

TRANSCRIPT

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INTERVIEWER: David Todd

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David Todd [00:00:03] Well, good afternoon. My name is David Todd, and I have the privilege of being here with Jeff Bennett. And with his permission, we plan on recording this interview for research and educational work on behalf of a non-profit group, the Conservation History Association of Texas, and for a book and a web site for Texas A&M University Press, and finally, for an archive at the Briscoe Center for American History, which is based at the University of Texas at Austin.

David Todd [00:00:36] And I want to stress that he would have all rights to use the recording as he sees fit. It is his.

David Todd [00:00:41] And I just wanted to make sure that that's okay with Mr. Bennett before we went any further.

Jeff Bennett [00:00:48] Sure.

David Todd [00:00:49] Great.

David Todd [00:00:49] All right, well, then, let's get started.

David Todd [00:00:52] It is Wednesday, July 19th, 2023. It's about 2:15 in the afternoon, Central Time. As I said, my name is David Todd, and I am representing the Conservation History Association of Texas, and I am in Austin. And we are conducting a remote audio interview with Jeff Bennett, who is based near Alpine, Texas.

David Todd [00:01:18] Mr. Bennett has worked as a hydrologists, hydrogeologist and a geologist through positions at the National Park Service in Big Bend National Park, and the American Bird Conservancy's Rio Grande Joint Venture. He has worked on habitat restoration along riparian corridors that were once lined with cottonwood and willow. And he's also looked into using beavers as partners in reducing scour and rebuilding some of these woodlands and refilling some of the nearby alluvial aquifers and recovering those streams.

David Todd [00:01:56] So, today we'll talk about Mr. Bennett's life and career to date, especially focus on what he has learned about the study and conservation of the North American beaver and the riparian world where they were originally found.

David Todd [00:02:11] So I thought we'd ask a little bit about your childhood and early years to start off, and if there were some people or events in your life then that influenced your interest in nature and mammals in particular, even to speak about the beaver.

Jeff Bennett [00:02:33] Okay, so I'm an Army brat and a preacher's kid. I grew up on Army bases. And, you know, in the sixties anyways, a lot of the Army, there was a lot of open space

on Army bases. So that's where I spent my time was in the woods. I was born at Fort Hood there in central Texas, and we returned to Fort Hood after being in Germany and then on the Presidio in California for a while. And I found myself playing on the creeks.

Jeff Bennett [00:03:07] I've always been interested in streams and those wet habitats, I guess - catching crawdads, you know, just chasing whatever was there. Getting a closer look was how I spent my time.

Jeff Bennett [00:03:26] Again, my dad was, you know, military. So Boy Scouts fit in pretty well. I was big into Boy Scouts. My legs are a tad bit crooked, so sports was out for me. I can't run very fast. Even though I played sports, I just didn't focus on it, really. What I focused on was Boy Scouts and then Explorers when I got old enough for that.

Jeff Bennett [00:03:49] So being outside, hiking, climbing, boating, I've been a big boater since probably sixth, seventh grade. I started first canoeing.

Jeff Bennett [00:04:03] So those were sort of how I got introduced to nature and the natural world was just through being on army bases and having a dad that would, you know, encourage my Boy Scouting career and my Explorer career.

David Todd [00:04:19] Well, so it sounds like your father was involved in encouraging or at least supporting what you're doing with the Scouts. Were there maybe some examples of his role or maybe other people in your childhood who kind of, you know, were enthusiastic about that?

Jeff Bennett [00:04:42] Well, dad took us camping. You know, when we were in California, [Excuse me. I swore I could turn those notifications off.] he took us into the Sierra and we did quite a bit of camping. And my older brother, whose, he and I don't have the same mother, his mother passed away of cancer when he was just a young boy, so he was a decade older than me, and he was a big influence on me. He took me camping quite a bit. Got me out of eighth grade, probably three weeks, almost a month early, to go backpacking along the Divide, the Continental Divide in Colorado.

Jeff Bennett [00:05:28] He was a big influence.

Jeff Bennett [00:05:31] You know, he was when he came back from Korea, I remember one of the things he spent some of his money that he had, you know, that he accrued while he was overseas, was on a bunch of camping gear. And I was fascinated by all the high tech stuff of, you know, 1975 or '6, whenever that was. You might, you're old enough to remember as I do, that sort of back-to-nature movement of the seventies. So I was fascinated by that and.

Jeff Bennett [00:06:06] Just went camping a lot with whoever would go - my brother, but my father, friends. I just did not pay attention much to high school sports. I went camping instead.

Jeff Bennett [00:06:22] And hunting: there was some hunting too. You know, as I was growing up, we had a farm out near Cross Plains, Texas, and, you know, big enough to hunt deer and turkey and things like that. So there was a lot of that.

Jeff Bennett [00:06:35] Uncles, cousins, aunts, that that were always encouraging me to go outside to play. So, yeah, so family and friends, I guess would be my biggest influences.

Jeff Bennett [00:06:52] And some scoutmasters, although I couldn't tell you any of their names. Scouting was pretty important and encouraging for the whole that so?

David Todd [00:07:03] And it sounds like some of your experience outdoors who was in boats and canoes. How did all that get started there?

Jeff Bennett [00:07:15] Boy Scouts was, I am pretty sure a Boy Scout troop in Arlington, Texas - we went on our first canoe trip, on the Brazos on the John Graves reach of the Brazos from Possum Kingdom down past, what's the name of that Scout ranch - I'm going to forget - you know, it was a two or three day trip in aluminum canoes with all our stuff in trash bags to keep it dry and, you know, things like that.

Jeff Bennett [00:07:50] And, you know, I was hooked from the first time. So I've been boating ever since. I have several canoes and rafts and things, and I like to spend a lot of time on water when I can.

David Todd [00:08:06] So, it sounds like you had a pretty full life between family, friends, scouting and hiking trips. Was there any sort of activity in in school, whether it was in grade school or later at Sul Ross State or Northern Arizona University, where maybe teachers or classmates might have helped introduce you to hydrology or animals?

Jeff Bennett [00:08:40] You know, I have a life-long friend. I've known him since middle school. And he was always game to go boating and canoeing and, you know, jump in the truck and go camping at the LBJ grasslands there in north central Texas or wherever, you know, several road trips to Colorado. And he lives down the street from me now. So we've been life-long friends. And always, that's always been important because we both had a big interest in that.

Jeff Bennett [00:09:13] And then at Sul Ross State University, you know, I came here to study geology and I was going to minor in chemistry, but I connected much more with Dr. Scudday, the vertebrate zoologist at Sul Ross. So I didn't take much chemistry. I took every class he offered and I got work-study projects with him. So I took care of his, you know, his snakes. I went through his collection of birds and rodents that needed to be prepared for the museum collection and worked on those.

Jeff Bennett [00:09:55] And I did quite a few trips with Dr. Scudday. We went, we did, I spent six weeks, I think, in Chihuahua, Mexico, with Dr. Scudday and half a dozen other students. We were looking for a species of mud turtle, a rough-footed turtle, again, hiking along the streams of Chihuahua looking for turtles. So Dr. Scudday was pretty important.

Jeff Bennett [00:10:23] And then when I got to Arizona, I was, actually, in looking for uranium for a company on the South Rim and got, but that introduced me to a group of guys where I got an opportunity to volunteer on a river trip through the Grand Canyon, surveying sand deposits, beaches, basically camping spots. And that led to a decade of boating in the Grand Canyon and a master's degree at Northern Arizona University.

Jeff Bennett [00:10:59] And Dr. Rod Parnell was my major advisor. And he was super important. Dr. Larry Stevens was a mentor. He, at the time worked for the Grand Canyon, no, Glen Canyon Environmental Studies Group that was BOR funded. Dean Bland, who was on my committee, he's an aquatic ecologist. Those three gentlemen were pretty important.

Jeff Bennett [00:11:29] Christen Rowel, Wendy, there were several students that I worked with that were also, you know, highly energetic and motivated. And it's hard to not be in a group like that and find yourself being the same way, you know.

Jeff Bennett [00:11:48] So, that was that was sort of my introduction to water and hydrology, you know. I mean, I started out thinking I was going to work on purely groundwater projects, but then I ended up on this sort of groundwater / aquatic ecology project where I was looking at nutrients spiraling through sand deposits in the Grand Canyon, as those reactions were governed by regulated flows out of Glen Canyon dam. So all of a sudden, I found myself wishing I had finished my chemistry minor, because I had to get caught up on chemistry.

Jeff Bennett [00:12:31] So, yeah, there were some pretty important professors that sort of helped me find open doors, I guess.

David Todd [00:12:45] Well, it sounds like you had some good outings while you were at Sul Ross State. When you were at Northern Arizona University, did you take any field trips or was it mostly work in the lab or bench scale stuff?

Jeff Bennett [00:13:01] Yeah, it was both. You know, my professor was a geochemist, a low-temperature aqueous geochemist, and well, he also did some volcanic stuff. But we spent a lot of time on the Upper Mancos in southwestern Colorado. There's some acid rock drainage up there and some old mines. So we got to look at sort of the impact of, you know, perturbed places from the mine, the acid mine drainage versus acid rock drainage.

Jeff Bennett [00:13:36] So besides that, you know, I did probably 50 or more trips through the Grand Canyon collecting water samples for my thesis and surveying beaches for the other project. So yeah, there was a quite a bit of time in the field, actually. There were several years there in the middle of all that where I was out in the field, you know, 150 days plus a year. So, yes, a lot of field work at NAU.

David Todd [00:14:12] Boy, that's extraordinary. I think most of us may walk to the mailbox, and that's about it.

David Todd [00:14:22] So aside from this, you know, these years of schooling, can you point to any other influences that might have excited you or exposed you, you know, maybe some books or films or TV shows that were more in the general culture?

Jeff Bennett [00:14:49] Well, I was fascinated by the merit badge books, primarily the camping and hiking and wilderness survival merit badge books when I was in grade school. But by the time I got to college, you know, it was "Thinking Like a Mountain", books by John Graves. Excuse me, "Thinking Like a Mountain" is, you know, Aldo Leopold - and his essays. Plus, John McPhee - "In Suspect Terrain" and "Survival of the Bark Canoe" and things like that. His books were pretty important. Some of the books by Edward Abbey were pretty influential, as was Silent Spring by Rachel Carson.

Jeff Bennett [00:15:44] You know, so I didn't watch a lot of TV. You know, cable was expensive back then. And at Sul Ross and Alpine, if you didn't have cable, you didn't watch TV, and there really wasn't a movie theater here. So it's mostly books and getting on the field, so.

David Todd [00:16:04] Okay, well, maybe we can move towards talking a little bit about your career. So, my understanding is that you worked as the hydrologist for the National Park

Service in Big Bend National Park from 2000 to 2018, and then more recently for the Rio Grande Joint Venture through the American Bird Conservancy from 2018 to the present.

David Todd [00:16:32] And I was hoping that you could just lay out some of the basics of the hydrologic challenges that you were focused on and trying to understand.

Jeff Bennett [00:16:44] Okay. Well, let me correct the dates on my service at Big Bend National Park. That was 2003-2018.

David Todd [00:16:51] OK.

Jeff Bennett [00:16:53] And, you know, it's a Big Bend National Park and the Rio Grande Wild and Scenic River. There's two units there that I worked for. And I was the physical scientist slash hydrologist. So I managed not only the hydraulic / hydrologic aspects of the Park, but also the air quality, you know, things related to the atmosphere, whether it's noise or light or air pollution.

Jeff Bennett [00:17:27] But when I got there, you might remember, the General Land Office wanted to pump waters from their west Texas properties into the Rio Grande and send it down to the Valley and sell it to farmers in the Valley. And because I'd been a hydrogeologist with a consulting firm prior to working for the National Park Service, I knew that that meant pumping from the GLO properties between the Park and Black Gap Wildlife Management area could diminish spring inputs there at Rio Grande Village.

Jeff Bennett [00:18:04] So I, you know, informed my boss of that and wrote some emails and briefed the superintendent. And at some point we were talking with geologists and hydrogeologists at the national level and they just said, "You know, there's no information". We looked through your Park's foundation documents and there's really no information on those springs. So that sort of led me on a project to define, or at least measure, how important those springs are from Big Bend National Park down to Amistad Reservoir. So, that that was one project that became very obvious to me right off the bat that needed to be done.

Jeff Bennett [00:18:51] As well as there was an obvious problem with sediment accumulation in the channel. So we've, both countries have dammed the streams above the park, so there's no more or very little flow coming through compared to historical amounts. However, the local arroyos are still delivering sediment. So the monsoonal and snowmelt flows don't wash that sediment downstream so that sediment accumulates in the channel.

Jeff Bennett [00:19:23] That sediment is a place for plants to grow. And, you know, because invasive exotic plants are so successful because they lack all the predators and parasites behind, they thrive. So between the salt cedar and the giant river cane, the channel was getting choked. The habitat was getting choked. There weren't any open gravel bars. There weren't backwaters. All that was gone because it was covered up with sediment.

Jeff Bennett [00:19:52] So, I picked that project up as well. And I worked with Dr. Jack Schmidt, another important mentor out of Utah State. We put together a project to define, or at least figure out, the geomorphic history of the Rio Grande and the Big Bend National Park and the Rio Grande Wild and Scenic River.

Jeff Bennett [00:20:14] So, you know, when I got there, basically there was a lot of science to do between the river sediment accumulation, the flows as impacted by loss of upstream diversions, and you know, the remaining presence of the groundwater.

Jeff Bennett [00:20:37] And on top of that, there was problems in the uplands. You know, there was ... the Big Bend National Park had been overgrazed. There was lots of grazing pressure prior to it becoming a national park. And the upper-elevation and the middle-elevation grasslands recovered, once the cows and the sheep were removed. The low-elevation grasslands and shrublands - not so much. They were highly eroded. So I embarked on a project there as well.

Jeff Bennett [00:21:08] And all the, you know, all these projects require someone to sit down and write the proposals to get the grant funding. In the National Park Service, those kind of projects are awarded on a competitive basis. So I was lucky to be in a Big Park where we had quite a few natural resource managers, so I had the time to sit down and write those proposals and get them funded. And I was lucky enough to find good partners at universities or in-house to make them happen and be successful.

Jeff Bennett [00:21:40] So we started off on a project on the grasslands, in the low-elevation grasslands to develop some methodologies to basically turn large bare areas, you know, tens of acres of bare ground where you can obviously see that we've lost, you know, a meter of soil or more and grow some plants in there. And if you can grow plants, you can increase infiltration, you can increase interception, you can decrease erosion.

Jeff Bennett [00:22:10] So, we hit on this idea of using branch mulch in 2004, I guess, not long after I got there, to do just exactly that. So we would put out seed with a hydromulcher, and then cover it with branch mulch that was produced by our fire brigade when they would reduce, you know, when they would increase defensive space around buildings, basically by removing tree small trees and brush. I would put that on the seed that I put out.

Jeff Bennett [00:22:47] And that branch mulch shaded the ground and intercepted the rain and prevented the rain from washing the soil away. And that worked: that grew grass, that grew native plants. So we took several hundred acres of bare ground and were able to convert that to a banded brush sort of scenario. Banded brush is the natural arrangement of vegetation on arid landscapes. So we, you know, we didn't grow a carpet of grass. It doesn't look like Kansas. But there are bands of some vegetation now along the contour, or patches of it in the rilly areas. So all that vegetation catches the water, slows it and prevents the erosion.

Jeff Bennett [00:23:38] So, that was another big project besides the river science and the air quality stuff.

Jeff Bennett [00:23:50] But that led me to thinking about some of the streams and trying to understand sort of the hydro-ecological conditions of streams in the Southwest. And, you know, I'd learned about down-cutting erosion while working on my Master's. And I knew that there was some controversy whether that was totally due to grazing or if that was climatic or what the deal was.

Jeff Bennett [00:24:19] But as I got into it, I became fairly convinced that it was a mix of all that, you know, grazing pressure, logging of riparian forests, you know, over-grazing on the uplands. All those things contributed to flows that stripped our streams of their gravels and led to down-cutting, which meant that the annual flows no longer got to the floodplains and

no longer watered those riparian forests. So, even though the cows and the sheep had been removed, those riparian forests never really recovering.

Jeff Bennett [00:24:59] So, we started discussing and thinking about a ways to work on that. And our first thought was to plant a bunch of trees. And you know, this is, I was working as, you know, one person in a team. There was Amy Roberson from the U.S. Fish and Wildlife Service, Joe Saronic, our botanist at the park. You know, we were trying to think through these things. And Fred Phillips from Flagstaff, he's a landscape architect, was the guy that got the contract to help us plant a bunch of trees.

Jeff Bennett [00:25:36] We thought we could plant trees that would catch water and sediment, you know, and regrow some of those forests that had been lost to the mining logging operations.

Jeff Bennett [00:25:49] And he reached out to someone at M.I.T. And they had modeled floodplain vegetation. And we all got on this idea of planting trees in diamond shapes because that's how vegetation arranges itself on floodplains and not, you know, sometimes they're linear, but they're often in these diamond-shaped patches.

Jeff Bennett [00:26:09] So we planted thousands of trees in Terlingua Abajo, which is at the bottom of Terlingua Creek. And I don't know if you're familiar with that creek in the western portion of the park, but it's a large watershed. It's a HUC-8 watershed. And we were attempting this at the bottom of that, which, you know, we probably should've known how difficult it was going to be because for several years our trees grew wonderfully and the stream would come up, you know, during monsoonal flows, the stream would come up and wash through those diamond patterns that we had planted and slow the flow and catch sediment. And it was looking really good.

Jeff Bennett [00:26:50] But then, you know, the mother of all storms came and scoured most of that out.

Jeff Bennett [00:26:55] So we knew that the we needed to move upstream.

Jeff Bennett [00:27:00] Anyway, that all got me to thinking about stream restoration and realizing that I can work, you know, as hard as I possibly can, no matter how hard I can work, we need some help. And that was when I hit on this, you know, I guess, craze or fad or idea of using beavers.

Jeff Bennett [00:27:31] However, our streams aren't wet enough to bring beavers in. They do live at Terlingua Abaja where we planted all those trees. And they do have a beaver dam there that comes and goes with the annual flooding cycles.

Jeff Bennett [00:27:43] But, for most of our streams in West Texas, they're not wet enough. You know, a beaver needs a pool deep enough to hide from the coyotes and the bobcats and whatever else might prey on it.

Jeff Bennett [00:27:58] So, that was when we hit upon the beaver dam analog concept, which has been, you know, it's an old idea, but it's been sort of popularized by folks like Joe Wheaton at Utah State University and others. So that's been our latest tactic to try to put these brush weirs in the streams to slow the flows, catch the sediment and reconnect flows to floodplains

and hopefully recharge these riparian aquifers where we'll have pools deep enough to bring in some beavers.

Jeff Bennett [00:28:37] You know, right now we're trying to do the work, we're trying to mimic the work of, you know, of the beaver. And I don't think we're ready to bring beavers in yet.

Jeff Bennett [00:28:49] So, there's a, it's a controversial thing. I generally don't really talk about it, to be honest with you, because some landowners might get a little excited, I guess, and not realize that the benefits far outweigh any challenges they might have with having beavers on their property.

David Todd [00:29:12] You know, this might be a good point to just try to go back in time a little bit and make sure that we're all on the same page about what some of the history is behind some of these problems of down-cutting and scouring that, you know, you've recognized. I think you've mentioned that there were problems with overgrazing and some, I guess, timbering out there from the trees along those creeks. Can you lay out some of the history that might be causing some of the problems that you see out there now?

Jeff Bennett [00:30:01] OK. Well, the way we think about this is that, you know, the mercury mines needed timber, both structural timber in their mineshafts and adits, but also for their kilns, cooking wood. You know, they needed timber resources and lumber. And yes, so some of that timber came from far away, came from the upper mountains, you know, pine trees. But a lot of it came from right nearby.

Jeff Bennett [00:30:35] We know that for a three-year period, the Chisos Mining Company bought four miles of cordwood. 3000 cords, basically, I believe it was. Don't quote me on that. What I remember was it was four miles of cordwood in one three-year period. That's one mine, The mines were open for 30 years and I think there was at least three different mines, if not four.

Jeff Bennett [00:31:01] So, they bought a lot of timber. So they stripped out those riparian forests, if not wholly, at least sufficiently to sort of remove the hydraulic dampening that those important forests would provide to flood flows.

Jeff Bennett [00:31:22] But on top of that heavy grazing pressure in the uplands. There's no longer any grass, standing grass, to intercept the rain and help infiltrate it. So all that hits the ground and runs off.

Jeff Bennett [00:31:35] So, you've got bigger runoff events and you don't have the hydraulic dampening provided by the riparian forest. So that's sort of what scoured out the channels.

David Todd [00:31:46] And the grazing there, I gather it was sheep and cattle, is that right?

Jeff Bennett [00:31:52] Sheep, goats and cattle. And to be honest, you know, there are other people that can speak more confidently about that. Dave Keller comes to mind, but I think Tom Alex, the Park archeologist, told me that in the years around World War One, Brewster County was one of the biggest producers of beef in the country. You know, those grass resources were only around for a short time. Once they got grazed off, they didn't come back. So it's hard to imagine.

Jeff Bennett [00:32:30] But that's you know, we hear these stories and I don't know how apocryphal they are, but, you know, they're so that a lot of places stirrup-high grass and all that kind of stuff. But yeah, the grazing was for food and fiber.

David Todd [00:32:51] So, is part of the issue out here the, the pattern of rains? It sounds like you get these deluges, I think you call them monsoonal rains. Is that part of the issue with the scouring?

Jeff Bennett [00:33:08] Well, yes. You know, the Chihuahuan Desert doesn't really get winter rains. Right? You know, the Sonoran Desert, the Mojave, they have two rainy seasons. They get winter storms, and then they get monsoonal storms. You know, they benefit from the North American monsoon. The Chihuahuan Desert, at least the northern portion of it, also benefits from the North American monsoon. But we don't get winter rains. We only have one real rainy season. It might snow. It doesn't mean it doesn't rain or snow in the winter. It just means it's not significant. It doesn't contribute greatly to the yearly averages. So we get monsoonal storms, often towards the late summer or early fall that are the big ones.

Jeff Bennett [00:33:59] So, that's, you know, it is a desert.

Jeff Bennett [00:34:03] But we also have great variability in elevation. So we have sky islands where you might get 20 inches of rain or more while the low ones get six or eight. Inches of rain a year.

Jeff Bennett [00:34:20] So, it is variable, dependent on elevation, and we certainly depend upon the monsoons to bring it, to make up for our yearly deficits in rainfall.

David Todd [00:34:34] And so is it pretty flashy where you might get a very short but intense rainfall storm?

Jeff Bennett [00:34:41] Sure. Now, but I want you to think about that, because if the trees, the riparian forest, were in place, the trees weren't cut down and those channels weren't now an efficient sluice to carry that water downstream, instead, that water hit the riparian forest, spread out, meandered and was braided, all that water would sink in. And so you would have large perennial flows, perennial streams for, you know, tens of miles.

Jeff Bennett [00:35:07] One of the ranchers, James Gillette, said that Terlingua Ceek was both old and alive with beaver, that he could park a thousand head of cattle in the shade of cottonwood trees at the confluence of Rough Run and Terlingua Creek.

Jeff Bennett [00:35:24] A lot of these streams were perennial, and they're not anymore because the streams don't catch the water and don't soak them up. The riparian sponge has just been, you know, cut in half and the streams are more, more like an efficient, you know, sluice to carry the water to the river very quickly. So it doesn't have a chance to, to be cycled through the riparian aquifers.

Jeff Bennett [00:35:51] So, yes, our systems are flashy. Were they this flashy a hundred years ago. I suspect not.

David Todd [00:35:58] Okay. Well, you know, this may be a good moment just to talk a little bit about how these streams might have looked, you know, before the big grazing operations

and mercury mines moved into the Big Bend and Trans-Pecos. Is that something that that you could give us any kind of insight on?

Jeff Bennett [00:36:23] A little bit. You know, we don't have a lot of pictures, and we don't have a lot of accurate historical accounts, despite a few ranchers that spoke about the streams. But there is a book out of Arizona called "The Changing Mile". They took pictures of of streams in southern New Mexico, which is Chihuahuan Desert, and southern Arizona. And then they found these old pictures and they went and retook them.

Jeff Bennett [00:36:51] And so there's a couple of things we you know is that prior to stream incision and arroyo down-cutting, these streams were, you know, slower, more like a cienega, you know, just a slow-moving stream. Riparian forests were patchy and often at the valley edges, not centered right along the stream, because those valleys were pretty wet, you know, and the cottonwood doesn't want to be in standing water. They want to be in that, you know, wet area but not super wet. So the cottonwoods and the willows were at the edges of the valleys.

Jeff Bennett [00:37:34] You know, the other thing to remember, because we don't have a snow melt season here, we don't have a spring freshet. That's when cottonwoods makes its seeds. So getting a recruitment year, a big recruiting year, for cottonwood seeders here is tough because we don't have those spring flows to push the cottonwood seeds into an appropriate environment and keep them wet long enough for them to germinate and be successful.

Jeff Bennett [00:37:59] So, you know, our cottonwoods and willows in West Texas were, well, it's hard to say. We know there weren't along the main stem of the Rio Grande. The only place that you found them along the Rio Grande was in protected areas like it, like at Black Dike in the Park, or in some of the mouths, tributary mouths, of the bigger, bigger tributaries. But the streams were probably, you know, nothing like they are now.

Jeff Bennett [00:38:35] You know what? I can tell you that that those changes didn't just happen 100 years ago. They also happened in the last 40 years. We can look at pictures of Rough Run Creek at Terlingua and there weren't any bridges. They were just low-water crossings. And now there are bridges, and the stream's 18 feet below the bridge. So that down-cutting happened since 1970. So that's 50 years.

Jeff Bennett [00:39:02] So these changes are, you know, they're not all just historical - 100 years ago. They're happening now, too.

David Todd [00:39:14] Well, and were beavers part of the ecosystem in the Trans-Pecos and the Big Bend area 100 years ago or 50 years ago, some point in the past.

Jeff Bennett [00:39:28] James Gillette said they were in Terlingua Creek. I haven't found any other historical accounts of beaver. I'm going to suggest, I'm going to say they were, just because if they were in Terlingua Creek, why wouldn't they be in the other perennial streams.

Jeff Bennett [00:39:43] You know, Terlingua Abajo in Big Bend National Park is at least four miles up from the Rio Grande and the channel is dry. So Terlingua Creek is dry below Terlingua Abajo. So, it's wet at Terlingua Abajo because there's an igneous dike that pushes the water, the riparian aquifer, to the surface. So it's flowing at the surface four miles above

the river. And occasionally the beavers get wiped out by the flooding, and then they find their way back. They walk up four miles of dry channel to find their way back to Terlingua Abajo.

Jeff Bennett [00:40:23] So, it's hard for me to believe they wouldn't have walked up the streams from the river, from the main stem, into our perennial tributaries. You know, because conditions were probably wetter and better, you know, before, you know, all the disturbance from the Europeans. So, you know, we don't have a lot of historical accounts to back that up. I don't see any reason to say that they weren't here. They were definitely not here, though. We know they were at least at Terlingua Creek. And there is 100 breeding pairs of beaver in the main stem of the Rio Grande in Big Bend National Park.

Jeff Bennett [00:41:08] So I think they were in our streams.

David Todd [00:41:15] And also in the Rio Grande.

Jeff Bennett [00:41:18] And in the Rio Grande. You bet.

David Todd [00:41:23] You know, for those of us that aren't really familiar with beaver, how does a beaver or a whole colony of beaver affect the behavior of a stream, or even a major river like the Rio Grande?

Jeff Bennett [00:41:39] Well, they're full-time engineers. So they work all day, every day, in managing vegetation to suit their needs, in managing flows, to suit their needs. The beavers in the Rio Grande don't build dams. That's just too big a system. But at Terlingua Abajo, the beavers that come from the Rio, wake up from the Rio Grande, build weirs because they have some sort of intuition or, you know, they just know, that if they build it there, it'll last for several years.

Jeff Bennett [00:42:18] And they have a way to pick out the right spot to put a beaver dam. It's in the same spot every year, even if it's a completely different set of beaver. You know, they were, when I first went to work in the park in 2003, there was a beaver dam at Terlingua Abajo right below the International Boundary Water Commission gauging station. That population got wiped out and we didn't see beavers for four or five years.

Jeff Bennett [00:42:42] And then they came back. And they built in the same spot. And it happens to be right where the flow is deepest and greatest, based upon that big dike I told you about a while ago, that brings that riparian aquifer to the surface.

Jeff Bennett [00:42:57] So, there's, you know, they're, they've got the ability to pick it out and figure it out. And that's not something that needs to be taught from generation to generation. They can figure it out, apparently anyways.

Jeff Bennett [00:43:10] So, they again, they're full-time engineers and they will build structures to slow the water and they'll dig deep pools. And in the process they are increasing the recharge to those riparian aquifers, and they're decreasing that flashy nature that you asked me about earlier.

Jeff Bennett [00:43:30] You know, if we could get them all up and down Terlingua Creek, I think it would be a much different looking place.

David Todd [00:43:39] Well, maybe this is something you can sort of tell us a little bit more - the mechanics, I guess, of what they do that might slow the flow, decrease this flashiness. How does their engineering, you know, manipulate the vegetation, do that?

Jeff Bennett [00:44:01] So, as they build their dams, they harvest trees and vegetation and even excavate mud to pack in between the branches. But they build dams out of the materials that are right there at hand.

Jeff Bennett [00:44:20] And, by building a dam, you know, a leaky dam, they raise the level on the upstream side of it so that they can build their lodge. And then they will, you know, reproduce and disperse. And then the, you know, the next generation will move 100 yards down to build another dam, or 100 yards up and build another dam.

Jeff Bennett [00:44:47] So, through that 24-7, 365 days a year, they are building dams and harvesting food.

Jeff Bennett [00:44:56] And so, they, you know, they keep the forest sort of trimmed so that they're trim and wet, so they're not really fire-susceptible.

Jeff Bennett [00:45:12] You know, they build aquifers is what they're doing, you know.

Jeff Bennett [00:45:16] By slowing the flows, they're also slowing the sediment transport. So, those streams get, you know, right now they're stripped, like I said. So, the channels are incised, and that aquifer's just not there anymore.

Jeff Bennett [00:45:35] But, if you had beavers working at it, they would rebuild that aquifer, just by increasing the amount of sediment for that water to soak into and blocking the, you know, that flashy nature of each flow.

David Todd [00:45:54] So two things that you mention are really intriguing. You're talking about how they might trim the forests that are along that riparian corridor and that it might make it less susceptible to burning. Is that part of how a woodland might build up is that that it would just be protected from as much fire risk that might be there otherwise?

Jeff Bennett [00:46:19] I think the more important aspect there is the wetness. There's several papers you can find in the literature right now that show that fires, you know, that fires in the West are getting bigger. Right? And there are several papers that have pointed out that when they get to those streams where beavers are, the fire doesn't really burn through the riparian forest.

Jeff Bennett [00:46:42] I think it's reasonable to suggest too, though, that the forest thinned by the beavers, you know, might lessen the fuel and might help as well.

Jeff Bennett [00:46:53] But I think the more important thing there is the wetness.

David Todd [00:46:58] I see.

Jeff Bennett [00:47:01] And those beaver landscapes, streams impacted by beavers, regulated by beavers, are much less susceptible to fire. I think that's well-established in the literature.

David Todd [00:47:19] But sort of unclear whether there's just less fuel or maybe it's just wetter.

Jeff Bennett [00:47:28] I think it's fair to mention that there's less fuel too.

David Todd [00:47:35] Something else you mentioned I was curious about: you said that these beavers' engineering might slow sediment transport and I'm wondering if that might expose gravel beds that would be good for fish to spawn on. Is that a possibility or not so much?

Jeff Bennett [00:47:55] It just builds new gravel beds. You know, I don't know that we have any. Of course I even though I work with fish a lot, I'm not a fish ecologist. I'm not so sure how important gravel beds in our tributaries are for spawning fish. Certainly having backwater habitat, still water habitat, those things are important, but definitely I think it's absolutely fair to say that the beavers, by slowing sediment transport, encourage a much wider diversity of sediment deposits and sediment types - grain sizes, elevation, slopes, all those kinds of things. It's much more diverse with beaver present than without.

Jeff Bennett [00:49:01] So however that impacts fish ... certainly, you know, there's more still water for those fish that needs still water. There's more current for those fish that need to spawn in the water column. Yes, I think the positive impacts to both fish and mussels is without a doubt.

David Todd [00:49:37] So it sounds like the beaver were there maybe in more areas or in bigger numbers beyond the Rio Grande and then the Terlingua Abajo area. Do you think that they have declined because their habitat changed because of, you know, the timber removal and overgrazing, or were they shot out, trapped, removed?

Jeff Bennett [00:50:12] It's probably a little bit of both.

Jeff Bennett [00:50:15] I read a story years ago and I'm going to forget the name, the gentleman's name, but one of the early accounts after the border surveys by the International Boundary Water Commission, one of the early accounts of the Rio Grande was by a beaver trapper. I believe he put in and began boating up, you know, up near El Paso and boated until he couldn't carry any more pelts. And so I know he was trapping.

Jeff Bennett [00:50:49] So, I think it's probably a little bit of both.

Jeff Bennett [00:50:51] Their habitat became degraded, the stream dried out, and they didn't have what they needed. They moved on. And the ones that remained were trapped.

David Todd [00:51:07] So as they've fallen, you know, their populations have declined, I guess there's been some speculation about trying to bring them back. This has been done elsewhere. Is that right?

Jeff Bennett [00:51:24] Oh, yeah. So the Forest Service, I believe, you know, dropped beavers out with parachutes after World War Two into the northern Rockies and Idaho. So it's not something that, it's not a new idea, certainly, trying to bring back beavers.

Jeff Bennett [00:51:46] People recognized the need for beavers a long time ago. But more recently, as these beaver dam analog, or brush weirs as we call them, projects have gained

popularity, there are more and more streams that are going from intermittent back to perennial, which allows either natural expansion, but there's also been some reintroduction efforts in the Northern Rockies and in the Great Basin deserts.

Jeff Bennett [00:52:16] You know, we haven't tried that here yet, though we're watching and learning and listening.

David Todd [00:52:23] So at this point, it's more building these sort of weirs, brush weirs, that are analogs for what a beaver might try to do at the outset before they built a full dam. Is that what you're saying?

Jeff Bennett [00:52:38] Exactly.

David Todd [00:52:39] Okay. So is part of it, the fact that there haven't been these beaver reintroduction, is that more like a, it's just not that far along in the experiment, not sure how to work? Or is it a political challenge to reintroducing beaver?

Jeff Bennett [00:53:05] Well, there's probably a little bit of both, right? We are just beginning. We will be working with the Borderlands Research Institute on what we call the Alameda Creek Conservation Initiative. We have funding there to build a bunch of more beaver dam analogs.

Jeff Bennett [00:53:25] We're learning a few things. We put in a set of beaver dam analogs this past spring that were pretty beat up by the third flow that came through it. We didn't really build them well enough, I don't think. We didn't sink the posts deep enough. We didn't put enough posts in. We probably should have put them in last fall instead of this spring, so they had all winter to sit there and get solid in the ground.

Jeff Bennett [00:53:55] So, we have some things to learn. We're going to put more structures in, and bigger and better structures.

Jeff Bennett [00:54:04] But also, you know, we're not talking about beavers really just yet, except amongst ourselves, a couple of us, have recently started having those conversations.

Jeff Bennett [00:54:13] But it's a lot of work, what we're talking about.

Jeff Bennett [00:54:17] And, you know, if we can get an area, rehydrate an area enough to support some beavers, then I think we should try that. We have a willing landowner. You know, whether or not other landowners will get on board? I don't know. Hopefully they will.

Jeff Bennett [00:54:43] You know, a lot of these ranches are changing hands. And as they change hands, in some cases, there's sort of a new way of thinking that people are a little bit more willing to think about these kinds of ideas differently.

Jeff Bennett [00:54:58] You know, the prairie dog has the same problem. I mean, it's a keystone species for grasslands, right? And you need those burrowing animals in grasslands to help with the hydrology of those grasslands. But people don't want them. Beaver has the same problem.

David Todd [00:55:20] That's fascinating, that there are these animals both, I guess, kind of in the rodent world, that people just, they resist. Is it fair to say, that they fear what they'll do?

Jeff Bennett [00:55:37] Well, yeah, you know, I mean. Fair may not be the best word. You know, there is more concern about the impact to their ability to make a living on these lands. You know, it's now less and less about cattle than it is about hunting. And in some cases, these ranches being bought by people with deep pockets who are very much interested in conservation. So that's why I'm saying there's a change coming. And I think we'll find some landowners. You know, in the next decade we'll maybe be able to find places appropriate to start putting beavers out.

Jeff Bennett [00:56:24] And, you know, if you can get them established here and there, I think they'll spread on their own. I think they'll rehydrate and make improvements to hydrology and increase aquifer storage, and then they can spread a little bit. You know, especially if we're there to help them a tiny bit, you know.

Jeff Bennett [00:56:45] I'm probably a bit of a Pollyanna about this kind of stuff, but what else are you going to do?

David Todd [00:56:53] Well, so I think you said that are the beaver have been reintroduced in the Great Basin and in the Rockies years ago. And I was curious how that had fared and what sort of impacts the beavers' return had, and how successful the repopulation was.

Jeff Bennett [00:57:16] Well, the stuff where the Forest Service was dropping them out of airplanes with parachutes on - that's, the success there, I don't think was very good. I think they didn't all die when they jumped out of a plane. But, you know, that was a little bit of a wasted effort.

Jeff Bennett [00:57:35] But more recently, in the last decade, you know, people are much more methodical about how they reintroduce them. They're much more cognizant of the fact that they need to find, you know, provide some sort of care for them in the first year. Be sure that they've got access to the right amount of food and things like that. So I think those newer efforts are working out, and I don't really know the ins and outs of it because we haven't gotten there yet with our project.

Jeff Bennett [00:58:12] And, you know, I'm a physical scientist. I'm not, even though I have worked with animals and have had a lot of training there, I'm really not a wildlife expert.

Jeff Bennett [00:58:22] But, um, it's working in Utah, in Nevada, in Idaho, Oregon, Colorado.

Jeff Bennett [00:58:36] So, people at agencies are coming around: I would put it that way. You know, agencies, not so much in Texas, but agencies in the other Western states, if they get on board with something, it's going to get, there's going to be enough projects, sort of, you know, a big enough number of projects to where they figure out the ins and outs and how, if they can, to make those projects successful. So that's certainly happened in the last decade.

David Todd [00:59:09] So, one of the things I think is intriguing about a lot of these Western streams is the impact of the big cane and the salt cedar. And I'm curious if the beaver would have an effect on those exotics.

Jeff Bennett [00:59:34] Well, it's a good question. You know, they're certainly going to, I think you can drown a salt cedar. I think it can be too wet, just like it can be too wet for a cottonwood. You should probably ask a botanist this question. But if we rehydrate these tributaries to the Rio Grande and those conditions are more favorable to the native species, they'll at least be able to compete better. So I think it would be a negative for the exotics and a positive for the natives.

Jeff Bennett [01:00:15] But what that vegetative community would look like in total, I'm not sure I know. But it's a good question.

Jeff Bennett [01:00:26] You know, I'm a fan of biological controls. I wish that the beetle had stuck around. It appears the beetle, the salt cedar beetle, the diorhabda maybe didn't survive the decade after it was released in 2008. It did a lot of good but we haven't seen the last couple of years, haven't seen the salt cedars increase.

Jeff Bennett [01:00:50] There's a number of different biological controls for the *Arundo donax*. It's hard to get people on board with that, though. They want, our state agencies want immediate satisfaction. They like burning and spraying, so. But I wish we would give biological controls more of a chance.

Jeff Bennett [01:01:11] And that, you know, those biological controls mixed with, you know, a more historic hydrology you know, might work together to really push those exotics into the background.

David Todd [01:01:31] So, here's another question. I think you mentioned this in passing, that the activity of beavers might be helpful for some of these mussels that have gotten to be so rare, as I understand it, in a lot of Western streams. Can you maybe lay out how that would happen?

Jeff Bennett [01:01:52] Well, if we rewet the streams, right, we have more fish. And the mussels have a larval stage that lives in the gills of our native fishes. So, if we have more fish, the mussels have more opportunities for reproduction. And so, they can certainly move upstream just as well as the fish can move upstream.

Jeff Bennett [01:02:20] So, you know, just by, I think that's one of those cases where "build it and they will come". If you make the habitat for them, and the fish are there, that you know it's important to their larval stage of their lifecycle, then the mussels would increase too.

David Todd [01:02:39] Gotcha. Okay. Well, thank you explaining that.

David Todd [01:02:44] So I think you mentioned that there are changes afoot in West Texas with new landowners, maybe new ideas, new approaches. And I was intrigued that with Rio Grande Joint Venture, and I guess some of your other work you've been, you know, engaged in trying to pull together some of these new partners, whether it's the water planning groups or financial teams, water masters, other constituents. Can you talk a little bit about how you can pull people into a conservation effort like, you know, stream restoration or even beaver reintroduction?

Jeff Bennett [01:03:38] You know, we sort of skipped over the controlled flooding I did in the Grand Canyon. So let me just start there for a second.

David Todd [01:03:43] Yes, please.

Jeff Bennett [01:03:46] You know, the natural, the sediment deposits, the beaches, the camping sites, all that stuff in the Grand Canyon were all set by a flow regime that was, you know, twice as big, twice the instantaneous discharge as what's currently possible with the dam in place. So, you know, you've got these sandbars that people camp on that were set by flows that were almost 100,000 CFS, cubic feet per second. They were 98 or something like that, I think was the peak in 1985.

Jeff Bennett [01:04:31] And then now we're under these damn conditions and you can't go above 40, 45,000. I don't think you can go above 42 actually is what the capacity of the Glen Canyon Dam is.

Jeff Bennett [01:04:44] So, people talk about restoration and that's really the point I want to get at. But you're not going to put the Grand Canyon, you're not going to restore the Grand Canyon to pre-dam conditions. No matter how you play with flows out of the dam, you just can't. It's impossible because you can't raise the levels up to what they were historically. Right?

Jeff Bennett [01:05:04] So, you have to settle on what is, you know, better than not thinking about it, you know, just letting the dams run whenever people turn on their air conditioners. We know that's bad. We know that washes sediment downstream very quickly. So what's better? That's ending up becoming the question.

Jeff Bennett [01:05:27] Well, that's a value judgment. Right? And that means everybody's going to have a different opinion. That's not something that you can define through some sort of scientific study. That's a value judgement. The tribes have one concept of that. The cities have another concept. The Park Service has, you know, a set of values. The Western Area Power Authority - they have a set of values.

Jeff Bennett [01:05:54] So, the only way you can come to agreement, to make things better, is for everybody to get in a room and talk to each other and, you know, build some sort of coalition. Now, those, those are extremely difficult to do.

Jeff Bennett [01:06:10] And the success comes and goes. Those things, you know, ebb and flow. So, some years it's everybody's talking to each other and getting along really well. Other years, not so much. You know, the last couple of years with the fear of reaching dead pool in Lake Mead, I bet those conversations were fairly difficult. And I bet people were, those rooms were tense.

Jeff Bennett [01:06:41] So, it's the same here in Texas. You know, you've got folks that don't quite understand the hydrology of the situation, but they do understand that they need water for their cotton fields or their whatever, you know, whatever they're trying to grow in south Texas. Or you've got river runners who know that they can't, you know, make a living, or they won't get customers when there's no water in the river. Or Mexico says, you know, we don't have any water because our lakes are drought-stricken.

Jeff Bennett [01:07:16] So, the only way to come around to any sort of plan that can improve ecological conditions for the fish, the mussels, the river runners, the farmers downstream is to build partnerships, and to get to know each other and to talk.

Jeff Bennett [01:07:35] And even with all that effort, sometimes, you know, the return doesn't seem proportional.

Jeff Bennett [01:07:46] But that's really the only way to make any progress. And you know, I will say that the water planning groups, before I joined the water planning group, I was working as a consultant for the water planning group out here. And the first water plan for Region E, when we got to the surface water section, it was a paragraph or two long. Basically it said there is no surface water in west Texas other than the Rio Grande, because the landowners didn't want anybody to know about their water resources. Right? They were afraid somebody was going to come take them.

Jeff Bennett [01:08:25] And, but that water planning group, over the last 20 years, you know, it's come around because people were in the room discussing that, you know, the need to describe them in order to protect them. You know, if a landowner has a water resource that he's never measured, never described, then what's he going to use when he gets to court, trying to, you know, seek some sort of compensation for the loss of that from some neighbor?

Jeff Bennett [01:08:54] You know, so the water planning group in West Texas got much better about describing not only their water resources, their surface water sources, but also sort of the ecological benefit of that.

Jeff Bennett [01:09:10] I think Region E was one of the first regions to recommend ecologically significant stream segments to the state water plan. That was, that came out of one of the first water bills, that we should be doing that and I think Region E might be one of the first to do that. And, you know, I played a small role in that just by talking about it over and over again, and trying to be reasonable about it being one of the more sensible people in the room. You know, there were some, some difficult discussions early on before I was on the board that I watched. And I said, "Well, that's not going to be productive, you know, people being pushy and, I don't know, belligerent or at least terse about things, you know."

Jeff Bennett [01:09:54] So, again, I'm probably be a little bit Pollyannaish about all of this, but I think, through cooperation and talking is the only way we're going to make things better.

Jeff Bennett [01:10:07] And again, you know, or not again, but I sometimes wonder how, if we're moving fast enough down that road with climate change and so with so many things happening so fast lately.

Jeff Bennett [01:10:22] You know, that was the other thing: we couldn't mention "climate change" in the early days of the water planning group. Nobody wanted to. They all wanted to call it "extraordinary drought".

Jeff Bennett [01:10:32] I don't shy away from it anymore. I call it "climate change" in our discussions.

Jeff Bennett [01:10:38] So, you know, partnerships, whether they're binational, whether they're regional, whether they're within your county, you're not getting anything done if you can't talk to people. These aren't, you know, these come to be much more about value statements than they do about science.

David Todd [01:11:01] I can see that. And values are very personal.

David Todd [01:11:07] So, you mentioned climate change and I'm curious if you have any insights about the reintroduction of the beaver in areas that are as arid, in the best of times, as the Trans-Pecos and the Big Bend area, that may become even more harsh. How does that figure into how you look at the future?

Jeff Bennett [01:11:33] I think it's an adaptation strategy: repairing these systems so they store more water so that they're wetter. Rather than, you know, underneath the shade of a tree rather than in Lake Amistad where it just evaporates.

Jeff Bennett [01:11:52] One of the things I try to, one of the points I try to make with the landowners I talk to is that, you know, we've all heard, you know, it: salt cedar takes all the water. Willows take all the water. Cane takes all the water. We need to kill those plants.

Jeff Bennett [01:12:12] It's not that simple. You know, plants transpire water, but sun and wind will evaporate water.

Jeff Bennett [01:12:21] So, if you remove a bunch of trees, which also, by the way, are storing water along the stream, there's a lot of water stored in those trees. If you remove them, you just open those streams to the sun and wind and now you're evaporating.

Jeff Bennett [01:12:35] So, it's not as simple as people think: that if I kill a bunch of plants, I'll have more water in my stream.

Jeff Bennett [01:12:42] In fact, it's often just the opposite. Removing riparian forests decreases water quality, decreases water's, decreases the length of the wet season.

Jeff Bennett [01:12:57] So, again, what that means is that if we restore these sites, they hold water better. They have better water quality. They return more to the local communities in terms of recreational access for migratory birds or whatever, you know, whatever sort of recreational values want to bring up.

Jeff Bennett [01:13:16] But, you know, they're storing water and they're storing water more efficiently than the reservoirs are.

Jeff Bennett [01:13:23] So, that sort of thinking, that got the attention of the water planning groups.

Jeff Bennett [01:13:33] When you say it's a climate adaptation strategy, some of them glaze over. But, I think it is. I think it's very much a climate change adaptation strategy.

David Todd [01:13:44] Just by providing that shade and the root structure that may hold more water, and blocks the evaporation and the breeze.

Jeff Bennett [01:13:54] And the riparian sponge, the extra sediment, the sediment accumulation, in those tributaries. You know, it's a bigger sponge. It holds more water.

David Todd [01:14:08] Okay. That helps.

David Todd [01:14:11] You know, it seems like these partnerships and cooperative efforts are, in a sense, a kind of teaching effort. I noticed that your career included some periods when you were a teacher in the traditional sense at Argyle Junior High School and Kayenta

Middle School. Would you share any thoughts about how you might convey your conservation interests to young people?

Jeff Bennett [01:14:48] It's one of the most rewarding jobs I had were both those, you know, was teaching. Also the most difficult.

Jeff Bennett [01:15:01] You know, the way, I feel, the way I got I felt like I got kids connected was by just taking them outside. You know, when I was teaching at Argyle, I was a new teacher. And, you know, I'm not a psychologist. You know, that's not my background.

Jeff Bennett [01:15:19] But, I can tell you that the kids that were the most difficult in the classroom, generally boys, generally, you know, ADHD was just being figured out in the early, mid, late eighties. Those students that we think are the most troublesome in the classroom became leaders the minute we went outside and started turning over rocks in the creek, counting bugs.

Jeff Bennett [01:15:44] Because that's what I would do, that was sort of my response. You know, I had 45 7th graders in a classroom. And anybody that tells you that you have control of that classroom every hour, every minute of every hour of the day, is either some sort of supreme being, a superhero, or they're not telling the truth. So, when things fell apart, that's what we would go do. We'd go outside and turn over rocks. It was a standard assignment we were doing. We were looking at seasonal trends. We turned over rocks, counted insects.

Jeff Bennett [01:16:26] So, I guess my point is, you know, that's how I got kids connected, was to go, let's go do something.

Jeff Bennett [01:16:32] I brought snakes into the classroom and had a caged, you know, aquarium where the snake was. The kids, all you know, the girls didn't want to touch them. They didn't want to be around them. And the boys all wanted to kill the snake. By the end of the year, everybody held it and everybody was much more comfortable with the snake.

Jeff Bennett [01:16:50] So just the up-close interaction with the natural world is what I relied on.

Jeff Bennett [01:16:58] And that was true for Kayenta Middle School as well as Project New Start in Flagstaff.

David Todd [01:17:09] That's really interesting how not only did they learn about these creatures, but it changed their behavior and their attitude.

Jeff Bennett [01:17:19] It was mostly boys. They just didn't want to be inside, stuck in a desk. You know, they're 12 years old. I think it's unreasonable to ask most 12-year old boys to sit at a desk for 8 hours a day. I have a hard time doing it.

David Todd [01:17:43] Well, so one of the other ways that I think that you're in this sort of conservation education business is when you were an outdoor educator and river guide for visitors who came to the Grand Canyon. I think you were working for Cerro Alto Geological Consulting.

Jeff Bennett [01:18:03] Mm hmm.

David Todd [01:18:03] And what do you think folks' experiences were there and how would you try to steer them, you know, help them navigate that role, which is, I guess, pretty far from where they might have lived and usually then.

Jeff Bennett [01:18:21] You know, so that was basically a guiding job. I was a river guide with, you know, an advanced degree. And the difference between that and sort of your average river guiding a river trip experience is that we were working with people who were there to learn something. So either summer classes or a field school for, you know, a geology department out in the Midwest or, you know, a summer field school for biology department, or we used to call them elder hostels, or now what do we call them - they're not Road Scholars. Oh, shoot.

Jeff Bennett [01:19:08] Anyway, some of our groups that we escorted through the lower third of the Grand Canyon, were, you know, retired folks and older folks. And you're right. It's pretty foreign. They don't really, they're certainly not used to it. They don't know what to expect.

Jeff Bennett [01:19:26] So, that was really my role, was to assist them. Make sure they don't get hurt, and that they have sort of the right environment for soaking it in, and then point them in certain directions and then help them explore and find things out on their own.

Jeff Bennett [01:19:51] We also did, you know, full-blown lectures on the side, on the banks of the river sometimes.

Jeff Bennett [01:19:56] But, and, you know, a lot of people can learn from something, can learn in that kind of situation. But, you know, again, the best part is just face-to-face communication with nature, with some knowledgeable people around that can help them find the right questions and, you know, maybe discover some of that answer on their own or, you know, get delivered the answer by one of the one of the educators.

Jeff Bennett [01:20:24] But it wasn't a whole lot different than middle school. The difference is, is just the energy level. You know, seventh, eighth grade boys and girls can be pretty entertaining with their energy levels, I'll put it that way.

David Todd [01:20:45] I can imagine - yeah, the energy level, the sort of nuclear-powered energy level of a 12-year old.

Jeff Bennett [01:20:54] Yeah, absolutely.

Jeff Bennett [01:20:56] You know, the college kids, they had energy, too. It's just a little bit different, you know. And so luckily, though, you know, college students, and the Road Scholars, they choose to be there. So it's not like there's a whole lot of personalities that get in the way of learning, but occasionally there is. But it's all sort of similar. You get them out there face-to-face with nature and be sure that they have, you know, a comfortable environment. They're not fearful. They're not worried, that they can start exploring on their own and figuring out some of the questions that need to be asked on their own. So.

David Todd [01:21:39] Okay. So, I have seen that you are a board member of the Big Bend Conservation Alliance, and I'm curious what the Alliance is working on and what your particular role and interests might be there at the Alliance.

Jeff Bennett [01:22:00] So, I came in as a board member as the Conservation Alliance was sort of in a growth period. But, you know, I was basically one of their water experts. I was just one of the persons that could help guide the Alliance as they worked on water issues.

Jeff Bennett [01:22:20] You know, they organized and hosted several water summits out here. They worked on some of the water issues out at San Salomon Springs a little bit.

Jeff Bennett [01:22:36] But I was you know, I was also a physical scientist. So I could talk about some of the air pollution and light pollution related to the Permian Basin, which is just close enough to where we were impacted by those things.

Jeff Bennett [01:22:54] So, that's been my role.

Jeff Bennett [01:22:56] Lately, the Alliance has decided to adopt, or take on, social justice issues more. We still work on water, but we're using sort of solutions to social inequities as our tools there. So there's, our director, Shelley Bernstein, is working with some indigenous folks in Presidio have set up, you know, are working on the cemetery there, the Lipanes cemetery there.

Jeff Bennett [01:23:35] And working with, they set up a program at the, I think, the middle school called River Rangers where they get kids out with water quality meters on the water to sort of explore water quality issues in the river, which is right there in their front yard.

Jeff Bennett [01:23:53] So, that's sort of where the BBCA is right now on these social justice issues, which I think is long overdue to do with the conservation community. I mean, you noticed how many partnerships I've been involved with, and I can't tell you how many times we get to the end of a discussion and we look around and we all say, "You know, it's all just a bunch of white people here. Well, how are we going to make any difference if we don't include all our communities."

Jeff Bennett [01:24:25] So I think BBCA is making a real positive change in that area. So that's what they're working on now.

Jeff Bennett [01:24:38] Sometimes I feel inadequate in counseling them anymore because water is not as front and center. It's still an element, but it's not front and center like it was. But they still seem to appreciate my input, so I'm still there.

David Todd [01:24:59] Well, I guess we're coming to the close here.

David Todd [01:25:04] And thanks for your thoughts.

David Todd [01:25:09] I'm curious if there may be some things that we missed, that we skipped over, that I didn't give the kind of attention that it deserved, that you'd like to mention now - whether it's about beavers in particular, or about hydrology, or about conservation more broadly.

Jeff Bennett [01:25:31] You know, I mentioned branch mulch earlier and you know, I was, it all started out, I was trying to keep some erosion control blankets from blowing away. So I started piling up brush. And then I came back in a couple of weeks and noticed that the grass was growing much better under the brushy areas than the non-brushy areas. So I hit upon something there and I didn't know quite what I hit upon. But as I explored that and then as I

got introduced into these beaver dam analogs, I got introduced to the term "low-tech, process-based restoration". And that's really what, where we're focusing.

Jeff Bennett [01:26:15] You know, you can spend a lot of money on engineering and big equipment in rearranging the stream to sort of put it back to where you think it was. Or you can use these low-tech methods that positively impact the processes that sort of drive those ecosystem attributes.

Jeff Bennett [01:26:40] So, you know, we're mimicking what beavers do. We're mimicking what vegetative cover does with our branch mulch. We're just trying to push these processes back to where they generate those attributes, those services that we value, and without spending a lot of money and investing a lot of time and expense and risk, really, putting all that money to risk.

Jeff Bennett [01:27:15] So, I guess that's the only thing I would add. But there is actually some science and literature behind what we're doing. If you look it up in the literature: low-tech, process-based restoration, it's there. And I think that's, I think that's, there's a lot of value there. You know, we don't get a lot of money out here in West Texas from mitigation banks, for instance. So we've got to think about it differently. So I guess I'd end there.

David Todd [01:27:47] That's great. I love that, you know, you're experimenting, it seems like kind of an iterative process where you're just trying to try things, you know, test them. See if it works, if they don't try something different.

David Todd [01:28:04] So, I wish you the best with your continuing experiments.

Jeff Bennett [01:28:09] Thank you.

David Todd [01:28:10] And I hope that you have good success.

Jeff Bennett [01:28:13] Okay. Thank you very much.

David Todd [01:28:15] Yeah. Thank you. It's very kind of you to do this. I appreciate it.

Jeff Bennett [01:28:20] I'm honored. Thank you so much.

David Todd [01:28:22] All right. You take care. Bye, now.

Jeff Bennett [01:28:25] Super, David. Good luck. Bye bye.

David Todd [01:28:25] Bye now.