient management or more habitat related irrigation practices – all informed by prioritization technologies and data analytics that can measure results and allow markets to be created for these services. Existing limited sources of federal funding should be used most efficiently to purchase results rather than actions.

9. **Support beginning farmers and ranchers.**

10. **Move towards managing for healthy forests**, as described earlier in this testimony.

Our goal at the Family Farm Alliance is to find solutions to Western water conflicts that protect our national ability to feed ourselves, export food to others and continue to lead the world in agricultural production while finding ways to accommodate the water supply needs of growing urban areas, energy development, recreation, and environmental preservation. We look forward to working with you to build a 2023 Farm Bill that embeds some of these sensible, workable policies.

Conclusion

The continued epic drought we have been experiencing across the western United States, especially in the last two years, and other weather abnormalities are different than in the past. Our organization has found that the best solutions are locally driven. Solutions come from the land. Farmers, ranchers, foresters and fishers across the West work in the extremes of elements and volatile weather, and we share a love of the land and our waters. They see the pressure on the land they manage and their water supplies. Sadly, strategies appear to be evolving to take water from Western farmers, from food production, and redirect it to other uses.

Farmers and ranchers must be at the center of all discussions and decision-making in Western watersheds. The revival of watershed forests is crucial to combating the effects of climate change. By bringing together changemakers and working collaboratively, we can change the paradigm of forest management. Success will mean healthier forests, healthier wildlife populations, more

prosperous and dynamic local communities, more recreation opportunities, greater economic benefits and much-needed security in our water supplies.

Balance in production and conservation is the answer to forest health.

Significant input will be needed from a wide range of farmer and other producer organizations outside of typical policymaking structures. We all must become more adaptable and open to change. We must learn from those who have experience.

We must become more effective in communicating to the world the value of farmers and ranchers. Our societies are confused. The basic principles of existence are under pressure. The steady rhythms of food production and ecosystem services are crucial to understanding our challenges and finding solutions.

Are we going to wake up and realize the world has drifted far from the stability we have known for our lifetimes and make required course corrections? Or do we remain committed to our own demise and continue on a crash course with what may likely be the greatest food shortage in American and world history?

We have some decisions to make.

Agricultural production in the West is an irreplaceable, strategic national resource that is vital to U.S. food security, the ecosystem, and overall drought resilience. The role of the federal government in the 21st Century should be to protect and enhance that resource by doing whatever it can to ensure that water remains on farms.

Western producers must continue to manage water as if every year is a drought year. We need to invest in water storage facilities to capture water in wet years, we need to look to innovative technology to enhance supplies and delivery, and we need to get the most benefit from the water we have available. The ability to measure, assess and show value for how that water is used is incumbent on every water manager - environmental, urban and agricultural.

The Alliance looks forward to working with your Subcommittee to address the issues we have identified in this testimony and those we have not. It has been a tough year for many of our producers and the rural communities they support. At the Alliance, we'll continue our efforts to ensure that irrigated agriculture continues to play a vital role in feeding our Nation and the world, while keeping our rural communities and the environment healthy. At a time of unprecedented change, one certainty holds firm and true – our nation's most valuable natural resource must be preserved.

Thank you for this opportunity to submit this testimony.

Reeder Creek Ranch

Subcommittee on Conservation, Climate, Forestry and Natural Resources Chairman Bennet and Ranking Member Marshall:

June 6, 2022

Dear Chairman Bennet and Ranking Member Marshall and Subcommittee,

Crowley County Colorado is a heartbreaking example of what happens when we fail to provide rural communities with necessary tools for adaptation. Agriculture is not just a stakeholder, agriculture grows the food we eat. Right now, the risk of climate adaptation is fully on the producer. In order for us to be profitable and productive, we need resources to adapt to a hotter and dryer future. We need better coordination between federal agencies and scaled resources focused on soil health. It all starts there. Our first and best defense against climate change are our forages and healthy soils...we need productive land and agriculture in the west now more than ever. It is time to act so that the west does not turn into Crowley County. Thank you for time.

Sincerely,

Paul Bruchez
Reeder Creek Ranch
(970) 531-2008

June 7, 2022

The Honorable Michael Bennet
Chair
Senate Agriculture, Nutrition, and Forestry Committee
Subcommittee on Conservation,Climate, Forestry, and Natural Resources

The Honorable Roger Marshall
Ranking Member
Senate Agriculture, Nutrition, and Forestry Committee
Subcommittee on Conservation,Climate, Forestry, and Natural Resources

RE: Hearing on The Western Water Crisis: Confronting Persistent Drought and Building Resilience on our Forests and Farmland

Dear Chair Bennet, Ranking Member Marshall, and members of the subcommittee:

Trout Unlimited's (TU's) mission is to bring together diverse interests to care for and recover rivers and streams so our children can experience the joy of wild and native trout and salmon. In pursuit of this mission across the West, TU has worked with ranchers, farmers, states, Tribes, federal, state, and local agencies, local contractors, businesses, and many other partners to restore streams while also sustaining working lands and vibrant communities.

TU writes in support of two strategies that are central to building drought and climate change resilience on forests and farmland in the American West. The first is the use of natural distributed storage through floodplain reconnection and wet meadow restoration in degraded stream channels. The second is the implementation of multi-benefit irrigation efficiency projects that improve agricultural operations while also increasing water security and providing environmental benefits. The Natural Resources Conservation Service (NRCS) and the US Forest Service (USFS) both operate programs that can and do put these two strategies into effective, on-the-ground projects that benefit agricultural producers, the environment, recreationists, and downstream water users.

Natural Distributed Storage

NRCS programs under Environmental Quality Incentives Program (EQIP), Regional Conservation Partnership Program (RCPP), and the Watershed and Flood Prevention Operations (WFPO or "PL-566" Program) provide an opportunity to target nature-based water storage solutions. Natural distributed storage provides both mitigation and recovery benefits in areas affected by wildfire, as well as drought resilience on private and public rangelands as a water supply "savings account" and source of forage. The USDA Climate Action Plan (CAP) recognized the need for aquifer recharge, the harm to aquatic ecosystems from construction of traditional built storage, and the high cost of built water infrastructure within the *Threat to water quality and quantity* section:

"Invest in water management infrastructure and adaptive irrigation systems. Investing in additional water storage infrastructure, such as new reservoirs and managed aquifer recharge, and increasing the ability of water related infrastructure to survive extreme events, can help irrigated agriculture adapt to a variable future and expand availability of seasonal runoff. In traditional rainfed agricultural regions, producers may adapt to more variable growing season precipitation by beginning to irrigate or practicing supplemental irrigation. Barriers to these actions include the need to address the ecosystem impacts of dams, the relative lack of institutions to guide the development of managed aquifer recharge, and the high cost to build on-farm irrigation infrastructure."[1]

A key omission of the CAP is the role of cost-effective nature-based solutions for retaining water on the landscape. EQIP and RCPP are important resources for funding projects that implement nature-based solutions in western watersheds and have great potential to promote nature-based water retention options. Restoring lost hydrologic function through process-based restoration, by re-connecting incised stream channels to their historic floodplains, for example, to "re-soak the sponge" across a landscape, provides climate resilience to the watershed, underlying groundwater resources, and surrounding communities. We encourage this Committee to direct the NRCS to prioritize the restoration of groundwater reservoirs, floodplains, and other natural features through the EQIP, RCPP, and PL-566 Program) to utilize their full potential as natural water retention solutions and climate-resilient water resources. In addition, we encourage this Committee to direct the USFS to ensure that valley-floor restoration that maximizes aquatic restoration and natural distributed storage is a co-equal priority to be accomplished in tandem with fuels reduction and post-fire restoration. Please see the two examples below which illustrate how such natural features, if restored, can act as powerful tools to combat drought and wildfire in the West.

Example 1. Climate resilience from beaver-dam assisted wetland complexes on Dixon Creek after this summer's Bootleg Fire burned over 412,000 acres north of Klamath Falls, Oregon. *Photo: Charlie Erdman, TU*

[1] "Action Plan for Climate Resilience and Adaptation," at p. 6, United States Department of Agriculture (August 2021) https://www.sustainability.gov/pdfs/usda-2021-cap.pdf.

Example 2. Drought resilience through beaver-dam assisted hydrologic connection in the Upper Colorado River Basin's Muddy Creek, tributary to the Little Snake River during the summer of 2021, one of the driest on record for the area. Planned restoration work aims to replicate this result along the creek's length.
Photo: Nick Walrath, TU

In addition, nature-based solutions could be added as resilience strategies to existing programs including the Conservation Innovation Grants (CIG) and EQIP's Livestock Set-Aside. The addition of a statutory directive under CIG for a funding a carve-out for regenerative agriculture and nature-based solutions such as restoring wetland/riparian areas would help advance drought and climate change resilience. Congress could also direct the EQIP livestock carve out to incentivize climate resilient strategies for working ranches – i.e., promote nature-based solutions and regenerative agriculture grazing/range improvement with enhanced Technical Assistance while restricting concentrated animal feeding operation (CAFO) eligibility for EQIP funding.

Finally, the Forestry Title presents several opportunities to advance key resilience strategies such as science-based forest management and nature-based approaches, including restoration of source water wetlands and riverscapes. Specifically: reauthorizing the Water Source Protection Program (increasing its funding, including aquatic restoration as a primary strategy, and decreasing the 50% match requirement) and prioritizing valley-floor, aquatic restoration in parallel with fuels reduction and post-wildfire restoration would support implementation of natural distributed storage projects on USFS lands throughout the West.

Multi-benefit irrigation efficiency

TU also supports the implementation of multi-benefit irrigation efficiency projects that improve agricultural operations while also increasing water security and providing environmental benefits. In the USDA CAP, the section *Threat to water quantity and quality* not only identifies that "reduced water use" will be needed in priority areas, but that "[d]rought-adapted varieties, dynamic and data-driven irrigation technology, and increasingly efficient delivery, storage, and recycling of water will be important adaptation tools."[2] Water delivery irrigation efficiency projects must enable irrigators to consume the

[2] "Action Plan for Climate Resilience and Adaptation," at p. 8, United States Department of Agriculture (August 2021) https://www.sustainability.gov/pdfs/usda-2021-cap.pdf.

same amount of water while diverting less, resulting in enhanced streamflows that help facilitate downstream irrigators' access to their consumptive water rights while also providing aquatic habitat and mitigating the impacts of drought. It is therefore absolutely essential that all irrigation infrastructure investments through EQIP or PL-566 do not increase consumptive water use. Currently, however, EQIP funding for water delivery infrastructure projects enables increased consumptive use by effectively hardening water demand, exacerbating basin-scale water scarcity, and increasing water conflicts among users.

To date, NRCS has not defined water conservation nor water-use efficiency under EQIP. An NRCS adapted approach to water conservation, as defined above, will inherently be tied to a definition of water delivery efficiency. We proposed the following **definition of irrigation efficiency eligible for EQIP funding**:

Irrigation efficiency obtained through an upgrade or repair of irrigation delivery infrastructure provides for the continued delivery of the amount of water historically consumed, while the amount of water formerly diverted that is no longer required to deliver historically consumed water remains in the source of supply.

To ensure this definition is an effective piece of the USDA CAP, and that EQIP only funds irrigation efficiency projects that enhance drought resilience and reduce water use conflict, we recommend that any EQIP funding for the planning, design, permitting, implementation or construction of any upgrade or repair to irrigation delivery infrastructure meet the above definition of irrigation efficiency, and post-project water consumption is monitored through the OpenET platform and other water measurement resources, as described above. Adopting this definition of eligible irrigation infrastructure would create a comprehensive and impactful water conservation strategy and an effective strategy for drought resilience.

Conclusion

TU's experience in grappling with water security and drought resilience in the West over the last twenty years has led us to support both natural distributed storage and multi-benefit irrigation efficiency projects as key strategies in responding effectively—and urgently—to climate change in the region in partnership with the NRCS and USFS. TU appreciates the attention given by this Committee to western water issues and we look forward to continuing to work with you all on these pressing issues.

Sincerely,

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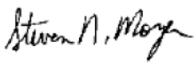

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The Honorable Michael Bennet
Chairman, Subcommittee on Conservation, Climate, Forestry and Natural Resources
U.S. Senate Committee on Agriculture, Nutrition and Forestry
328A Russell Senate Office Building
Washington, DC 20510

The Honorable Roger Marshall
Ranking Member, Subcommittee on Conservation, Climate, Forestry and Natural Resources
U.S. Senate Committee on Agriculture, Nutrition and Forestry
328A Russell Senate Office Building
Washington, DC 20510

Dear Chairman Bennet, Ranking Member Marshall and members of the Subcommittee:

Thank you for holding this hearing on "*Confronting Persistent Drought and Building Resilience for our Forests and Farmland.*" The Western Landowners Alliance (WLA) appreciates the opportunity to provide comments on this important subject. WLA is a landowner-founded, landowner-led non-partisan organization that advances policies and practices that sustain working lands, connected landscapes and native species. Our members represent millions of deeded and leased land and waters across the West.

Background

There is a saying, "Water is Life," and in the arid West with relatively low annual precipitation, our streams and aquifers are literally lifelines for both people and wildlife. As these water sources diminish, so does our capacity to produce food and energy, sustain and grow communities, and support fish and wildlife populations. The western water crisis is not just a regional emergency, it is a national emergency already affecting the lives of all Americans.

The West is facing increasingly frequent and critical water shortages. Drought, climate change, wildfire and the associated impacts on water resources and rapidly expanding population centers are all accelerating the challenge. These shortages, including diminishing surface waters and aquifers, pose an immediate and major risk to all of the human and natural communities that depend upon resilient working landscapes.

Because a large percentage of water in the West is allocated to agricultural uses, many are targeting agricultural water to support continued municipal growth. Water distribution is an important and inevitable consideration and voluntary conservation incentives and increased flexibility in water resource management can help landowners address critical shortages. However, shifting large volumes of water out of agriculture to meet growing urban demands can also have unintended and potentially devastating consequences. Among other things, this approach has the potential to deepen and accelerate the water crisis.

Taking water off the land and fallowing fields can have the consequence of accelerating desertification. Healthy soil and well-vegetated land play critically important roles in capturing precipitation and storing water and carbon, which in turn replenishes aquifers and streams leading to a healthy hydrologic cycle. A healthy hydrologic cycle and increased soil carbon are a important components of climate health and key to mitigating the climate crisis. By contrast, drying up agricultural landscapes and watersheds can lead to reduced vegetative cover, exposed soils, higher soil temperatures, soil erosion, carbon emissions and "dust-on-snow" effects, all of which accentuate and accelerate climate change and reduce climate resilience.

Building Resilience

In short, the western water crisis on the whole will not be solved by drying up the agricultural lands and watersheds that supply our food and water and are essential to climate health. At the same time, we can make better use of water, we can share water and we can actually increase water supply.

Rather than drying up farms, communities and watersheds, there are opportunities to adjust what and how we farm. For example, crop selection and rotation under the right circumstances can help conserve water and build soil. No-till farming has the potential to keep soil covered, lower soil temperatures and better maintain soil moisture. This can reduce the need for irrigation. We need more research, incentives and support for agricultural producers to experiment with water conservation practices. We also need to remove disincentives to improving soil health and conserving water.

Some agricultural communities in the West have developed strategies to reduce water consumption and share water among producers in times of shortage. There is a need to support communities and water managers across the West in sharing these kinds of strategies and lessons learned with one another. Congress also has the opportunity through the farm bill, annual appropriations and other opportunities to provide support for producers who participate in water sharing agreements or are attempting to make their operations more resilient to drought and climate change.

One of the most important things that needs to be done is to improve the health and resiliency of our forested watersheds and rangelands, which in turn can lead to increased water supplies, slower runoff, and improved water quality. When it comes to forests and rangelands, we don't need less management, we need better management.

Landowners and managers need the tools and flexibility to restore forest and rangeland health. While the National Environmental Policy Act (NEPA) and the National Historic Preservation Act (NHPA) are important and well-intended, they are having the unintended effect of impeding many watershed restoration efforts, delaying projects in some cases by more than a decade and dramatically increasing project costs. Congress should consider opportunities to support increased capacity within public agencies and to partner with tribes, NGO's and businesses to improve and accelerate environmental reviews for watershed restoration projects.

Livestock producers have a critical role to play in improving forest and rangeland health and reducing the risks of high severity fires. To do so, however, they need to be able to apply the latest science and to practice adaptive management in a rapidly changing environment. Solutions such as the Bureau of Land Management's outcomes-based grazing authorizations which provide flexibility with retained accountability are already demonstrating positive results and merit greater support. In addition, providing incentives and removing regulatory hurdles to improving water distribution for livestock and wildlife on rangelands can help improve forage utilization and recovery, keep livestock and wildlife out of fragile streams and riparian areas, and provide drinking water for wildlife where other water sources have diminished or disappeared. In many places in the Southwest today, wildlife are increasingly dependent on livestock water tanks provided and maintained by ranchers.

Above all, we need economic drivers that support landowners and managers in keeping working lands whole and healthy. This is the only viable path to mitigating climate change, increasing climate resilience, providing food and water security, and maintaining watershed health and wildlife habitats. Regulatory approaches that exert downward economic pressure on the very lands that hold the key to climate resilience and species recovery will not succeed. By contrast, tools such as the recently announced U.S. Department of Agriculture (USDA) conservation lease offer a path forward.

Farm Bill Recommendations

Federal funding and technical assistance have a key role to play in addressing the West's water challenges, but the programs have to work for landowners, for state and local governments, and on the ground. In addition to the above, the 2023 Farm Bill presents a timely opportunity to direct federal investment toward making working landscapes more resilient in the face of persistent and worsening drought. As the Subcommittee considers how to address these challenges, we offer the following suggestions.

Enhance capacity for place-based, collaborative water resource management. In many cases, locally-led and community-based organizations offer the best and most durable solutions to water scarcity and other resource challenges. These groups have the local know-how and trust to accomplish what outside organizations or government agencies often cannot. What these groups often lack is the capacity to sustain themselves and grow, as time that could be spent on the ground, or in the field is instead spent scratching for funding to keep the lights on.

Federal programs such as the Regional Conservation Partnership Program (RCPP) offer opportunities to promote community-based solutions to improve landscape resiliency, but often suffer from excessive complexity and inadequate delivery. Cash match requirements and the structure of funding pools in particular make RCPP effectively inaccessible to many truly local organizations.

We recommend the Subcommittee consider how to improve access to farm bill programs for community-based organizations and improve the ability for programs to provide local capacity. This should include options for more flexibility around non-federal match and protected or enhanced funding pools or application periods for community-based organizations. The Subcommittee should also explore how to empower eligible community-based organizations to receive and deliver funding for water conservation practices, expanding upon authorities established in the 2018 Farm Bill for water management entities to be eligible under the Environmental Quality Incentives Program (EQIP).

Simplify program delivery and address agency capacity issues. Any discussion on the USDA's role in supporting increased resilience on working landscapes must include a focus on increasing the human capacity to deliver programs and partner with landowners. Without this capacity, agencies will be unable to provide sufficient technical assistance to producers and process program enrollment applications effectively. Complexity of the enrollment and agreement process also limits the efficacy of staff and serves as a barrier to entry for interested landowners. The amount of paperwork required to carry out programs should not be so cumbersome that staff do not have time to learn the specifics of conservation programs or assisting landowners in the field.

Increased funding for federal conservation programs will only do so much without a dedicated focus on simplifying the process for producers. This should include exploring how to better leverage the capacity and social license of trusted local leaders to conduct community outreach and assist producers in nativaging the suite of programs and initiatives available.

We encourage the Subcommittee to explore opportunities to expand resiliency from the ground up through placing jointly-funded, dedicated "resource coordinator" staff positions within community-based organizations. Coordinators would be trained experts, providing capacity for outreach as well as serving as an informative, time-saving single point of contact for landowners. Coordinators would be knowledgeable on a wide range of USDA programs, but also familiar and able to work across state and federal departments and jurisdictions to help align interagency expertise, priorities and funding.

Expand support for practices that conserve water. The 2018 Farm Bill provided the Natural Resources Conservation Service (NRCS) authority to promote practices that conserve water. Beyond directing the NRCS to fully take advantage of these authorities and examine barriers to further deploying practices that conserve water under EQIP and other farm bill programs, the Subcommittee should consider how else to broadly integrate support for water conservation practices through RCPP and the Conservation Reserve Program (CRP) and transition incentives in certain landscapes. For example, Grassland CRP contracts could further support land stewardship that will result in enhanced water quality or quantity in priority landscapes through additional payments or enhanced eligibility.

Improve forest management. Farm Bill programs should be sure to include support for active forest management. including capacity and funding for regulatory compliance requirements. This could include increased agency capacity and funding, greater flexibility in the use of third party contractors, and better coordination across agencies on large landscape projects to reduce unnecessary duplication, time delays and project costs.

Conclusion

WLA appreciates the opportunity to submit these comments and commends your leadership in convening this timely and much needed hearing. We look forward to working with you to ensure that the 2023 Farm Bill works for the West, and meets the needs of producers, communities, and working landscapes in the face of more persistent and destructive drought conditions.

Sincerely,

Lesli Allison
Executive Director

QUESTIONS AND ANSWERS

JUNE 7, 2022

U.S. Senate Committee on Agriculture, Nutrition, and Forestry
"The Western Water Crisis: Confronting Persistent Drought and Building Resilience on our Forests and Farmland"
June 7, 2022
Questions for the Record
Dr. Courtney Schultz

Senator Amy Klobuchar

1. Dr. Schultz, in your testimony you talked about the increase in smoke from wildfires and its impact on air quality. Last summer's severe drought contributed to the rapid spread of over ten separate wildfires in the Arrowhead region of Minnesota and, combined with wildfire smoke from Canadian wildfires that drifted south, created hazy and unhealthy air quality conditions. At that time, the Minnesota Pollution Control Agency reported the highest particulate air quality levels ever recorded in the state.

   - Can you talk about how communities can better prepare for, respond to, and monitor poor air quality as a result of wildfire smoke?

   - Do you have suggestions for how the Forest Service can better communicate real-time information about the risks posed by wildfire smoke?

Response: Thank you for the questions, Senator Klobuchar. Public health impacts from wildfire smoke can be severe and are an ongoing and growing challenge in the United States. Preparing communities to handle smoke is outside of my area of expertise, although I can point to a few public resources I am aware of. The USDA Forest Service-EPA joint map at https://fire.airnow.gov contains real-time information about smoke plumes, fires, and particulate matter measurements; measurements are from regulatory monitors, USDA Forest Service and state emergency temporary monitors deployed to measure wildfire smoke in communities that are not normally monitored, and from low-cost PurpleAir monitors. Public health agencies and community-based groups can provide information and recommendations based on the Air Quality Index (https://www.epa.gov/pmcourse/patient-exposure-and-air-quality-index). They can also provide clean-air spaces, air filters, or N95 masks. Vulnerable individuals can be identified beforehand for outreach and assistance during smoke events; this can be done through the Smoke-Ready Community efforts spearheaded by US EPA and USDA Forest Service. Community-based groups can be essential in this context. Many people do not trust or access government information. Community-based groups, working in partnership public health agencies, can provide targeted messaging through trusted sources and can add capacity to identify vulnerable individuals and help them access needed resources. These same groups have played a role in some communities by supplying air filtration equipment for those in need and not financially able to acquire such equipment without help.

On the second question, the USDA Forest Service-led Interagency Wildland Fire Air Quality Response Program at https://wildlandfiresmoke.net/ also is an important effort. The website identifies four primary program components: "specially trained personnel called Air Resource Advisors, air quality monitoring, smoke concentration and dispersion modeling, and coordination and cooperation with agency partners." To my understanding, this effort has been critical for embedding smoke awareness and expertise in wildfire teams so that smoke management and communication has become a fundamental aspect of fire response. Their cadre of Air Resource Advisors are typically deployed to Incident Management Teams on large and long-duration wildfires in the United States. The Air Resource Advisors provide public-facing Smoke Outlooks tied to the specific wildfires and nearby impact areas as guided by the 2019 Dingell Act, although the program started in the early 2010s. These Smoke Outlooks can be found on the aforementioned Fire and Smoke Map and are distributed by the public information efforts of the Incident Management Team and the agency responding to the fire. The Forest Service can also support local and state air quality agencies in providing more place-specific smoke outlooks and information. This information from the USDA Forest Service could be made more visible or prominent in coordination with state air quality agencies. There is perhaps room for the agency to take a more active role in predicting and reaching out about possible transport smoke (i.e., smoke from outside a particular state or from Canada).

U.S. Senate Committee on Agriculture, Nutrition, and Forestry
"The Western Water Crisis: Confronting Persistent Drought and Building Resilience on our Forests and Farmland"
June 7, 2022
Questions for the Record
Dr. Ellen Herbert

Senator Amy Klobuchar

1. The United States has lost approximately 52 percent of its original wetlands and continues to lose over 80,000 wetland acres each year. That's why I have helped lead bipartisan efforts to secure funding for the North American Wetlands Conservation Act, which is a popular conservation program that funds projects to protect, restore, and manage wetlands and associated habitats for migratory birds.

   - How does preserving and expanding wetland acres fit into the overall strategy of addressing climate change?

     Wetlands can act to both mitigate and aid in adaptation to climate change.

     We know that wetlands provide a natural solution to adapt to climate change. We are already observing changes in the timing, form, and magnitude of precipitation events that are altering flood and drought regimes. Wetlands can help adapt to future conditions caused by climate change by mitigating floods, recharging groundwater and sustaining river flow further into the dry season, depending on rainfall conditions and the location of wetlands within watersheds.

     Wetlands regulate hydrology by capturing water during snowmelt or high precipitation periods and capturing peak flood flows. These flows are then forced through slow subsurface flows can provide increase baseflow during dryer periods by providing a constant subsurface discharge to streams and rivers. For example, DU works with multiple public and private partners to deliver South Platt Wetland augmentation wetlands that direct water to wetland ponds during high-flow snowmelt periods where it slowly infiltrates the alluvial aquifer where it returns to the South Platte River over time. These projects offset agricultural well depletion, supplement baseflow and provide habitat for waterfowl, wading birds, cranes and other threatened and endangered species. Water credits are used to cover municipal, industrial and agricultural needs.

     Wetlands can also capture floodwater and reduce flood peaks and slow storm energy. One study led by Two Degrees Adapt and conducted in partnership with the Mississippi River Cities and Towns Initiative, DU and others estimated that reduce the probability of overtopping by 10 percent for Levee No. 2 in St. Genevieve in a one percent riverine flood in 2030. Nature-based solutions must

offset 95,000 cfs of peak discharge. A set of wetlands with 60,000 acre-ft of flood storage can do this for a duration of ~ 8 hours of peak discharge.

Creating or restoring wetlands can also impact local climate in similar ways to large bodies of water. In the Prairie Pothole Region, new research also demonstrates the ability of wetlands to buffer local temperature. A cooling effect of 1–3°C in summer temperature is evident where wetlands are abundant. In particular, the wetland simulation shows reduction in the number of hot days for >10 days over the summer of 2006, when a long-lasting heatwave occurred.[1]

Wetlands are also one of the most crucial ecosystems for the biodiversity of plants and animals. Wetlands provide habitat for countless organisms, including important pollinator species. They also protect the overall health of the surrounding environment such as protecting farmers and ranchers from floods and droughts. Protecting and restoring wetlands on the landscape creates a more divers landscapes in space and time that allow migratory species to move around and exploit spatially variable resources. Migratory birds and other migratory species evolved under highly variable environmental regimes, but wetland loss has severely curtailed their ability to move around the landscape in response to droughts to find appropriate habitat.

- Can you talk about why wetlands are such an important resource for sequestering carbon?

  The waterlogged soils of wetlands hold tremendous stores of carbon despite how little surface area of Earth (5-8 percent) they cover. In fact, approximately 20-30 percent of the Earth's soil carbon is found in wetlands. This means wetland protection can be important to reducing carbon emissions from the land sector. When wetlands are damaged by wetland drainage, erosion or other activities, enormous reservoirs of stored carbon are released into the atmosphere. Because of this, maintaining our wetlands is incredibly important to avoiding further carbon emissions.

  For instance, the USGS estimates that agricultural conversion has resulted in the average loss of 10.1 Mg ha of soil organic carbon on over 16 million ha of wetlands in this region.

  In terms of increasing wetland carbon sequestration though the removal of carbon from the atmosphere, the highest rates of potential sequestration are achieved in tidal wetland systems and forested wetlands where carbon burial is high and

[1] Zhang, Z., Chen, F., Barlage, M., Bortolotti, L. E., Famiglietti, J., Li, Z., et al. (2022). Cooling effects revealed by modeling of wetlands and land-atmosphere interactions. Water Resources Research, 58, e2021WR030573. https://doi.org/10.1029/2021WR030573

methane emissions are low. Work by Drever et al. 2021[2] suggests the restoration of inland freshwater wetlands in Canada can also contribute to climate mitigation, but work funded by USDA is ongoing in the United States to evaluate the strength of this carbon sink.

It is important to consider that restored wetlands can be sources of methane, but most wetlands have a net cooling effect due to the accumulation of vast stores of carbon over their lifetime[3]

[2] Drever CR et al. Natural climate solutions for Canada. Sci Adv. 2021 Jun 4;7(23):eabd6034. doi: 10.1126/sciadv.abd6034. PMID: 34088658; PMCID: PMC8177698

[3] Neubauer SC (2014) On the challenges of modeling the net radiative forcing of wetlands: reconsidering Mitsch et al. (2013). Landsc Ecol 29:571–577. https://doi.org/10.1007/s10980-014-9986-1