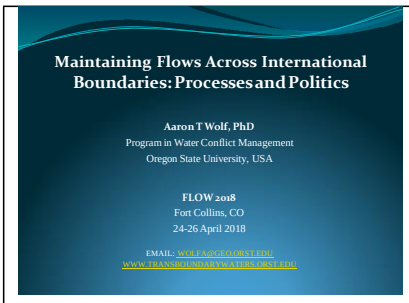
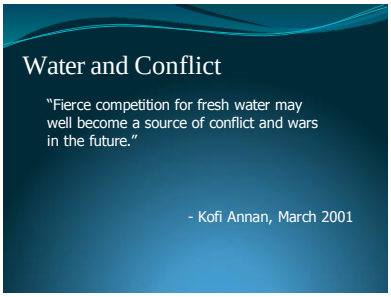


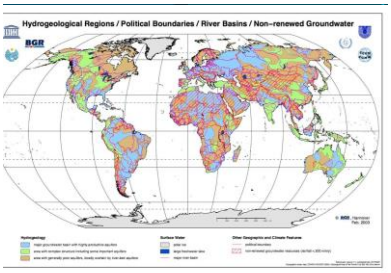


Aaron Wolf: Thank you for that generous introduction. It's a pleasure to be here. There is a mediator's tool that a lot of folks here know and probably use. When you show up to a workshop and you really want to get to work you show up in jacket and tie and then you make a big deal about taking off the jacket and tie and I thought, Okay this is a workshop. I want to get to work. Then I saw who was going to be here and I thought, oh man! I don't need this, we're going to be good from the get-go. So, saved some time too. I really appreciate being here.

Most of my work is international and a lot of the same issues exist here in the Western US. The problem of course, is you have an international boundary in between the two which makes things a lot more complicated.

New legal structures, new economic systems, sometimes real hostility. Not that we have hostility here in the Western US anyway.... But these are the kinds of basins when I first started to get involved in water resources, these were the basins that people were talking about. They were talking about the Jordan Basin, of course the Arabs and Israelis get along really well... Indians and Pakistanis on the Indus Basin, also really close relations. The Tigris and Euphrates, this is Iraq, Syria, Turkey. Turkey's building dams upstream and all these places are hit by drought, hit by, even without drought forty percent up or down variability above or below the mean and so variability, overuse, all of these things happen. As a consequence, and especially people were noticing the tensions across these boundaries, people started to say this and this was kind of the dominant paradigm when I first started to get involved in these issues. Fierce competition for fresh water may well become a source of conflict and wars in the future.

How many people agree? Okay. It seems intuitive. We're running out of water; this room is full of people who are on the ground and see the implications and the repercussions as we run out and now you throw these real deep enmities across. The trick is, my second degree was in



DATE	BASIN	COUNTRIES	BAR SCALE	EVENT SUMMARY	ISSUE TYPE
12/5/73	LaPlata	Argentina--Paraguay	4	PRY AND ARG AGREE TO BUILD 1B DAM, HYDROELECTRIC PROJECT	Infrastructure
1/1/76	Ganges	Bangladesh--India--United Nations	-2	Bangladesh lodges a formal protest against India with the United Nations, which adopts a consensus statement encouraging the parties to meet urgently, at the level of minister, to arrive at a settlement.	Quantity
7/3/78	Amazon	Bolivia--Brazil--Colombia--Ecuador--Guyana--Peru--Suriname--Venezuela	6	Treaty for Amazonian Cooperation	Economic Development
4/7/95	Jordan	Israel--Jordan	4	Pipeline from Israel storage at Beit Zera to Abdullah Canal (East Ghor Canal) begins delivering water stipulated in Treaty (20 MCM summer, 10 MCM winter). The 10 mcm replaces the 10 mcm of desalinated water stipulated Annex II, Article 2d until desalinization plant completed	Quantity
6/1/99	Senegal	Mali--Mauritania	-3	13 people killed in communal clashes in 6/99 along border between Maur. & Mali; conflict started when herdsmen in Missira-Samoura village in w. Mali, refused to allow Maur. horseman to use watering hole; horseman returned w/ some of his Samoura, attacking village on 6/20/99, causing 2 deaths; in retaliation that followed, 11 more died.	Quantity

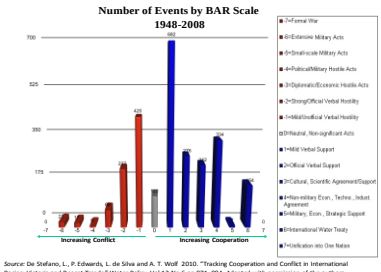
Events Database, Example

hydrogeology and I worked it for a while as a, I won't say which agency, it's a Federal agency that surveys geology. But in that training as a scientist you got to look at these big projections and you go, How do you know? This is a massive projection and what I was interested in was what's the data? What do we actually know? We didn't even know how many trans boundary basins there were in the world before we sat down and spent two and a half years making this map trying to get a handle and it's way more than the six case studies that people are talking about. It's actually 310 trans-boundary basins in the world.

Of course, we're sitting in one here, in Oregon we have another big one with our neighbors to the North and it's about half the land surface of the Earth. Eighty percent of all surface water flow originates in basins that are shared by two or more countries. The other thing that people hadn't done and in this kind of Water Wars literature they had only looked at the conflict, and they hadn't looked at all at cooperation. We know there is a whole spectrum of things that people can do with each other, they could conflict or they might do nothing or they might even cooperate and at the time nobody was even asking across the broad spectrum and of course nobody was looking at groundwater.

I'd be remiss if I didn't say there's 600 shared aquifers as well, and of course, the uncertainty makes this even more difficult. So one of the things that we did is we do what scientists did. We started to collect things and we started to count things. We looked back over a sixty year period and captured every time two countries did anything over water. We asked what did they do and put it along the spectrum from conflict and cooperation. So it was 1800 events over a sixty year period and this, I always have to start with this because I think it's such a telling graph. This goes back to 2003. This is all events in the world across this spectrum from cooperation to conflict and that's cooperation on the right, conflict and war on the left.

As you look at this, two thirds of the time we do

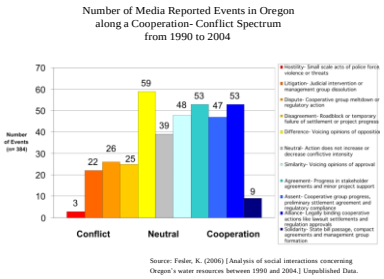


Source: De Stefano, L., P. Edwards, L. de Silva and A. T. Wolf 2010. "Tracking Cooperation and Conflict in International Basins: Historic and Recent Trends." Water Policy. Vol 12 No 6 pp 871–884. Adapted with permission of the authors.

anything over water it's cooperate. That is nowhere truer on this at all and this is the same people we said were conflicting. This is Israelis and Arabs, its Indians and Pakistanis, its Azeris and Armenians and the really interesting thing is how much cooperation there was, you see that minus 1, minus 2? That's verbal conflict. That's somebody saying there's going to be conflict: We're going to go to war to protect the lifeblood of the nation and who are the two groups of people who talked up conflict regularly? Got two groups.

Journalists and politicians. Right, this is who is playing up this scenario and those of us who deal with those two groups of people know. You'll sit and you'll talk forever. Oh this magic elixir, it brings Arabs and Israelis together, oh isn't this wonderful! And so little violent conflict and the headline regardless is going to be water wars on the horizon. Absolutely inevitably. And the politicians, of course, who are they speaking to when they are saying we are going to protect the lifeblood of the nation, are they even speaking to the enemy? Generally not. Who are they speaking to? Their own constituents. Exactly. And they don't mean we're going to go to war, they mean vote for me in November. Right? The two profoundly different things.

And if we look on the violence, this minus 5 and this minus 6, it's 38 cases of violence over sixty years. Always small scale, never escalates into war. Twenty-seven of these are between Israelis and Arabs which is interesting because the last shot fired on the Jordan over water was in 1970. They ran out of water, ran out of water, demand hit supply in 1968, last shot fired in 1970 and you think about, now this is a basin, again forty percent above or below the mean in any given year. Millions of immigrants and refugees, wars over other issues entirely, economy is growing, population is growing, all the stresses that we assume are going to lead us to violence; ran out of water in 1970 and all of this happens in the absence of violence over water. If you look at the number of wars, it's zero. You have to go back 4500 years to find an actual documented case of



Source: Fesler, K. (2006) [Analysis of social interactions concerning Oregon's water resources between 1990 and 2004.] Unpublished Data.

two countries, city-states of Lagash and Uma, was the last and only documented water war that then led to the only documented, the first documented water treaty between two countries.

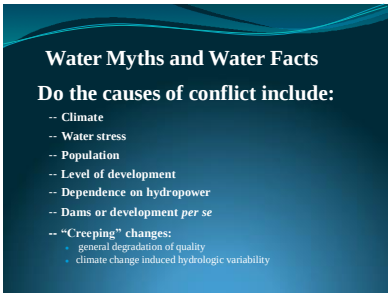
So if you think, oh that's foreigners, they have a whole different thing going, it's the same in the West. We worked with Bureau of Reclamation for five years. This happens to be the state of Oregon. Crystal Fessler, a former grad student of mine, this is the state of Oregon. Again, two-thirds of the time we do anything over water, it's cooperate. If you know one basin in Oregon, what do you know?

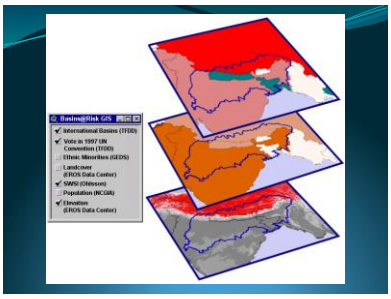
Speaker 4: Klamath

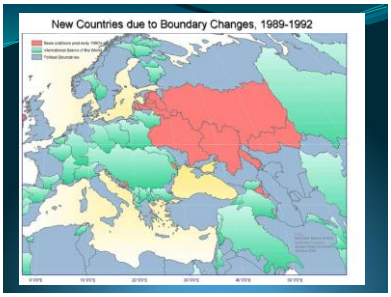
Aaron Wolf: Klamath, absolutely because that was the one that blew up and we'll gloss quickly over the ten years of negotiations and really detailed and nuanced relations that formed and so you have recently a drought worse than the 2001 drought that doesn't escalate precisely because of the relations that are formed.

So at some point, there was a security type agency that was interested in this kind of work and they said we need to, we want to project, we want to figure out what the indicators of conflict, of water conflict are going to be in the next three to five years. We get that they're probably won't be war but we know it causes tensions, we know it exacerbates relations, we know that it makes good relations bad and bad relations worse and we want to be able to project that three to five years. Come up with some indicators for us and make sure that the indicators actually have indicated something in the past. Don't just come up, he knows I'm a professor, don't just come up with indicators off the top of your head. Show us that this is actually, actually indicated something. Fortunately we had these 1800 events so we put our heads together and if you'd just call out what would you think would be indicators of conflict? Of tension?

Oh here he goes again. Going interactive. Come







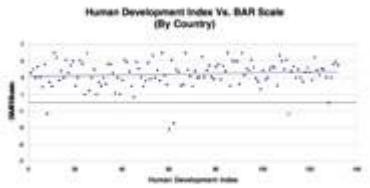
on, somebody help me out here. Thank you! Drought! Of course, drought is going to be an indicator. What else? Population growth. What else?

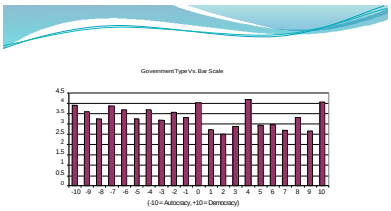
Speaker 4: New dams.

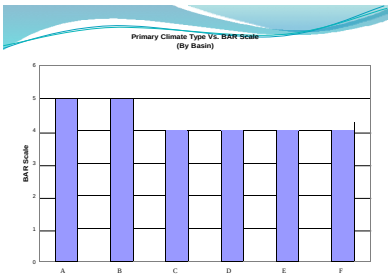
Aaron Wolf: New dams, big dams. Newer, the bigger, the better. What else? It's all up there. There's a cheat sheet right in front of you. Come on guys. So this is what we did. We sat together and we had a brainstorming session just like this and we actually came up with a hundred possible indicators. Now what are they before we've tested them? Just hypotheses, right. We don't know. We got to go back and test. So what do we use, we use geographic information system, so we have a hundred indicators, right, a hundred indicators that we suspect over a sixty year period. Does the data stay static over that sixty year period? Absolutely not so we got to go every year, the data changes so we have sixty years hundred layers, how many? Quick. 6000 data layers. Now the nice thing, the nightmare was it took two and a half years to get the data and put it into place. The beautiful thing is that once you have it in place, out will pop your indicators.

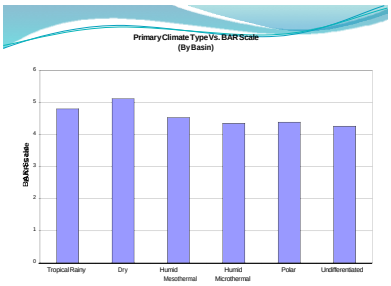
Unfortunately a couple of things happened in the middle of our study period. The Soviet Union broke apart which was hugely frustrating. These are all the new trans boundary basins that were created by the Soviet Union breaking apart. There were actually two basins that were international that became national in that same period. Anybody? Trivia question for the day. Anybody think of two countries that united together in this period?

Yeah the two Germanies. Right. So we lost one basin with the two Germanies and extra credit? Well this always works with my classes. The two Yemens. The two Yemens united together. There was a North Yemen and a South Yemen. So anyway, we had the data in place, we were ready to push the button, the funders on the plane, I said don't worry we're about to push the button, the indicators are going to pop out, we push the







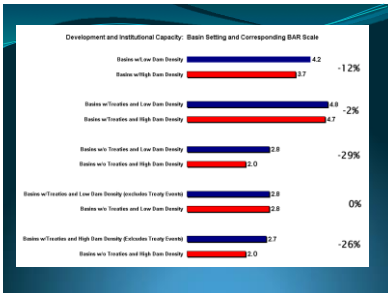


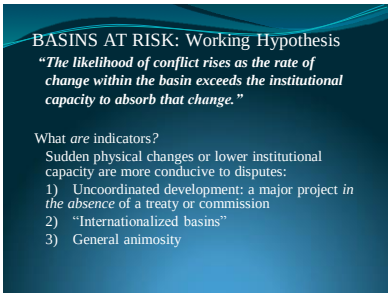
button, out comes absolute garbage. Six thousand charts that looked exactly like this. According to our statistics nothing indicates anything about anything anywhere. That's it, thanks very much.

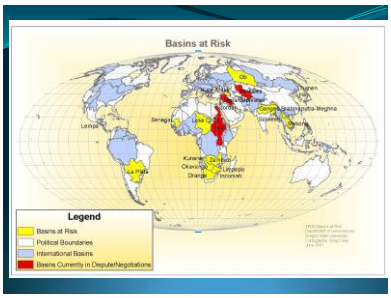
So what did we miss, right? What did we miss? It can't possibly be that this is the most complicated thing. We get it, right. So what did we miss? You're going to say interactions and stuff. So we did a bunch of multi-variant things and couldn't find anything. We looked at government types so on the far right here, that's the conflict level of ardent democracies and on the far left that's the level of Fascist dictatorships. Absolutely identical. We had assumed, like all of you, that drought, scarcity, all the things that folks in this room deal with would be the indicators of conflict. It's absolutely intuitive that if you're running out of something as critical as water, it's going to be an indicator.

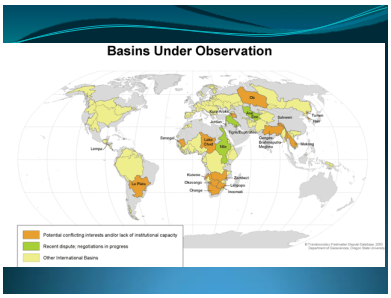
These are the climate types and here, long bars are good so you would assume that, oh the long bars are the arid climate, and so this is when the little light bulb went off and I can actually see light bulbs going off with some of you. Does this make sense? Yeah, absolutely. People in dry climates have to cooperate to deal with dryness. People who deal with variability have to cooperate to deal with variability. People who live in, I saw this talk on Georgia, and Alabama and Florida, right; ninety inches of rain a year; they've been dealing with that for twenty years. There's no pressure, there's not the same kind of pressure that we have in the West or that you have in a lot of the world. So here's when the light bulb went off for us. It's not just about the changes in the basin. That's one side of the equation. All of the things that we named as possible indicators but on the other side are the institutions that we craft to deal with precisely the stressors on the other side of the indicator.

If you have great relations and you have a good river basin organization and you have a strong treaty, you can deal with an awful lot of change and that change is precisely the kinds of things that drive you to create the institution to begin





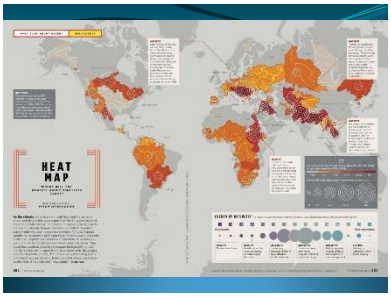


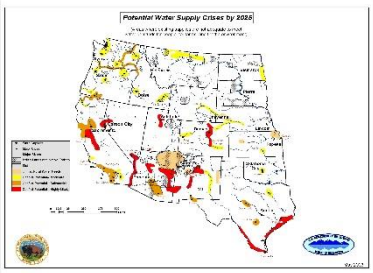


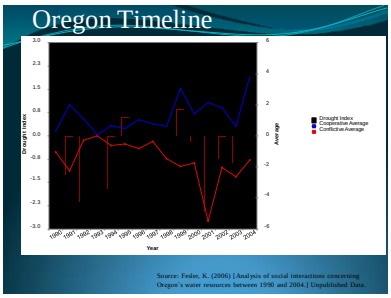
with. So now we recognize, let's look at dams because we like here had assumed that dams drive conflict. So this top set of bars, this is basins with high dam density and low dam density, not much of a difference and it's not statistically significant but now take away if you add treaties. Basins with good treaties and high dam density with good treaties and low dam density, the overall level is more cooperative and the difference disappears. If you take away the treaties, that's that third set of bars, the conflict level, the basin gets more conflicted and the difference between them goes up threefold.

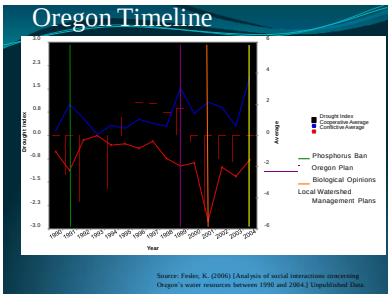
What does this mean? Dams don't cause conflict, dams and the absence of an agreement about what to do about the impacts of the dam; that's what causes conflict. So now we understand how to synthesize all of this work and this is what's driven my work ever since is the relationship between change and institutions. The likelihood of a conflict rises as the rate of change within a basin exceeds the institutional capacity to absorb the change. So that's what we look for. We look for big change with poor institutions. We look for people building things without agreements and of course, we look for general animosity and with that this was a Basins at Risk Map that we used. This was the first version, 2003, and I would argue that a lot of these basins are no longer at risk, precisely because they built up the institutional capacity.

Southern Africa, all those basins, there's been a focused program to craft institutions on these basins precisely to mitigate the impacts of change. This I love, this was our version of the map. This was coming out of the University. The UN published this and that's their version. Where's my geographer way in the back? So that's our color scheme, right? What's that called, stoplight color scheme? Reds and yellows. They said no, you can't use that; that's too conflictive. We don't have conflict in the UN system. That's what we use. This is greens, this is called the grapevine color scheme. Greens and browns. Here's our title, right. Look at that up top and that's their title. We don't do conflict.





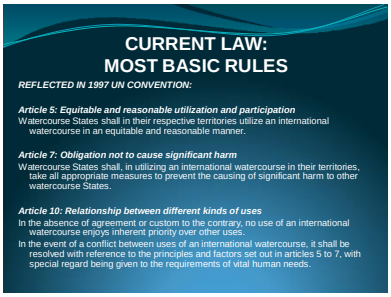


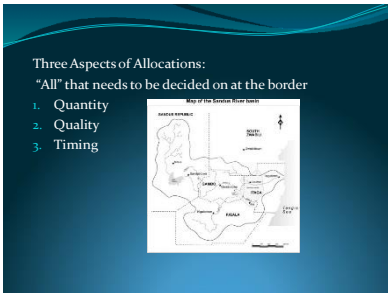


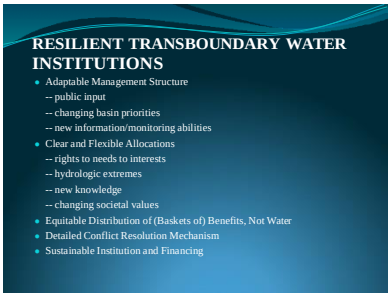
So we've been doing this ever since. We've been trying to update. We have a really good understanding and then a number of years ago I came across this map, I thought oh my gosh, this is awesome! I went to the guy, who's with Reclamation here? Also way hiding in the back. What it is it with, what's going on here? Right so I saw this and I said man, you guys must have thrown a huge amount of science and data and all. That guy just laughed. He said well it wasn't quite like that. Well basically what we did and this is a really important point, people are involved here. Basically what we did is we did a survey; we sent out to the area managers, said is there going to be conflict in your area and almost everybody said yes and we can't figure that out. Why would everybody say yes.

Conflict draws resources. Right? Conflict draws resources and this is exactly part of the point. We also did a study within Reclamation at the time and found that people who had worked and managed in very conflictive basins where everything had blown up, rose faster, made more money, won more awards. The people who were quietly preventing conflict from breaking out, having the better conversations earlier, they were getting passed over, over and over. The assumption was if you are dealing with big flashy conflict, you're a brave person. Right? Rather the opposite and so in Oregon, for example, and again in the West in the US West, part of the thinking was that this is an issue of demand and supply. Right? So this was a question of when demand hits supply that's where you're going to have conflict.

Again I'll show you Oregon. This is precipitation above or below the mean and the top timeline is the cooperative timeline and the bottom timeline is a conflictive timeline. You'll see, except for 2001, there's no relationship at all between precipitation and a conflict. Absolutely none. 2001 what basin is that. Klamath. This is the Klamath blowing up and the question is was it the drought that caused that to blow up. But what we do see, we see inflection points in these timelines where





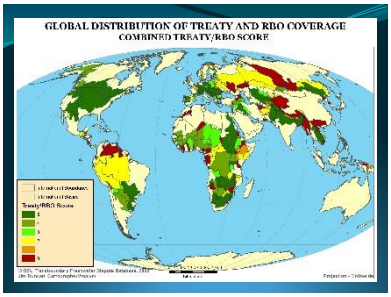


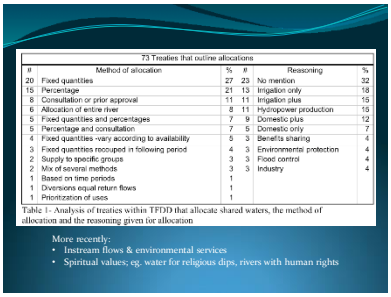
suddenly something changes. And it turns out at least in Oregon and probably west wide, what generally drives conflict is a sudden change in the institutional structure.

A new listing of endangered species, a new requirement for farms and buffer zones or what chemicals you can use on your farm. That's in the negative direction. These are the indicators of conflict. Indicators of cooperation are the opposite. This is suddenly when you see towards the end things are shifting in the positive direction, this is the state of Oregon with it's Oregon Plan for Salmon crafting the statewide conversations based in local watersheds on what we're going to do together to scale up and deal with the issue of salmon.

So the point about all of this, it doesn't matter if we're talking about US West or internationally, the biggest thing that we can do to help deal with both water stress and conflict is to have richer conversations earlier. If we can have the crisis mentality in the absence of a crisis, we really can sit down and do the kinds of things that we all know need to be done.

I want to quickly go internationally, talk about the legal structure. There really isn't any. There are a couple of guidelines: you should use water reasonably and equitably. You shouldn't cause harm. The bottom line is what has to happen at the international scale is you only have to deal with three things at the border: quantity, quantity, and timing. Doing this turns out to be really, really complicated of course and so instead of asking a law to help drive a solution, in the international realm they've done the opposite. They have the institution that can manage adaptively to whatever comes it's way. So these are kind of the components of a resilient institution: adaptable management structure, clear and flexible allocations, enforcement and so we know what works in theory. In practice, this happens almost not at all. This is the richness of institutions around the world and so you can see North America, Europe, have really good intuitions and almost nothing that strong or





73 Treaties that outline allocations

#	Method of allocation	%	#	Reasoning	%
20	Fixed quantities	27	23	No mention	32
15	Percentage	21	13	Irrigation only	18
8	Consultation or prior approval	11	11	Irrigation plus	15
6	Allocation of entire river	8	11	Hydropower production	15
5	Fixed quantities and percentages	7	9	Domestic plus	12
5	Percentage and consultation	7	5	Domestic only	7
4	Fixed quantities -vary according to availability	5	3	Benefits sharing	4
3	Fixed quantities recouped in following period	4	3	Environmental protection	4
2	Supply to specific groups	3	3	Flood control	4
2	Mix of several methods	3	3	Industry	4
1	Based on time periods	1			
1	Diversions equal return flows	1			
1	Prioritization of uses	1			

Table 1- Analysis of treaties within TFDD that allocate shared waters, the method of allocation and the reasoning given for allocation

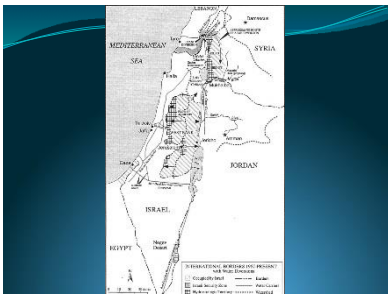
More recently:
- Instream flows & environmental services
- Spiritual values; eg. water for religious dips, rivers with human rights

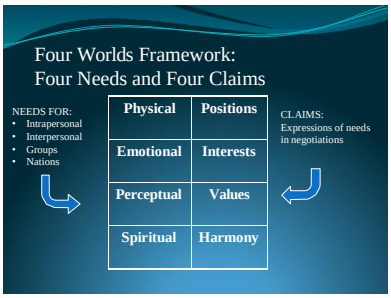
resilient in the rest of the world.

So we're really dealing and if we really break down what the treaties, the topics that they deal with out of 73 treaties that have actual mechanisms specified, you'll see only three specify environmental protection. This idea of thinking about instream flows is really new and really recent and really tough to pitch in most of the developing world. There is a saying that I learned in Laos: for a starving person a bird is not beautiful, it's delicious. It's really hard to talk to people about fish when people literally don't have enough water to drink. So this is a new and increasing facet that's coming in and I think a lot of the world is going to be watching us, specifically for lessons in how this gets done.

I just want to talk about things that I've seen in the room and this kind introduction. This is half of my world, is being in a really tense room, a lot of people, mostly guys, being really angry, doing anything they can not to come to the table. And so just some of the lessons that I've learned in that room that I think may be useful. One is to think about how we elevate and nuance a conversation. So in my world you would never have a meeting on instream flow. The definition, the title is divisive; it says you are either for it or against it and there's an action already prescribed.

What I mean by elevated is instead we'd have a meeting about our future, our wonderful watershed, the glorious watershed of X, right and so that elevates it so everybody can see themselves in the room and everybody has agency to bring all the issues that they have at the table. That's elevated. The nuancing, and the nuancing is one I just want to talk about how, at least in the international setting, in order to get something to work, you've got to make it politically viable. We're so focused on the science and getting the science right. Science is great, as I said, I once worked for an agency that does science and it's a great baseline but we got to remember it's people that cause the problems, it's people that are going to be responsible for the solutions so we got to think about how to make whatever solution we



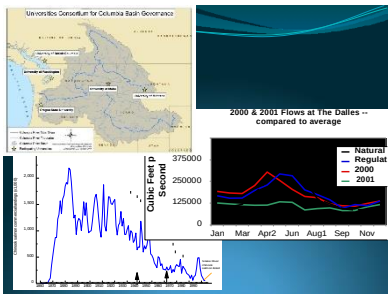


come up with politically viable.

So here's the Jordan Basin and again there's Arabs and Israelis, no love lost between them. This hatched area, this is an area where I want to say this diplomatically. Over the years that Israel had the area the border migrated slightly into Jordanian territory. I'm not going to ascribe blame because that's not my role. But the border migrated into the Jordanian territory and when they sat to negotiate it, this felt like an intractable issue. What does both sides. Here it is. That's the little area and in the 50 years that Israel had it they've been farming it happily and so now it felt intractable. What do both sides want? Jordan wants the land back. Israel wants the land. If you say it like that it's absolutely intractable. But now let's nuance it. What does Jordan actually want? They want sovereignty, right? They want to be able to fly their flag over it. What does Israel actually want? To farm. Now if you nuance it, can you find a solution? Yeah. You turn sovereignty back to Jordan, you see the Jordanian flag flying over it, Jordan then leases it back to Israel for 50 years. That's how you then find a politically viable solution.

You think in really deep, deep detail about what it is that each side wants and find a way to meet both sets of needs. So this is again, one of the mediators tool kits. Every time you see an or, is it to Jordan or to Israel, you try and figure out a way to do an and. So is it fish or farmers, you try and figure out how to do both. How do we have a healthy ecosystem and healthy farming economy, right? This is the elevating and the nuancing.

The last thing I want to talk about, and I realize I'm starting to run out of time. Last thing I want to talk about in this idea of elevating the conversation, how do we, what motivates people to act? If there are four basic sets of needs that we all have, we have physical needs, we have emotional needs, we have mental needs, we have spiritual needs. And this is true individually, this is true as groups, this is true internationally. Of these four, water is used for all of them and we're really good at dealing with physical water and mental water. We

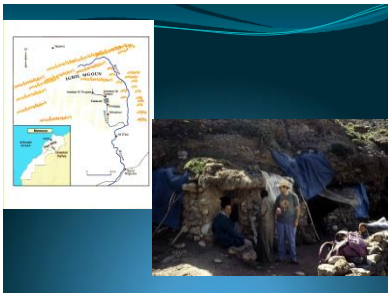


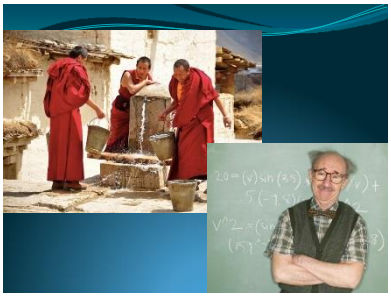
can calculate efficiencies, we can do all this stuff. We are really bad at dealing with emotional water and spiritual water. We have a hard time talking about it, we have a hard time bringing it in the room and this is precisely why so many people are deeply wedded to their water resources and why it's both so conflictive and why it brings people in the room.

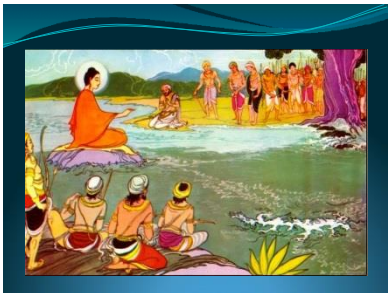
One of the questions is how can we tap into these other aspects of water? This is how science does it. This is how science says we're in trouble in the Columbia Basin. We try and scare the bejeebers out of people. There's the fish population, oh they're all dying and there's the flow and it's falling apart and its coming earlier and the peaks are higher and so and so it's a hellfire and damnation speech. We're all in trouble. Well how do people experience water? Science is great at scaring people but really bad at thinking about what motivates people to change. This is how people experience water; they celebrate it, they love it, they're out there partying, literally partying. There's river festivals all over the world. There's a dancing catfish, I'm betting that dancing catfish gets way more attention than the graph of the salmon population plummeting. And when you're out there celebrating, people will learn willy nilly about their water resources and enhance their relationship with it and then will be more thoughtful about how to save the salmon population.

So I think we need to tap into this. We have to remember who our allies are. Water is freaking sexy and we have some amazing allies. We have both Matt Damon and Leonardo Di Caprio. Absolutely. Right? We got them both. They both have water NGO's. Matt Damon should be here, not me. Guy LaLiberte, he created Cirque de Soleil, one of the first space tours. He looks down and he goes oh my gosh, it's all water. I had no idea. So he starts an NGO, right?

These are the folks that we really need to be getting in the room and tapping into them. I'm interested and do a lot of work with indigenous people and how they resolve water disputes. This





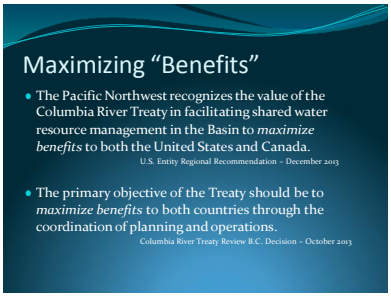


is way up in the Atlas Mountains. This is the first store I came to, there's no roads, no electricity, been walking for days and this is about as far removed as anything I know as you can get and if you'll notice in this little shack you can still get a can of Coca-Cola. Which on the one hand is a plus, but on the other hand you think oh my gosh if we could tap that distribution network. If we could tap that incentive system so along with the Coke you could bring filters, you could bring, you could bring packets, you could bring medication, you could bring whatever else.

These are now the allies we need to be working with. And they all have water programs, Coke, Pepsi, Starbucks, all have water programs. Finally we need to be thinking about the faith community. Villages all over the world. These are the folks that people listen to and oftentimes will work with us and NGOs and think together about how people in the villages are going to adapt and change to changing times. This is who we ought to be working with and this is who we end up sending to the villages. And we can't be shy about talking about faith where it works. Faith can be really divisive in a lot of places but you also have to recognize there's some profound models out there in all of the churches in the US, in the synagogues and the mosques.

Buddha actually resolved a water conflict. I don't know if you know this. He stopped a water war. The story is he went to this area and the armies were facing off against each other and he went to the princes and he said what's it about? They said we don't know. So he went down and he said to the assistant princes what's it about? They said we don't know. So he went down to the villagers. They said it's about the water. This village wants it, we want it, we're going to go. He went back to the princes and says, really is the blood that's about to be spilled less valuable than the water that's in the river? One sentence he stopped it.

All I'm saying is the lessons and the moral agency that our faith communities have is something, again, carefully. I totally get all the dangers of this, but carefully we have to remember that we can



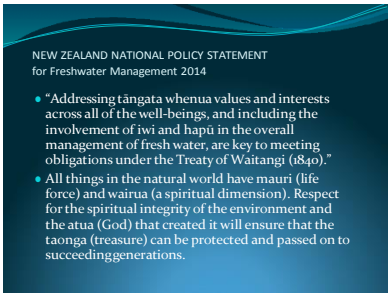
tap that agency and have allies within the faith community and again we shouldn't be scared about reaching out and figuring out where we have things in common. The Coptic Church was tapped as a mediator in the Nile precisely because of that.

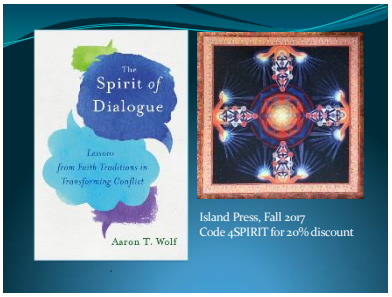
Here in the Columbia, we're used to, we're used to seeing this as two states, right? The United States and Canada. So we do the Western thing, we talk about quantifying the benefits, we do the ration the water so both sides were negotiating a new treaty and both sides are talking about measuring and rationalizing the benefits but again how do we elevated the conversation? Well for one we remember there's 15 tribal reservations in the basin. Similarly, first nations in Canada and they don't think about water in terms of quantifiable benefits, they think about water in terms of all four of our sets of needs. The physical water, the emotional water, the intellectual water, and the spiritual water. Oftentimes in these conversations throughout the West, and I know you all have been in the room we are reminded of the spiritual dimensions of water and again how do we tap that to elevate the conversation?

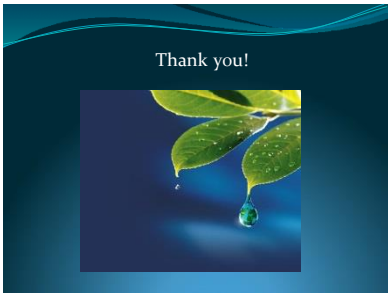
In places like New Zealand rivers have been given actual personhood so you can't harm a river without it's acquiescence. There are two guardians, one from the state and one from the trust which is the indigenous people's trust. I just want to end, I know we thought oh you can't do this as we're industrialized, we're Western. The country in New Zealand this is their water low in 2014. I just want to read you one paragraph from it and just hear how the language doesn't help elevate our thinking about this.

All things in the natural world have a life force and a spiritual dimension. Respect for the spiritual integrity of the environment and God that created it will ensure that the treasure can be protected and passed on to succeeding generations.

You feel differently about water than when we're talking about parts per million or quantifying







benefits. This is my last slide and I just, this is not for self promotion. It's a little bit for self-promotion. If you are interested, particularly in these last aspects, the reason I put this there is there is a code on the bottom, if you are interested and you go to Island Press you can use that code for discount. It deals a lot especially with this relationship, this fraught relationship that we have in the US with using the tools and principles from faith. Thanks very much!