

In the spring of 1997, I accepted a job with the Ducks Unlimited Western Region to be their project engineer for the Intermountain West. What was meant by the Intermountain West? It meant that I had responsibility for designing, contracting and overseeing construction on wetland restoration projects from the Mexican to the Canadian borders and from the eastern border of California to the Great Salt Lake. Just a small area. I was quite the road warrior, much to the chagrin of my family. After a year of work in the Intermountain West, I was able to transfer my responsibilities so that they only comprised the San Joaquin Valley and California north of Redding.

Working for Ducks Unlimited was my dream job, was the reason I had earned an master's degree in Civil Engineering several years previously. I wanted to do environmental work. Working as an engineer to do that was a natural fit for me.

I arrived in Sacramento with Becky, my two boys, and an infant daughter in late June after a 3-week journey from Ohio in a much too small camper. Two days after arriving, I was on an airplane to Yuma, Arizona with Paul, a DU surveyor. For the next 3 days we put in long hours in 105 degree temperatures, surveying a project area next to the Colorado River on the Yuma National Wildlife Refuge. We bushwhacked our way through dense stands of salt cedar, or tamarisk, a bad actor invasive species. By the end of day two, I had heat exhaustion, despite drinking enormous quantities of ice water. I had yet to learn about Gatorade. I've since done field work in temperatures pushing 115 degrees, but for a guy fresh from Cleveland, 105 degrees was plenty hot enough.

How many of you have read *Cadillac Desert*? In that 1986 book, the late Marc Reisner describes the dam building spree of the 1930's through 1960's in the West. He describes the how water was harnessed for cities and for farmers. He

describes the negative environmental impacts associated with the dams. He posited that the water infrastructure system in the West was unsustainable, and that was prior to the impacts we are seeing due to global warming. Recent research shows that the 16 year draught in the Southwest is only partially responsible for the record low water levels in Lake Powell and Lake Mead. According to a recent article in the journal *Water Resources Research*, about 1/3 of the reduction in flows of the Colorado River are due to increased temperatures, with corresponding increased rates of evaporation.ⁱ

I had not yet read *Cadillac Desert* when I arrived in the West. I read it with fascination as I traveled in that first year, seeing the on-the-ground management of irrigation water everywhere I went. It slowly dawned on me that, excepting the highest elevations, the entire water system of the West was under human control.

Back to that razorback sucker project. What were we hoping to do? The intent was to create habitat for the razorback sucker, an endangered and ancient species of fish that was once numerous in the Colorado River Basin. It lives nowhere else. The sucker is now on human engineered life support. Without our intervention, it would likely be gone. But, of course, without human meddling to begin with, it would probably still be doing just fine.

What has happened? In short, dams and nonnative fish species. The razorback sucker lives up to 40 years and grows to a length of 3 feet, making it one of the largest suckers in North America. Historically, it spawned on gravel bars during spring high flows. The newly hatched young moved into floodplain wetlands and backwaters, much as young salmon here preferentially move into the bypasses when they are flooded. As the fish reach adult size, they moved into deep pockets and eddies in the main river and in backwater channels.ⁱⁱ

Hoover Dam was conceived to harness the water on the Colorado River to irrigate land, produce power and to protect river towns and cities from yearly flooding. All laudable goals. But with the completion of the dam in 1935, the flow regime on the lower Colorado River changed drastically. Prior to the dam, yearly flood flows typically exceeded 100,000 cubic feet per second, or cfs. That's how much water was flowing through the Feather River in Oroville during our recent dam emergency. However, during the winter, when most precipitation was in snowpack, river flows would drop to 2,500 cfs. This, too, is a number comparable to the recent flow in the Feather River while the spillway was shut down for repair. Think of that visual on the Feather River. That's what happened every year on the Colorado. During the flood year of 1884, peak flow was measured at 384,000 cfs. Try to imagine that. During a dry 1935, minimum flow was only 422 cfs.ⁱⁱⁱ

Let me help you out with imagining. What exactly is a cfs? Due to the quirks of the units and the math involved, it turns out that 1 cfs is almost exactly equal to 2 acre-feet per day. And 1 acre is almost exactly the size of a football field. So...384,000 cfs would fill 768,000 football fields to a depth of 1 foot in one day. That's 1200 square miles of football. That's a square 35 miles on each side. To a depth of 1 foot. In one day.

When the dam gates closed, the river flat lined. The comparison to a heart monitor is intentional and appropriate. Flow below Hoover Dam now rarely exceeds 35,000 cfs nor drops below 4,000 cfs. You might imagine that this would adversely affect a fish that evolved 3-5 million years ago on a river system with the huge annual historic flow variations we have just been talking about. Here is how.

Those gravel bars needed for spawning? They become covered in silt, just as they do here, impacting both sucker and salmon. What gravel bars are left become

inaccessible due to dams. The sucker used to migrate significant distances to spawn, although nothing like what the salmon does.

The other thing that the altered flow regime and reservoirs have done is create ideal habitat for introduced game fish, such as largemouth bass and striped bass. Both of these fish are voracious predators, and all but the biggest of the slow moving suckers don't stand a chance. These same fish wreak havoc on our young salmon.

The life cycle of the sucker included the young hanging out in flood plains. There are no more flood plains on the Colorado. Levees and reduced flows have eliminated these in most places. The Colorado River channel is as constrained as the Sacramento River is south of here. An important difference is that there are no bypass channels that create artificial flood plains, such as the Sutter and Yolo Bypasses on the Sacramento. Bypass channels were never built on the Colorado.

Consequent to all of this adverse river manipulation, the razorback sucker was protected in Utah in 1973 and listed as endangered in Colorado in 1979. It was added to the Federal list of endangered species in 1991.

What's being done? The recovery efforts include the same laundry list we are familiar with for salmon: manage flows, restore floodplains, build fish passages, manage nonnative fishes. The website I went to indicates that recovery efforts are at least partially effective.

OK. I've just spent a large amount of time talking about the razorback sucker, and peripherally, the salmon. The trouble is, these fish species are only two, of 2,400 plant and animal species that are listed in the United States on the Federal Fish and Wildlife website. 2,400 species that are on human life support because of human disturbances. Add to that the many, many more species that are

listed as endangered at the state level, and the "threatened species" and the "species of concern" that are in trouble, just less so, and you've got an idea of the magnitude of our stewardship responsibilities.

What do we do? In 2012 deep ecologist Joanna Macy and Chris Johnstone published a book titled *Active Hope*. The subtitle read *How to Face the Mess We're in without Going Crazy*. Does this sound like it is as current now as it was in 2012? Probably more so?

In their opening chapter, Macy and Johnstone describe three stories for our time. 1) Business as Usual. In this story, we continue doing what we have been doing, either because we choose to disbelieve, or because we truly believe things are just fine. For whatever reasons, most of us operate in the business as usual mode at least some of the time.

The authors call the second story "the great unraveling." In this story, we believe that things are just going to get worse and worse and worse. Environmentally, socially, economically. Based on the social activism we are seeing since November 8th, I think a lot of people who had been operating in the business as usual mode have shifted to a very real fear of the great unraveling.

The authors offer a third story, a story of hope. They call it "the great turning." They think that we are on the cusp of a shift, a radical shift, in the way humans interact with each other and with the world. They think that the change is happening already, but is under the radar of most people. They cite as partial evidence the more than 1 million, yes, 1 million nongovernment organizations worldwide that are working for ecological sustainability and social issues. Paul Hawken, in his book *Blessed Unrest*, describes this phenomenon and calls it the "largest social movement in history."^{iv} Macy and Johnstone compare the magnitude of this shift to that of the agricultural revolution 10,000 years ago and

the industrial revolution a few hundred years ago. It remains to be seen how it will play out. And of course, in this country, we seem to have suffered a major setback. We are discouraged, but also fired up.

Macy and Johnstone describe three dimensions of The Great Turning, three ways in which we can participate. We can participate in Holding Actions. Some of us have been or are involved in this professionally. This is the work that I did for Ducks Unlimited, creating habitat for razorback suckers and wetland habitat throughout the West. We can adopt life-sustaining systems and practices. This can be done on the individual or family level. Those of us who have skills in public policy or politics can work toward system change. Finally, we can Shift Consciousness. In 2011, I realized that the work I was doing as an engineer was a holding action, and while that work was important, I was now being called to ministry to help with shifting consciousness around social and environmental justice. But we don't have to be ministers to shift our consciousness about how we view justice and our interconnectedness. Being here, supported by and supporting this community, living our UU values, goes a long way.

May it be so.

ⁱ Accessed 3/16/2017. <https://uanews.arizona.edu/story/colorado-river-flows-keep-shrinking-climate-warms>

ⁱⁱ <http://www.coloradoriverrecovery.org/general-information/the-fish/razorback-sucker.html>

ⁱⁱⁱ Accessed 3/10 2017. https://en.wikipedia.org/wiki/Colorado_River

^{iv} Active Hope, 27.