

# Water Underfoot

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**Greg Dalton:** Welcome everyone. Thanks for coming. It's great to see you here. I'm really looking forward to our conversation here on stage, and also with everyone in the audience, so hope you get a chance to talk to some people today about water and whatever else. Welcome to Climate One. I'm Greg Dalton. Today we're talking about California's searing drought and what can be done to keep the Golden State hydrated. Reservoirs are at historic lows, mandatory water rationing is in effect in some areas, and groundwater is being sucked out at an alarming rate. Over the next hour we will look at groundwater, conservation, recycling, agriculture uses, and residential landscaping. Along the way, we'll include questions from our live audience here at the Commonwealth Club in San Francisco. This program is underwritten by the S. D. Bechtel, Jr. Foundation.

Our guests are three water experts. Debbie Davis is Community and Rural Affairs advisor, the Office of Planning and Research at the state of California. I think that means she's one of the governor's top water advisors. Felicia Marcus is chair of the State Water Resources Control Board, effectively the state's top water cop. And Buzz Thompson is director of the Woods Institute for the Environment at Stanford University. Please welcome them to Climate One.

[Applause]

**Greg Dalton:** Felicia Marcus, let's start with you. Droughts come and go in California, they're part of life in the American West. Put this current drought in context. How bad is it relative to the other droughts we've seen in our lifetime?

**Felicia Marcus:** It is really, really bad. We've had in the -- since we started recording a little before the -- I think we started recording in the beginning of the 20th century in 1900s early, and technically, this is the third least amount of precipitation by a smidgen, pretty close that we've had but the impact of it is infinitely greater.

Because since 1924, 1977, the other two years that were slightly drier, we've grown by millions of people, you have far more agricultural production dependent upon the same amount of water, in part because agriculture has become so much more efficient at growing food. You have more endangered and threatened fish and wildlife species who don't have the resilience they once did to be able to weather a drought, and so the impact is considerable.

**Greg Dalton:** Debbie Davis, a few months ago, recently, Governor Brown called for 20% voluntary

reductions in state water use. As a consequence, water use in the state actually went up. So what does that say about how well Californians and the California government are doing and responding to this drought.

**Debbie Davis:** I'll answer that question but actually, first, I want to answer Felicia's really quick and say I'll let you know how bad this drought is when it's over.

**Felicia Marcus:** That's right.

**Debbie Davis:** Because the fact is, is we don't know how long this drought is going to last, and we're in a world of hurt already but it might continue next year and the year after that. And so get back to me on that one.

**Greg Dalton:** Okay.

**Debbie Davis:** As far as conservation is concerned, one of the challenges we face is that people around the state has done such a good job investing in making our water systems more reliable. We've diversified our water resources and so in some parts of the state, people aren't feeling the hurt. And so it's hard they still see the sprinklers running at the golf course and so it's hard for them to internalize that we really are in a state of emergency. And so we do, we have big urban areas that have continued to use water basically at the rates that they were using water before the drought happened. We're working very hard across the state to get the word out. We have the Save Our Water campaign that is communicating with water districts and through them to their customers but we definitely need to do better.

**Greg Dalton:** Buzz Thompson, I read on a website, Water in the West, which is part of the Institute of Stanford that you manage. A quote from Mother Jones which says, "To live off surface water is to live off your paycheck. To rely on groundwater is to live off savings." So tell us the relationship between groundwater and surface water, and how that matters during a drought like right now?

**Barton Thompson Jr.:** So let me start out by just saying that, no matter how bad the current drought is, as Debbie already pointed out, we don't know whether it's going to end and we know that we're going to face future droughts, and many of those droughts are going to be even worse than the one that we're facing today. So when we're talking about these issues, we need to be thinking not about what's occurring today, but we need to be thinking about how do we prepare for those droughts of the future? And groundwater is essential in doing that.

During a period of drought, we know that our surface water is going to be lower. What we can do in a period of drought, however, is to turn to that savings account that you mentioned earlier to our groundwater aquifers. Groundwater aquifers naturally fill up during wet periods of time, and then we can use that water during dry periods of time to help us through the drought. The problem, however, is that we've been too tempted to invade our savings accounts of water, not only during dry periods, but also during wet periods. And ultimately, that's going to mean that that groundwater is not available to us when we really need it.

**Greg Dalton:** And right now, California is one of the few states where we don't really know what's coming out of the ground. How is that going to change potentially in this drought in terms of measuring and having some rules around groundwater extraction? Because pretty much anyone in this state can poke a hole in the ground, suck some water out, and it's theirs, right? Felicia Marcus?

**Felicia Marcus:** It depends on where you are. We do have the least amount of statewide regulation of groundwater of any state in the country. It is very different from what people assume in California but it really varies by region. You have some local areas in the state that are very highly managed and managed very, very well, where the pumping is measured, where folks abide by a code, either that's sanctified by a court.

Sometimes it takes many years to get these things through but they are dealing with quantity and quality. They know what they are taking out. They know what they are putting in, and they are affirmatively recharging with water that runs off the mountains and streams, but also with increasingly with recycled water -- storm water captured from urban areas and the like - and that really is our future for particularly for urban resilience but also throughout the state. You also have some special districts that the legislatures create. You have some counties that do a good job but it's not mandated at all at the state level. So you do have some parts of the state where it's sort of the person with the biggest pump and the most amount of money to spend on it, can basically pump as much as they want. And because of that, and because people are starting to realize that you have some areas where there has been such great subsidence of the earth from over pumping that canals are running backward, that infrastructure is crumbling, that there is a loss of flood control, and also importantly you have neighbor versus neighbor impacts.

And I think because of those neighbor versus neighbor impacts, and the fact that people realize that we really have to do something about it now but also for the future, in order to be more resilient in the face of climate change when we're going to lose half of our snowpack or more, which right now is half of the storage in the state. So if we don't have that snowpack that melts off and refills our reservoirs and our surface streams, the dislocation and the pain that we're feeling right now is going to feel like a picnic, unless we get ahead of it. And so people do see the need to manage our groundwater basins and so there is a very strong effort going on right now with nonprofits, associations of water districts, people on all sides of the spectrum to try and come up with a framework for statewide regulation that would encourage, in the strongest terms, locals to step up and manage their groundwater basins in whatever flavor works for them but in a way that truly will manage their groundwater for the future off into the long term.

**Greg Dalton:** Buzz Thompson, how should California more consistently, statewide, manage its groundwater resources to take advantage of this drought?

**Barton Thompson Jr.:** I actually just want to go back for a second to your question about how do we manage groundwater when we don't even have basic information in main parts of the state about the groundwater that we have available, and about how much people are actually pumping. Take your analogy earlier to thinking about groundwater as a savings account, and think about we have a really important savings account that will get us through a period of drought. Then recognize that we have given hundreds of people, in some areas of the state, access to that bank account so anyone can draw out of that bank account anytime they want to. And then imagine that we have no information about that bank account. We don't necessarily know exactly how much money we have in our bank account, and we're not keeping track of how much money people are actually taking out. That makes it very difficult to actually manage what is an essential resource today.

Now, as Felicia mentioned earlier, we have done a great job, in some portions of the state, managing groundwater at a local level and I'm optimistic that we can also manage groundwater at a local level elsewhere in the state. But what's really crucial is that the state come in, sets standards for how we should manage our groundwater, give the local populations and agencies a period of time to actually then meet those state standards. And then importantly, if the local agencies don't meet those standards, that the state has the power and the willingness to step in for the local governments.

**Greg Dalton:** Debbie Davis, that sounds like a proposal that's in the legislature now and does Governor Brown support that? Is that where he'd like to go for managing the state basically have some state guidelines but let local areas manage their own water and not have big feet from Sacramento coming in?

**Debbie Davis:** Actually, yes. The administration has taken a very strong position at the best way to manage groundwater is at the local and regional scale. The reality is that that's the scale at which people truly understand how their systems work. We could never hire enough staff at the statewide level to be able to do a good job at that. But we also believe that we have to have a state backstop and in the body of Felicia at the state --

**Felicia Marcus:** Personally just more.

**Debbie Davis:** Yes, she's going to go racing around the state.

**Barton Thompson Jr.:** We all trust in Felicia.

**Debbie Davis:** Yes [Laughter]. But at the state water board so that for the places that can't or choose not to do it, we have the tools that we need to protect what is truly a fundamental water resource in the state. But I also want to say something that's I fully agree with both of my colleagues here. But I would like to see us looking even a little farther into the future because ultimately we have to stop making this artificial distinction between surface and groundwater, and we need to manage every drop of water as part of one water system. And so I hope that this step we're taking on groundwater is a step that gets us closer to that direction.

**Greg Dalton:** Let's talk about the incentives for conservation. If we're all drawing from a particular aquifer or well, it's either use it or lose it. I've talked to people in mirandas like, "Well, I got a lawn. If I don't use it, someone else will use it." So there's very little incentive, Felicia Marcus, for conservation when there's no rules, no penalty for extreme use.

**Felicia Marcus:** Well, I don't know that I would buy into that construct having lived through earlier droughts in Los Angeles, for example, where L.A. really stepped up.

You have a whole host of places in Southern California that have grown by millions of people without increasing their water use because of a conservation ethic, but also because of rules at the local level on toilet retrofits and incredible efforts on the part of water districts and multiple agencies to help retrofit inside the house. In some places you actually have communities like one of the water districts in Western Riverside County, where they've actually gone and done landscape ordinances in every single one of their communities to say, "We have to have a climate-appropriate landscape and you've got to have that in order to get our water." You also have communities that have gone and figured out what is the reasonable amount of water for a community, a family of a certain size, a yard of a certain size and a certain climate, it really varies, and so there's an incredible array of activities that people have.

I think that have taken in across the state. I do think the notion that, "If I don't use it, somebody else will," just frankly doesn't hold true. Well, you can't necessarily draw the droplets. Every drop of water saved is water saved for the future. And as we know the droughts are going to be more frequent than we know, as my colleagues have said, that we don't know when. What we do know is that we know we don't know when this drought is going to end. We do know from the Australian experience where they kept thinking they were in the three-year drought cycle for at least six years, as the story goes, and then it ended up being a 10 or 12-year millennial drought that the lesson that they learned, as well as our own forbearers in the '70s at the state government, was that they wished they had conserved more sooner. And that is true for every local community. It's also true that at a local -- so it's in self-interest. It's also true at a local level that if you increase your security, it allows communities to be more gracious in helping other communities through this time of drought.

And one thing I neglected to say earlier, in addition to saying it was just bad, I mean we have over

400,000 acres of fields that are fallowed in California. We have over 17,000 people out of work, dependent on the farm economy in the Central Valley. I mean it is really -- it's a terrible circumstance. And saving water, wherever you are, makes us one California, but it also yields flexibility in the system, and as I started out to say, it's just the right thing to do and it yields water security for your community. I think the one thing we've lacked is the will to actually just work with our communities as much as we should to help people see the ways in which they can save water.

You may not have to go all the way to saying, "Here's a landscape ordinance work. You can't have plants that are different than what would work exactly in this climate." But there's a long way to go in many communities where people are wasting water and they don't even know it.

I have to say, we did these mandatory, very modest, conservation rules at the state level which is the first state in the country I understand to ever do it, and we did it to ring a bell because we were getting sort of a lackluster response...Folks not really sure what to do if they had one or two years in storage. We said, "Hey, guys. We don't know when it's going to end and everybody can step up."

And we just mandated essentially things that are not wasting water. We didn't say, "Kill your lawns." We said, "Don't overwater your lawns. Don't use a hose when a broom will do. Don't be using ornamental fountains without recirculation pumps in a drought." I mean things that make sense and while we've gotten a little bit of pushback overwhelmingly, we've gotten support from regular people. The Public Policy Institute of California did a very timely poll that said 75% of the public want mandatory conservation regs, in part because they want their local agencies to tell them what they ought to do and they want everybody else to have to do the same thing so you have a common engagement.

**Greg Dalton:** Let's pick up on lawns because outdoor landscaping is a big part of residential water use in California. Remember, when my family came to California, we had a lawn. We put up a lawn because my dad was from the Midwest and just, that's what you did. Felicia Marcus, let's talk about lawns and culture because it's a little bit of the American Dream having a decorative lawn in front and back. Tell us about your past experience with grass.

[Laughter]

**Felicia Marcus:** I don't know where to start [Laughter]. No, I grew up like many people in Los Angeles. Everybody had a front lawn. We didn't really have. We had a little back lawn but it was always kind of brown - I don't know why that was - but there were front lawns. But the difference then was everybody played outside. All the kids, they'd let you out the beginning of the day, we played on each other's lawns. We're all out on those lawns all the time. We didn't give it a second thought. But increasingly, folks are not out on their front lawns. And as a friend of mine likes to say, "If the only person that walks on your lawn is the guy that mows the lawn, maybe you should lose the lawn." There are some lawns that makes sense.

I gave my stepson permission to put a little lawn in the back if he promised he would play ball with my grandson on it so he could fall. I love the smell of cut grass. Remember when you were shorter, you smelled it more. Now, when you got taller, it's really a difference. I love that smell. So there's

some lawns that do make some sense that people use, it's just when we don't even think about it and take it for granted, it seems like an extravagance that doesn't work. The other thing is that people really don't realize how little they need to water their lawns. People tend to water the three feet below their lawn. They water the sidewalks. They just think more is better and it's not necessarily.

**Greg Dalton:** Buzz Thompson, do you have a lawn and do you think that we ought to rethink lawns in this era of drought in California?

**Barton Thompson Jr.:** Okay. You put me on the spot now, so I do have a lawn. It's in the back. We don't have a front lawn. And even with a lawn, there are ways in which you can reduce your water use significantly. So my wife and I have just purchased a smart irrigation controller for not only our lawn but also for our gardens. This does some things that, of course, you would expect everyone to do on their own which is, if it rains, it automatically turns off the entire irrigation system.

But in addition to that, it helps you determine exactly how long you should water your lawn. If, for example, you should water your lawn for a 10-minute period of time, but after five minutes, the lawn will be saturated and some of the water will begin to run off. Then it actually breaks up into two segments and it will turn on for five minutes then water a different part of your yard, and then come back to the lawn for another five minutes. It also takes local weather into account and adjust how long your sprinkler system or your drip irrigation system is on in order to minimize the amount of water that you're using.

All of you who are here in the audience and all of you who are listening on the air, my guess is that your local utilities have a rebate program. We were able to get this for \$50 and I can tell you that the payback on that is going to be almost immediate, and it's going to help reduce water significantly. Now, I also have to tell you, when I was a kid, what I remember on the backyard was that we had one of those slip and slides. I don't know if any of you remember those but, of course, what you would do is you would hook it up to the hose and the water would run continuously. And the slip and slide would then kill the lawn which require my parents to then water the lawn for a longer period of time in order to make it green again. So we've come some ways.

**Greg Dalton:** Buzz Thompson is director of the Woods Institute for the Environment. We're talking about water at Climate One. Debbie Davis, how about your lawn and let's talk about Cash for Grass that's sort of buying out lawns as a policy tool to get people to forgo this little piece of the American Dream?

**Debbie Davis:** Well, I actually have lawn in my front but its dead [Laughter]. And in the backyard, we took the lawn out and we have-- I learned this actually, there's so much to understand about how to landscape in California that we don't tend to understand if you grew up here, I grew up here. I learned, though, that right now, if you have a lawn in your front yard and you want to get rid of it,

you should sheet mulch. Don't plant new plants now because if you plant new plants now, they'll use about as much water as your lawn will. So we have a sheet mulch system in the backyard waiting for those rains to come when we can plant some drought-tolerant plants. And then on our front yard, our neighbors probably hate us because our lawn is just yellow. But the Cash for Grass programs are fantastic. The one thing I will warn you is most agencies will require that your lawn is still green. So like, we would not be eligible for Cash for Grass because we let our lawn die already. So don't let it die until you show them that you got live grass.

**Greg Dalton:** Oh, it's too late for me, I killed mine. Okay, all right.

**Debbie Davis:** Well, check anyway because you'll never know.

**Greg Dalton:** Bring it back to life. Okay.

**Felicia Marcus:** Maybe it's not dead yet.

**Debbie Davis:** Yeah, that's right [Laughter].

**Greg Dalton:** Yeah, maybe. Yeah.

**Debbie Davis:** But that it's a great program. The one thing I would say on the equity side, though, is that it tends to be only available in agencies that have a certain economy of scale. So for folks who live in smaller water districts that don't have that economy of scale or who are on their own domestic wells, unfortunately, that's not a tool that's available. It would be great to see something like that with a little wider availability.

**Greg Dalton:** Debbie Davis is a water advisor for the state of California. Let's talk about what other individuals can do, what's meaningful individual action, with jokes about shower with a friend, that sort of thing. So Felicia Marcus, what can individuals do that really matters?

**Felicia Marcus:** Well, I think it varies by the individual. I mean there are the obvious like taking shorter showers. I happen to love long showers and it pains me. But being conscious of how much water you use and going as quickly as you can, turning the water off when brushing, loading your dishwasher full, and your laundry when it's full before you do a load. I personally don't have a yard but I have a very dirty car.

**Greg Dalton:** It's better to wash your car at the carwash than in your front yard, right?

**Felicia Marcus:** That is --

**Greg Dalton:** Because it's recycled.

**Felicia Marcus:** Absolutely true, and it is now against state regulations by the water board to wash your car at home without a shut-off nozzle on your hose, just so you know that, or you're subject up to a \$500 fine. But I just think it varies by people. There are people who call a drought shower, showering with a big pot or bucket in the shower, and then you can use that water for watering your plants in the house or outdoors and all that. There are ways to capture it. In a lot of communities in Southern California, people are retrofitting their homes. There are entire neighborhoods done in Los Angeles that folks where they attach rain barrels to the gutters on the house. This is true all over Australia.

In Australia, a common greeting is, "How's your tank?" That means, presuming if you have water in your tank, you're fine. They are now selling them at Home Depot, the Metropolitan Water District of Southern California, it has them, to give out to folks who also have greywater systems in many places where people are retrofitting their homes so they can take their sink and shower and washing machine waste water. It varies by locality and are able to recycle it for use, outdoor in their garden, that's another way to extend your water use. So there's a whole host of things people can do, depending upon their interest and their capacity, and different communities do it different ways.

What I'd like to tell people, is they don't have to do everything. Sometimes people don't even want to start because they are afraid they're going to do something wrong, and they can't get it all right.

But the fact that all of us think about what we can do and just do that or do what comes easily and then move on to other things if we care to, there are a lot of us. And so that particularly, in urban California, and that can have a profound impact.

**Greg Dalton:** We're talking about water conservation at Climate One. I'm Greg Dalton. You just heard from Felicia Marcus, chair of the state water board. But Buzz Thompson, agriculture uses 80% of water in California, and some individuals might think, "Whatever I do it's a drop in the bucket; it's really ag." So what's ag doing to use water more wisely during the drought?

**Barton Thompson Jr.:** So ag actually has made great progress over the last several decades in reducing its overall water use. And so if you look, not only in California today, but throughout the Western United States, agriculture has done, I think, actually a very impressive job of reducing its

water use through the irrigation equipment that it uses. I was mentioning a moment ago that I'm in the process of installing a smart irrigation controller. Well, agriculture uses those types of controllers today in many of their operations. So ag has done a great deal in the past. I think that having said that, that ag still has significant opportunities. I think our opportunities of changing the way in which we actually irrigate some of our crops. There are opportunities to actually, sort of, water starve the plants at the very early stages of their production. And in some cases, actually have exactly the same production, if not, slightly better production while using less water.

**Felicia Marcus:** Can I add something?

**Greg Dalton:** Felicia Marcus?

**Felicia Marcus:** Just something else that people don't realize that 80% - that's 80% of the developed water - 20% of --

**Greg Dalton:** Which means what?

**Debbie Davis:** The water not left in the environment and the rest of it is not all the water in California.

I agree with Buzz, there has been an incredible amount of advances. Frankly, if you go out through agriculture in California, you're just as likely to see farmers farming by iPad today when they've been able to have the economics to be able to or gotten the funding to be able to do these drip systems that also add chemigation and fertigation, is what they call it, and you can really precision water and feed the plants. So a lot have done an amazing job and as a result, we do have more agricultural production per drop of water in the state than we had. The other complexity that sometimes people don't realize that is different than urban, in the urban arena, we can do a lot more, and it yields real water savings. In agriculture, it's more connected. So one person's flood irrigation of a given field is groundwater recharge in that area.

**Greg Dalton:** So flood irrigation is not always evil.

**Felicia Marcus:** It's not. No. It's not always evil. It's a much more complex world, or that farm's runoff is what re-goes into the stream becomes another person's water, or becomes a refuge's water, and so it's just a much more complex picture than just saying ag versus urban. In fact, I really think we need to work at erasing that ag versus urban distinction because we do need each other. Food security is going to become one of the issues of our time in the coming decades, in part because of

climate change, in part because of population growth, but we have one of the five Mediterranean climates in the entire world that can grow healthy fruits and vegetables year-round, and that is a precious resource as well. So if the complexity of it sometimes makes it difficult in the conversation but we have to get to that complex place of figuring out how to honor all of us and figure out how everyone can do the best they can.

**Greg Dalton:** Debbie Davis, California still grows a lot of water-intensive crops. Should California be growing alfalfa, feeding it to cows, cotton, rice, et cetera, when water is so precious? But what about crop selection, is there a role for the state to play there or should it just be the market at force?

**Debbie Davis:** Again, I think I always go back to the idea that it's a system. And so if you look at agriculture, it's just one part of the system. That question is best answered at the local level, and best answered based on what water resources are available in that local area, and how can those best be put to use, both to serve the local needs, but also, frankly, to serve the worldwide needs? So I would hesitate to say that that should be regulated at the statewide level...I think we should have some broad state goals and we should ask locals to honor those. But I think our communities are going to be much healthier as we integrate, and we really manage our systems, as opposed to isolated silos.

**Greg Dalton:** Buzz Thompson, any thoughts on alfalfa, cotton in California?

**Barton Thompson Jr.:** Yeah. So one of the things that you said Greg a moment ago is, is this just the market at work? And the truth of the matter, it's not the market at work because, at least in some local areas of California, we don't charge agriculture the true value of the water that they are using. Some regions that water is subsidized. And so if you subsidize that water, if you do not charge people the full cost of that water, then they will utilize it for crops that probably should not economically be produced in that particular area. So one of the things that I think is imperative in the state, is that we begin to charge the full cost of water to everyone, not only agriculture, but also urban areas so that everyone recognizes the value of that water, and will conserve to the degree that they can.

**Greg Dalton:** Buzz Thompson is director of the Woods Institute for the Environment at Stanford. Our other guests today at Climate One are Felicia Marcus, chair of the State Water Resources Control Board and Debbie Davis, Community and Rural Affairs advisor at the Office of Planning and Research at the state of California. I'm Greg Dalton.

Let's talk a little more about water pricing. Felicia Marcus, it's not priced quite yet. Well, it's priced differently around the state. Let's talk about reforming pricing of water so that it pay more for it in a drought or pay more for it when you use more?

**Felicia Marcus:** Well, I can speak about it more in the urban context. In the urban context, there are drought surcharges. Again, it really varies across the state. The Alliance for Water Efficiency, nationally, is run by someone who used to be a senior leader in the urban water management arena in California, and they are just about to or just recently released a report talking about rate structures across the country that try and help agencies with the tools to come up with rate structures that are both fair, equitable, and effective. Many studies have found that pricing really is, in the urban context, the single most important thing you actually can do to help people conserve water. I think it's a combination of calling on the better angels of our nature, understanding what our neighbors are doing.

There's a whole series of technological advances in the metering such as the meters, the systems that Buzz is talking about, but also systems that not only can tell you how much water you're using but can give you feedback from your water district about how your neighbors are doing. And that there's a lot of behavioral research about how that's a powerful motivating force, not so much in the drought-shaming thing that we see in a lot of the stories, but people want to be a part of a community and they want to know kind of how they are doing compared to other people. And if they see that other people are sort of, doing better in this similar circumstance, they want to do better, and they find that very, very motivating...and that really just makes common sense. But then there are pricing mechanisms as well that get people to think about, a little bit more about, how they're using their water and it gives them an incentive to be a little bit more efficient.

**Greg Dalton:** Debbie Davis, you did some work on establishing water as a human right, yet water is underpriced. We don't pay the full value for it. Should we pay more for water?

**Debbie Davis:** I would love to see more equity across the state in how much people pay. Because there are communities in the state that are paying a lot for water that they might make on average \$14,000 a year and they pay up to \$200 a month for their water. So I think there's definitely room for some equalization of how we price water. But certainly, I think, it's reasonable to say that folks who are conserving water, and being responsible, might pay a lower rate. People who, for whatever reason, use a higher amount, I mean it's a basic tiered-rate system, but I also hope that as we move in that direction, that we don't just have a system where you can use as much as you can pay for...because that also, there are limits on the system, and so up until now, I think in California, we've been very fortunate to be able to have that kind of rate structure but I hope that individual agencies are also thinking about where the limits are.

**Greg Dalton:** There's also been some paradox as where people conserve and then do the right thing first, and then their agency comes in, says, "You have to conserve." And then like, "We already did." But they get punished and the agencies then make less money. So let's talk about that model about how the utilities can stay in business because they basically have a financial interest in selling more water. Felicia Marcus?

**Felicia Marcus:** Well, this is a place where quite a few agencies around the country have adopted rate structures where they call them "budget-based rate structures" or "foundational-based rate structures" where they've gone ahead and changed their rate structure because they do their -- they are not other than in the private systems that are regulated by the California Public Utilities Commission where they have to go and get approval for their rates.

So all the rest of them can do this themselves. They can change their rates to get a foundational base rate that pays for their basic infrastructure and then have a tiered ranking of some sort, where if you use much more, you pay more because that's going to cost the water agency a lot more to go after that next drop of water or implement recycling or implement all kinds of tools that are out there. And a lot of agencies are stepping up and doing those sorts of things, and it's a choice that, while difficult at times, only because going back to your board or your council or whatever structure you have, sometimes voters can be difficult. My experience from having been in local government is that if you explain yourself and you spend the time explaining yourself, the public steps up, but they want information to understand why it is they are being asked to pay more and that it's going to be fair.

Again, I think the issue of fairness and transparency is incredibly important in civil society and the more agencies can do that and explain why they need it, the more responsive people would be. I don't underestimate how challenging that can be at times but it definitely can be done because many agencies have done it.

**Greg Dalton:** Buzz Thompson.

**Barton Thompson:** If you look at energy pricing about half of our States have mandated pricing policies where utilities do not have an advantage in selling more electricity. California was one of the pioneers in that type of a pricing system. It turns out there's only four States that have mandated that for water utilities. One of the good stories here is that California is one of those four States. That policy only applies to investor-owned utilities, privately owned utilities. It should apply across the board to also all publicly owned utilities, city owned utilities. I was very pleased to see earlier this year that both the Los Angeles Department of Water Power and Glendale both separated their pricing system from how much they actually sell. So we're beginning to see again that happen in California at the public level also.

**Greg Dalton:** Buzz Thompson, some farmers say that they'd be happy to have more control in regulation on groundwater if there was less water left in the system for fish, so should some of California's environmental regulations be relaxed because of the drought? Serve people instead of fish.

**Barton Thompson:** So I certainly understand the agricultural concern that if they're being asked to actually reduce the amount the groundwater that they're pumping, then the State needs to find

them some type of replacement water for that. I think it's gonna be very difficult in many cases to find replacement water and certainly that should not come out of the environment. If you take all of the various sectors in which use water today: agriculture, urban, and the environment, in a period of drought, the sector that gets cut the most is the environment. It's always the environment that we pull the water away from first and that has significant implications for the fish that rely upon our river and stream flows. So, my answer is no, we can't find it there. What we need to do is to continue to find ways in which to stretch our available water supply, which is storage, personally I think it should be through groundwater storage more than through surface water storage but we should be storing more water...and to the degree possible we should be conserving water and reclaiming water in order to make that water available to hopefully make up for reduced groundwater that can be extracted.

**Greg Dalton:** But embedded in that is an expectation that there is a certain amount of water that people are entitled to that's gonna somehow come back and there are some questions about whether the last few decades or centuries have been unusually wet and that there's more water in peoples minds and on paper than is actual in reality. Felicia Marcus.

**Felicia Marcus:** No. I mean, that is a challenge. I think in some ways we've been living beyond our means if you're taking a longer term view and I think part of -- I think being sort of a modern society is thinking about how do we get smarter about how we use a precious resource. That's why the administration late last year came out with what we call the California Water Action Plan. It's less a plan than a promise from this administration on what we were going to prioritize and expressly says we have to do all of the above. Frequently, people say there's all one thing, it's all storage or it's all conservation or that one thing will solve our problems. If you look at what climate change is going to bring to us as we lose that snowpack, which is such an essential part of our storage, and storage is important whether it's in snowpack, in surface storage, in off-stream storage of all different sizes all over the place or underground, and this is why groundwater management is so important and such a high priority because you can't use it for storage unless it's managed in the first place is, as we lose that, we have the problem where we have the most variable hydrology, that's a big word, but the most variable hydrology in the country which means here when it rains it rains, when it doesn't it doesn't more than anywhere else in the country. It falls in the areas where fewer people are and less agriculture and it falls during the times of the year when it's not the highest use which is during the later spring and summer months, and so we have to deal with that reality of climate change making that much worse. And my view is we need belt suspenders, flying monkeys, whatever it will take and we got to break apart the historical dialogues that oversimplified things and say "all of the above." We're gonna have to have storage; big, small, above ground, below ground, wherever we can find it. A lot of regional stuff we're gonna have to augment it with recycled water as often as we can. It is not rocket science. This is just the application of energy and money to a problem. We totally can recycle water and use it safely, and our board recently made it much easier both in terms of financing and in terms of streamlining the permitting for recycled water use outdoors and irrigated ag and we will be doing even more in the next two years for augmentation of surface reservoirs and eventually reporting on the potential for direct potable reuse that will give us a lot more resilience. The storm water capture issue that I mentioned earlier is going great guns. I mean, Australia retrofitted quite a few number of their cities to capture the runoff in urban areas at cisterns under parks to capture it. So, you know, you do need public parks where people can play ball and have lawns but there's a way to make that more resilient. Los Angeles is, you know, digging up curbs and retrofitting communities not just with rain barrels but with French drains at the end of driveways, permeable surfaces on their driveways, swales instead

of curbs that capture water and what they're getting out of it is they're doing food control in areas that used to flood they're not any more. They are getting water supply by that water going back down into the groundwater bases. They're water quality because that water is now not running off the streets picking up motor oil, dog droppings, pesticides, you name it, and making a beeline for the ocean and they're greening a community that's the most park poor community in the entire country per capita and what they're doing is they're stretching scarce local dollars for multiple benefits and we need to find ways to reward that kind of work that makes a community better and there's a way to retrofit ourselves that's intelligent but it is complex. And so we have to get to the era of integrated thinking, complexity, not being afraid of complexity and just figuring out what it takes to make it work with conservation being the first among equals.

**Greg Dalton:** Debbie Davis let's drill a little bit on climate change. What can we expect with climate change in the State's water supply in the future? Are we gonna have more droughts? Are they gonna be more severe and what does it mean for water security?

**Debbie Davis:** I wish someone had a straight up answer on that. Perhaps Buzz you can correct me if I'm wrong here. As I've looked at the climate models myself and I'm not a climate scientist, so it's the layperson's analysis. We're in this little band that is hard predict. I, I actually -- one of the models I was looking it actually predicts that there will be more precipitation in Southern California. I think really, what the moral of the climate change story is, is that we have to do everything we can in every part of the State to be as resourceful as we can, as diversified as we can, as integrated as we can across our water supply system because that's the best way to hedge our bets on what climate change brings but I understand that the general consensus is that we'll definitely be drier and that we may see more and longer droughts moving into the future.

**Greg Dalton:** Buzz Thompson, something people talk about... mega droughts that we may be going back to more historically normal drier times, climate change or not.

**Barton Thompson:** So as Debbie has already mentioned, we don't know for sure exactly what's gonna happen in the face of climate change but we do know three things. First, thing is is that if you look back over California's history and the history of the Western United States over the past thousand years the last 150 years actually look pretty good. Over the last 150 years we've had droughts probably about every 10 to 15 years and we're used to those droughts being relatively short. In some cases they're just a couple of years, at their longest is somewhere between five and seven years. If you go back and you actually look at the records from a period of about 1000 to 1300 A.D. what you find is is that there were some droughts that were much longer than anything that we have seen today. Some of those droughts lasted for examples up to 13 years. Of much greater concern is that there were periods of time that sometimes lasted to 80 to 140 years in which, although not every year was a dry year, we never recovered from the droughts that we had. So we would have a 13-year drought then maybe we would have rain for a year or two but that wasn't enough rain to make up for the 13-year drought we have already seen before we went into the next 10-year drought and over those periods of time we actually know that a number of our lakes and rivers actually shrank in size because of the little precipitation that we were seeing during that period of time. So the first things is, even without climate change, if you look back we need to be

prepared for much worse droughts than we've seen over the last 150 years. And second of all if you look at climate change we don't know exactly what's gonna happen to precipitation levels in the State of California. Precipitation could go up, it could go down, it could vary as Debbie already mentioned, region to region, but what we do know is it's going to be warmer and as a result of it being warmer we'll probably have smaller snowpacks and those snowpacks will melt earlier in the year and that's of concern because those snowpacks are a natural reservoir for us and to degree they are smaller and they melt earlier in the year it's going to be harder for us to harvest those for the water that we need. In addition to that if you're a farmer and your evapotranspiration rates are higher, your crops are going to use more water and therefore the little amount of water that you have isn't gonna go as far as it might otherwise go, and then the third thing that's important to recognize is that climate change is not just about a change in the mean. It's not just about whether or not over time we're gonna have more rain, less rain, more snowpack, less snowpack. Climate change is going to bring extremes. Felicia mentioned already that California is a State of extremes. We have extreme droughts. We have floods. What we pretty well know under climate change is those extremes are gonna become more extreme. We will have more drought periods. We will have more flood periods. The droughts will probably be worse. The floods are going to be worse. All of that means that people like Felicia and Debbie who are managing our State water resources for us are going to have to worry about how do you manage for situations that we have never encountered in our own experiences.

**Greg Dalton:** Buzz Thompson is director of the Woods Institute for the Environment at Stanford. Our other guests today at Climate One are Felicia Marcus, Chair of the State Water Resources Control Board, and Debbie Davis from the State of California. I'm Greg Dalton. We're going to invite your participation at this microphone right here. I would like you to come up one by one and join us with a brief one-part comment or question and we're here to help you keep it brief of that's needed and starts with Alyssa and Jane Ann our producers right there. If you're on this side of the house we invite you to go through that door over there. We'll get in as many as we can. So we'll try to -- we have 16 minutes left and we'll go through some questions and answers as briskly as we can and we'll just get one more. Yeah, if you can go through that door over there that would help. Let's include our audience's questions. Welcome.

**Female Participant:** I have a question -- is this on? Hello?

**Greg Dalton:** There you go.

**Female Participant:** I have a question about groundwater and why -- it sounds like we don't -- that measuring it is too hard. I mean, if I were to ask you why don't we measure it, or why don't we know how much we have, you'll probably say because it's too complex but it seems to me that -- one person mentioned there's a framework for starting to have more of a handle on what we have, but it seems to that's the very first step before we can have any regs or recommendations about it.

**Felicia Marcus:** You're completely right. I think historically what's happened is folks have been

able to rely on groundwater and the way it's managed under basic law is that everyone over the basin shares in it but the question hasn't been called until it runs out or someone's hurt and then trying to figure out how the community can come together to deal with it. Generally, when they work these things out, in court proceedings, or in agreements, you know, the first that they always require is measurement of what's taken out, who's taking it out and what goes back in so that they can manage it. So that is a very live part of the discussion going on right now for setting a State-wide framework of expectation, you know, you need to have governance of some kind to run it. You need to have measurement 'cause you can't manage what you can't measure. You got to have some enforcement mechanism. You have to know what your thresholds are. You have to know what your geology is, to be sure, because every basin is very, very different. Some refill every year quite easily and are used, you know, as a very regular storage. Others are denser in pockets and it takes longer. So it is more complex than just the sheer measurement, but it is definitely doable. It's just that people have been loath to do it because it's been this kind of secret bank account or bank account they could count on without thinking about limits and it is frankly. It's just difficult as a community to come together and make it happen which is why the State is looking at how can we do the forcing mechanism to help people replicate what has worked in other places at the local level, help give the political will to get it together to organize their locality in the way that will work for them including what you suggested in order to forestall the State coming in to do it for them which is very much of a second choice.

**Barton Thompson:** And if I can just really quickly --

**Greg Dalton:** Buzz Thompson, yeah sure.

**Barton Thompson:** Just really quickly say I think Felicia's being too nice and it's probably because she's Chair of the State Water Resources Control Board. California is the only State in the Western United States that does not collect the information that we need in order to manage our groundwater throughout the jurisdiction. We've tried to pass legislation and we do that in the past and we didn't succeed in being able to get the information as to the exact amount that's being pumped. One of the great things though, is that there is now technology, satellite-based technology that is permitting us to actually figure out how much is being extracted from our groundwater aquifers without actually measuring it at the wells and one of the great things about it is we now know that probably, if you look at the State as a whole, we're overdrafting our groundwater aquifers by about 2 million acre feet a year which is enough water to actually provide the needs of about 10 million people. That's a lot of water.

**Greg Dalton:** We're talking about the drought at Climate One, let's have our next question.

**Female Participant:** Hi, I'm Miriam Gordon, I'm the California director of Clean Water Action and I do want to follow up on the groundwater issue. I want to say that today in the legislature, well right now as we speak, in the legislature both groundwater and the water bond are being addressed and I want to first note that the groundwater -- two bills that would require sustainable groundwater

management plans to be developed throughout the State are being heavily opposed by a long list of agricultural representatives throughout our State. So, they don't want to be forced to create plans and they don't want to be forced to measure their withdrawals or do any kind of reporting. So -- and -- we have a problem with that --

**Greg Dalton:** Buzz Thompson. Thank you for that. Buzz Thompson, ag doesn't want to be measured.

**Barton Thompson:** You know, I think there is a split within the agricultural community right now. You're absolutely right that there is a segment of the agricultural community that would like to have groundwater remain unregulated and I think that's partly because they want to make sure that if there's a drought and they need the water they can pump it out of the aquifer. I mean, I understand from a purely business interested perspective as to why that would be. But I think a real change that has occurred over just the last two or three years is that you now find a significant segment of agriculture which is behind, and in favor of, legislation that would mandate regulation at the local level, and I've been really pleased to see that, I think it's because a lot of farmers who pump groundwater are seeing their groundwater levels drop and they're as concerned about everybody else therefore to the sustainability of their businesses. So, there is a split in the community today.

**Felicia Marcus:** I'd like to say when I --

**Greg Dalton:** Felicia Marcus.

**Felicia Marcus:** When I first came back into government a couple of years ago, I was stunned at how this dialogue had changed since I left about 10 years before. It used to be you couldn't mention groundwater or people would go crazy and just say you can't -- don't you dare touch this, we can't even have a conversation and I was struck by how many people I said we're having conversations about it around the State in coffee shops and bars, if not, at microphones, and I even had people from the agricultural community frequently, I mean not just sporadically, frequently come up to me and say "You have got to do something about it, just don't say I told you so." Now those people are speaking at microphones too and I think a piece of it is this neighbor versus neighbor issue I talked about. There's something about being neighborly that I think is important to people generally, but I also think there's a lot of fear. Again, it's complex. Do people trust the State government or Government in general? Many people do not and so it's understandable as we're trying to do anything new, I mean it's been 100 years, it's, you know, part of the deal for getting the State surface water rights system passed in 1914, 100 years ago was they dropped ground water out in the legislature and so I think after 100 years the time has come to revisit that and people really are revisiting, but you are correct there's a tremendous amount of opposition and it's not going to be over until it's over.

**Greg Dalton:** We have a line of questions. Let's go to our next question. You can talk to them

afterwards. Thank you for that. Let's go to our next question. Welcome.

**Male Participant:** Thank you. One thing that you have not touched on this excellent presentation is that there is a whole legal construct out there called water rights and in parallel with that we have a whole legal construct of water supply contracts that are particularly important throughout the central valley. My question is whether the current circumstance in the opinion of any of the speakers is likely to lead to anything in the way of a change in the marketability of water between holders of water rights, you know, the ones who got there first still have pretty good rights, or contractors so that water can be moved more easily throughout the State in the future?

**Greg Dalton:** Felicia Marcus.

**Felicia Marcus:** Well, if I understand question. I want to be sure I do. I mean it is very complex. I did shy away from it just because it is so complex and hard to explain. I mean, there have been a lot of efforts to figure out how to facilitate the transfer of water and a lot of streamlining of that in the system that we have in California of water rights. It's a seniority based system which is not unusual but what it means is that in times of shortages, juniors are cut off progressively in favor of seniors. It's not that you reallocate with water, it's just if there's not enough water in the waters course you get cut off. If you're a junior and frequently what happens in that circumstance is that the junior water rights holder will buy it from a senior water rights holder, and that's been around for quite a long time probably in common law. In 1914, when the system was instituted, actually, junior water rights are considered 1914 and after and those are the water rights holders who actually have to get a permit or license. Ahead of them are what are called pre-14 appropriative rights holders where they had claimed the use, not just in the amount of water, but a time, a place, and a method of diversion and a huge part of what my board does is deal with disputes in that change in the post 14 circumstance but then trying to figure out how to deal with that allocation. See why I didn't talk about this? It's fairly complicated and then you have an overlying set of contract rights based on the State and Federal water projects that came in to build surface storage and canals to transport water as basically a supplemental source and then every year they do allocations of that from senior to junior of a certain percentage and obviously this year was a very tough year and you have juniors getting very, very low, and I think 5% in many cases and even the seniors didn't get full allocation except for a handful in the projects. And we have started cutting off junior water rights along surface water --

**Greg Dalton:** And I'm gonna cut us off here. If you want to learn more take Buzz Thompson's class at Stanford Law School. We have to go to our next question.

**Male Participant:** Okay. Real quick question, as I understand it the urban use of all the water considering environment and agriculture and so on runs roughly about 10% of the total amount used. Now if we all cut at 20%, were talking 2% of the whole -- of the water use. It seems like we're also fining folks. I live out in Orinda but our yearly bill runs in the vicinity of \$600 and we just passed a law that says that communities can charge \$500 a day for what they construe as overuse.

What I'm saying is that we seem to be spending an awful lot of time going for the people who use the least water and it seems totally unfair. What do you think?

**Greg Dalton:** Buzz Thompson.

**Barton Thompson:** If I can just jump in really quickly. I mean, obviously if we want to do is try to make more water available then the first place you look is to where all the water is being utilized today and that is agriculture. It is not agriculture's fault that the crops that we require also require a lot of water, but to the degree that we can develop new technologies and approaches that save water on agriculture, to the degree that we can develop new institutional mechanisms to do that, we're obviously gonna be saving a lot more water than we do in the urban areas. Having said that we're all in this together and we all need to be thinking about ways in which we conserve and save water.

**Felicia Marcus:** And I would just --ag --going back to what I said a little bit earlier, ag has been cut dramatically with very small allocations from the projects, 400,000 acres fallowed. If they didn't have groundwater still it would be 10 times as bad and this is the urbans being able to step up and deal with really excess use of water. Nobody's asked for anything dramatic but we are all in this together, so actually we've taken action at the urban level far later than action taken that cut agricultural water supplies.

**Greg Dalton:** Debbie Davis.

**Debbie Davis:** I just want to make one really important comment and that is that ag is not a monolith. There are lots of different kinds of agriculture in this State and lots of different kinds of farmers in the State and there are many who work very hard to be as conservative in their water use as they can, but the fact is it takes water to grow things. If you have a garden in your backyard you know that. And our division between how much water we use for ag versus our urban areas is very consistent with the rest of the world frankly. And what were asking is -- were not asking people to dramatically change their lifestyles. I can tell you about the stories of people who are carrying jugs of water in, you know, their domestic wells are dry and their level of conservation, their whole entire life is upside down because they can't flush their toilet and they can't take a shower, et cetera.

We're just asking people swap out your toilets, use a high efficiency toilet, install an aerator, install a low flow shower head, maybe you know have a shower timer so you're conscious of how much time you're taking in the shower. I don't personally think we're asking that much of our urban communities and there are huge benefits because the water that we're taking is not just that drop of water that we're saving, it's also the energy, it's also the impacts on the environment, it does have huge benefits even though it's a smaller percentage across the board.

**Greg Dalton:** We have just a couple of minutes left. Let's go to our next question. Welcome.

**Male Participant:** Hopefully a quick question. You say we don't really know what our groundwater bank account is, how big it is, we have some idea how much we're withdrawing. What's the overall budget look like, in other words of 100% of your mythical, typical year what percent flows out to the ocean, what percent is used and what percent is drawn from groundwater?

**Greg Dalton:** Buzz Thompson. I saw some charts, I think, on the website. The Woods Institute website about groundwater, surface water, et cetera, but take a stab at that.

**Barton Thompson:** You know, I think one of the things that is important to recognize is that we are overdrafting our groundwater aquifers and that means we're actually taking more water out of those groundwater aquifers than is naturally going back in. We have a lot of water in those groundwater aquifers and will be decades before we run out of water entirely. But in a relatively short period of time, we will actually reduce the groundwater tables. We will lower those groundwater tables where it will become prohibitively expensive to actually use that groundwater.

**Greg Dalton:** Next question.

**Felicia Marcus:** Yeah, just to add one thing so people know. It's not a uniform groundwater basin. There is some parts of the State that rely on it for 100% of their water. Some don't have much in the way of groundwater at all, like the San Diego area and so every community has a different mix of contract imported water, surface water and ground water, and so there are sort of three buckets.

**Greg Dalton:** Last question. Welcome.

**Male Participant:** I was wondering what is your opinion of building new desalinization plants to increase supply or having moratoriums on new buildings to decrease demand?

**Felicia Marcus:** I can talk about the desal -- what's the second part of the question?

**Male Participant:** Moratorium on new residential buildings in certain counties that didn't want any additional building.

**Greg Dalton:** Moratorium on building. Water supplies on building constrain.

**Felicia Marcus:** Well interesting, two interesting questions. I'll give quick answer and then we can do a lightning round to answer any question.

**Greg Dalton:** Sure.

**Felicia Marcus:** On desal, desal has a place in the portfolio in certain communities. It has some energy needs and it has some environmental aspects that make it challenging but it is the right piece of a portfolio for some communities. There are some communities that don't have that many other options, particularly around the central coast. As I said, San Diego doesn't have a groundwater basin that they can use regularly to recharge and the like, and so it has a place in the portfolio if it mitigates its environmental impacts and my board right now is considering actively a general policy for desal that would deal with both intake and discharge environmental impacts, but it has a place in the portfolio, in some places it is more expensive and has more challenges than recycling and storm water capture in many urban contexts but not all.

**Greg Dalton:** Debbie Davis.

**Debbie Davis:** I'll take the second question. You know, I think that the ability for water agencies to stop development because of water supply issues, it's an inelegant way to get at our huge challenge we have in a State and that is that we don't have a good mechanism to coordinate our land use planning and our water management. So, you know, I don't know that I have a particular opinion about that except to say that we really need to get better at that and, again, it gets back to, you know, being able to manage as a system, as a community as opposed to in our silos.

**Greg Dalton:** I grew up in Monterey County and terrible fights over that sort of thing. In Monterey County, people hate it. They think the water ought to keep flowing. They don't like it. Buzz Thompson last word.

**Barton Thompson:** Yeah. So I will address both of those two questions that you asked. First of all with respect to desalination, as Felicia mentioned it has a role but I think it's quite a limited role because at the moment desalination is the most expensive option we have for making more water available and it still does have some environmental problems. Australia during their millennium drought when they were confronted with no other way to produce some additional water to meet their needs built six of the largest desalination plants in the world. Today, when they aren't faced with a drought only two of those are still operating. The other four are effectively mothballed simply because of the expense of desalination. So it's really important that in a midst of a drought of this nature we don't panic and take particular solutions that might sound great at the time but actually are not cost efficient and effective over time. Second of all, we definitely need to coordinate our land use and our water resources to a much greater degree than we have. In many communities,

the water managers and the land use planners do not actively work together. They need to do that so that in areas which are water short we don't continue to grow as if water was available to whatever degree we want and second of all so that when we actually build, for example, subdivisions, we don't pave over recharge areas where we need that water to actually percolate down into our groundwater aquifers so that we have that natural recharge to our natural bank accounts.

**Greg Dalton:** We have to end it there. Buzz Thompson is director of the Woods Institute for the Environment at Stanford. Other guests today at Climate One have been Felicia Marcus, Chair of the State Water Resources Control Board and Debbie Davis, Community and Rural Affairs Advisor at the State of California. I'm Greg Dalton. Thank you all for coming. Free podcast of this and other Climate One programs are available in the iTunes store. Thanks for coming and listening to Climate One today.

[Applause]

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