

ORAL HISTORY INTERVIEW

John C. ("Jack") Schmidt

Logan, UT

11 June 2018

Interview conducted by:

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and

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Glen Canyon Dam Adaptive Management Program Administrative History Project

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Subject John C. "Jack" Schmidt
Date 6/11/18
Location Logan, Utah
Interviewer Paul Hirt
Annotator Jennifer Sweeney
Project Glen Canyon Dam Adaptive Management Program Administrative History
Notes/Bio Geomorphologist John C. "Jack" Schmidt has been doing research in Grand Canyon for more than thirty years. He was Chief of the Grand Canyon Monitoring and Research Center (GCMRC) from August 2011 to November 2014. Schmidt was Professor of Watershed Sciences at Utah State University, where he was Director of the Center for Colorado River Studies. He earned a PhD in Geography and Environmental Engineering from Johns Hopkins University.

Minutes Summaries of interview content during each minute of the interview

- 0 Legal name John C. Schmidt. Chief of Grand Canyon Monitoring and Research Center (GCMRC) from August 2011 to November 2014.
- 1 Was involved in science in Grand Canyon before this, did a Colorado River research trip in spring of 1984.
- 2 Did a research trip with U.S. Geological Survey (USGS) in May 1985. Completed dissertation in 1987 and continued work with USGS for another nine months. Took an academic position at Middlebury College in Vermont.
- 3 Advisor to Duncan Patten on sediment and geomorphology in early 1990s. (Schmidt is a geomorphologist.) Before going to Vermont, Schmidt was part of the team that wrote the Glen Canyon Environmental Studies (GCES) Phase I final report.
- 4 Involved in development of interim flow recommendations in early 1990s, early discussions in development of 1992 Grand Canyon Protection Act (GCPA), early discussions that led to formation of Glen Canyon Dam Adaptive Management Program (GCDAMP), and one of a group of five people who developed the idea of controlled dam releases [High Flow Experiments (HFEs)]. After GCDAMP was underway, Schmidt had more limited involvement.
- 5 Schmidt's involvement came as part of funded academic studies from this time until he became Chief of GCMRC.
- 6 **Q:** When did you come to Utah State University? **A:** September of 1991. **Q:** Were you doing research in Grand Canyon in around 1993 when there were large floods? Was this connected to the idea of artificial flood events? **A:** No, that's not really how it worked. It is very complicated and hard to explain in the interview setting. **Q:** Which of the three main components of GCDAMP--scientific research, policy and management, social and institutional engagement/stakeholder representation--were you mostly involved in?

- 7 **A:** Certainly the first two, all the time. Schmidt states he prefers to talk about his GCDAMP involvement in a personal story format rather than go through the interview questions. Interviewer agrees to this. Schmidt gave a talk in the month prior to the interview on the history and evolution of scientific ideas in Grand Canyon.
- 8 The science in the 1970s and at the inception of GCES focused on the effects of hydropower generation on the downstream environment. The lawsuit that created GCES was based on the effects of bigger flow fluctuations. **[1]** Later in life, Schmidt wanted to do his dissertation in Montana, which he considered home.
- 9 When Schmidt asked an "influential person" at USGS about dissertation topics, he was directed to the nascent GCES program, which was largely shunted aside by the agencies involved with Grand Canyon river science. In the early 1980s "you basically had this unwanted, irrelevant fish biologist who they let go out to Flagstaff to go run something that Reclamation [U.S. Bureau of Reclamation (USBR)] considered harmless." That scientist was Dave Wegner.
- 10 "Stuff that really mattered"--modeling, sediment transport--would be done by USGS "in the old traditional alliance between Reclamation and USGS." USBR considered GCES irrelevant. Some study questions were pursued to "placate" environmental interests.
- 11 Schmidt worked on one of these, the "sandbar question." Wegner agreed to fund Schmidt's grant proposal [through GCES?], but USGS insisted Schmidt do the study through that agency.
- 12 Schmidt was a graduate student hydrologist working with USGS. He lived in Tucson during this process because the state USGS office was there. In 1983 there were natural floods, and high releases from Glen Canyon Dam in 1984 and 1985.
- 13 On a river trip with a different study, Schmidt made an offhand comment that the effects of the 45,000 cfs (cubic feet per second) high releases should be studied. He was "dressed down" by his trip companion, who told him that flow rate was outside the scope of USBR-mandated studies.
- 14 Hydropeaking was the focus of that research. The high flows of the 1980s were viewed as an anomaly, "an impediment to what needed to be studied." USBR scheduled hydropeaking so that its downstream effects could be measured.
- 15 The study was abandoned three and a half months in due to heavy snow in the mountains.
- 16 Preservation of the trout fishery was another USBR priority. Hydropeaking was assumed to be bad for trout spawning.
- 17 Science was directed by assumptions about hydropeaking. External reviewers from the National Research Council maintained that limiting hydropeaking should not be the only element studied in regard to condition of sandbars: sediment transport is another factor. [Recording paused at Schmidt's request]

- 18 [Recording resumes] The status of any geologic deposit is based on the history of erosion and deposition. The early 1990s saw "innovative discussions" among key people in Duncan Patten's offices.
- 19 This group consisted of Ned [Edmund] Andrews, USGS; Jim [J.D.] Smith, USGS; Dick [G. Richard] Marzolf, USGS; Dave [David] Rubin, USGS; and Schmidt. Rubin and Schmidt were skeptical regarding artificial flood [HFE] events; the other three were advocates of the idea from the beginning. Schmidt considers it his good luck to have been involved with the group that advocated this idea.
- 20 Schmidt recommends a book for background on the research underlying the artificial flooding concept. **[2]** A seminal publication relating to GCDAMP.
- 21 USGS scientists proposed the controlled flood concept every year. Larry Stevens and Dave Wegner were against the flood idea, "and they fought it behind the scenes, relentlessly, every year." **Q:** Is that because they assumed floods would only cause erosion, and not deposition? **A:** "It was a mix of well-intentioned scientific reasons and who was in political control."
- 22 In the early 1990s, research planning was done annually. **Q:** Where was the funding coming from at that time? **A:** "It was helter-skelter." USGS funded some research. Schmidt led two research trips on sandbar erosion in the late 1980s funded through Middlebury College, because Wegner refused to fund them. The research situation in Grand Canyon was difficult, because multiple agencies and entities were involved and wanted to be in control.
- 23 While navigating politics and proposing the concept repeatedly, "finally, enough people thought it was their idea" so that controlled flooding experiments moved forward.
- 24 Schmidt prefers the term "controlled flood" to the administrative designation "HFE."
- 25 Sitting at Eminence Break Camp in Marble Canyon on one of the late-1980s winter research trips (approx. January 1989), the group came up with the "Beach Bill," which Schmidt wrote in his field journal, to protect Grand Canyon beaches. The group included Schmidt's students; Dave Rubin; Johnnie [J.N.] Moore, University of Montana; and river guides Tom Moody and Dan Dierker.
- 26 **Q:** For how long had you known that dam operations were leading to the erosion and loss of beaches? **A:** It has a long history: the first scientific article on it was published in 1974. **[3]** Hydropeaking plays some role, but so do sediment mass balance and other factors.

- 27 Schmidt describes his involvement in the origins of the 1992 Grand Canyon Protection Act (GCPA). After the Middlebury research trips, Schmidt contacted Ed Norton at Grand Canyon Trust regarding possible legislation. Norton stated the organization was not interested in legislation, but instead planned to work with USBR on an Environmental Impact Statement (EIS). Schmidt then contacted Tom Jensen, Chief of Staff [Counsel] for the U.S. Senate Committee on Energy and Natural Resources, to explore legislation, and wrote a report based on the findings of the two research trips.
- 28 Senator Bill Bradley, Chair of the U.S. Senate Committee on Energy and Natural Resources, was convocation speaker at Middlebury College that Spring. Dan Beard [USBR] and Tom Jensen (who himself was Executive Director of Grand Canyon Trust 1992-1994) led the GCPA effort.
- 29 Schmidt approached Bradley at the college. Within a month, Bradley flew to meet with Grand Canyon Trust, referencing Schmidt's erosion report. Jensen wrote Schmidt a letter of thanks when GCPA was passed.
- 30 "In the late 80s, I kept the idea [of what became GCPA] alive." In the mid-1990s when GCDAMP was being formulated, Schmidt and other senior scientists realized the program "was pretty aimless, and trying to be all things to all people."
- 31 They collaborated on "Science and Values in River Restoration in the Grand Canyon," a paper that had a significant influence on GCDAMP. **[4]** "It basically says, 'We can give you any kind of Colorado River in Grand Canyon that you want, and the problem isn't science, you just have to decide what you want. And we don't think you know what you want.'"
- 32 The paper is still relevant and still studied. **Q:** Can I go back to that quote for a second?
A: Yes. **Q:** I read that in the memo you sent me, from when you left GCMRC in 2014, and I thought it was profound. When you were there in the early years, what did people want from a program, and how did that change over time?
- 33 **A:** When Schmidt teaches the history of water development in the western U.S., he points out that dam and diversion decisions were made by the "technical elite: engineers, lawyers, civic boosters, corporate agriculture." Is it good to have all of these people in on decisions, or does it make the process more muddled?
- 34 Dave Wegner had a clear directive at GCES, based on administrative decisions or perhaps court rulings. The issues were sandbars, trout, endangered fish, and either riparian vegetation or recreation. "It's damn simple."
- 35 While doing the research on environmental outcomes that underlay "Science and Values in River Restoration in the Grand Canyon," Schmidt says "it became clear that there was no operational scheme that benefited everything." This made it imperative to prioritize management outcomes.

- 36 Schmidt says that, although he was the paper's lead author and is often given the credit, Dick Marzolf coined the terms "'relict resources' and 'artifact resources,' relics of the past and artifacts of dams." The most obvious artifact resource is recreational trout fishing. Schmidt "confesses" that he was frustrated by GCDAMP when it first started.
- 37 "It just instantly wanted to make everything more complicated." Adaptive management programs are stakeholder processes that focus on everybody getting along. Schmidt describes his past criticism of the program as "flippant" and "cynical." He did not agree with the emphasis on trust-building and thought that "nobody would make hard-nosed decisions."
- 38 The objective lists generated by GCDAMP stakeholders included both relict and artifact resources; Schmidt could not understand why they failed to realize the objectives were inherently not achievable because of this.
- 39 Schmidt became known as a "critiquer" of GCDAMP. **Q:** Is that because you wanted them to start making trade-offs and decisions? **A:** Schmidt has biases about what he wants the world to look like, but realizes the big factors are beyond his influence. Trade-offs are necessary.
- 40 Scientists worked hard to research controlled floods and bring the concept to fruition in the early 1990s, but now that adaptive management had been implemented, the overriding worry was stakeholder relationships.
- 41 The early 1990s was "a unique time" because traditional water managers and USBR lost control of the dam. A small group of scientists envisioned new processes, and Dave Wegner's influence helped push them through. USBR and what became the GCDAMP stakeholders did not like this change. Schmidt thinks the formal nature of GCDAMP was meant to counteract what they saw as "the tyranny or anarchy of scientists running the show."
- 42 He does not think Rick Gold and other early GCDAMP participants would disagree with his assessment, although they might have more or less intense ways of describing their points of view. Any government agency process is going to tend toward formality, especially over time.
- 43 "I don't know if that's good or bad, it's just what happens." The EIS specifically calls for an adaptive management program.
- 44 The first Chief of GCMRC was Dave Garrett, who left after a short time. His successor, Barry Gold, was "a real disciple of adaptive management."
- 45 The program brought in Carl Walters, one of the originators of the adaptive management concept, to consult. Schmidt describes Walters as a decisive "straight shooter": he had a clear vision of how an adaptive management program should operate. He wanted to "create models of the trade-offs."

- 46 Walters believed such a transparent process would lead to informed stakeholder decision-making. The ecosystem model creation process forced scientists to find answers and make decisions as well.
- 47 When the model was completed, Schmidt says stakeholders ignored it--"it had no impact on decision making. **Q:** Why? **A:** "Because you cannot practice adaptive management in Grand Canyon."
- 48 GCDAMP is trying to practice adaptive management "in a context in which there are major societal actions that cannot be experimentally adjusted," such as the mandated amount of water that must flow from the Upper to the Lower Colorado River Basin.
- 49 Institutional forces control major decisions in Grand Canyon. **Q:** You're saying that [adaptive management] requires experimental research, and there are certain experiments that are out of the realm of possibility. **A:** "Not only that. You cannot maintain a fixed experimental program."
- 50 Environmental conditions can change rapidly, making previous research inapplicable to the current situation. GCDAMP saw GCMRC's role to be a contracting agency, securing personnel to do applied research for the program.
- 51 GCMRC was also to write guidance for planning and adaptive management. This was Rick Gold's model for the center as a part of USGS. It remained this way until Schmidt's tenure, when he wanted to go in a different direction. **Q:** What was your new direction?
- 52 **A:** It was twofold. The science questions GCMRC was asking--which came from stakeholders--were "myopic, unanswerable, complex, and intractable." Schmidt attended GCMRC annual reporting meetings before he was Chief and felt GCDAMP participants were demoralized [initially sounds as if he is referring to GCMRC staff, but makes clear in Minute 53 he is referring to GCDAMP].
- 53 **Q:** What was the source of that demoralization? **A:** Nobody knew what they were supposed to be working on or what direction they were going in. Schmidt thought GCMRC should "rearticulate" GCDAMP questions as "big, simple questions, so that every stakeholder, if asked 'What are you studying, and why do you exist?,' every stakeholder will tell you basically the same thing, because everybody understands it."
- 54 **Q:** Give me an example of that kind of simple, direct question. **A:** I used to put them up at all my talks. There are two fundamental questions for Grand Canyon. The first: "What is the maximum size of sandbars that can be maintained with the existing, tremendous deficit in sand supply, and given the operational rules that exist, and is that size acceptable to society?"
- 55 The second: "What is the maximum population of the endangered humpback chub that can be maintained, given the fact that we have made a societal decision to also maintain a recreational trout fishery when those trout eat the endangered fish?"

- 56 The fish question is much more nuanced. There are other fish species to consider, and operations may not have an impact on populations at all. The program needed to play a "game" with Department of the Interior (DOI) and other administrators about what needed to be in guidance documents.
- 57 The Assistant Secretary of the Interior (SOI) for Water and Science made it clear that GCDAMP's priorities were "sand, fish, fish, fish." The job of GCMRC was to make questions simple and easy to articulate. It needed to listen carefully to stakeholder concerns and be able to reiterate them clearly: "I hear your concern, and this is the scientific question I think you're asking."
- 58 It was also important to point out when a question was too nuanced to answer easily, and would therefore cost more money to study. Stakeholders needed to determine whether they really needed difficult questions answered before committing resources to doing so. GCMRC scientists could also give positive feedback, or help reframe questions to make them more amenable to study.
- 59 Sometimes the GCMRC role was to say, "I hear your concern, but we can't tell you any more than we have told you already. You need to make a decision." In Grand Canyon, stakeholders in one group have aims that can only be met with large changes in operating rules. In the other group, aims can only be met by adhering to current operational rules.
- 60 The group members benefited by maintaining the status quo typically represent large organizations with political power and are paid for their involvement in GCDAMP--it is part of their jobs. Such stakeholders have the time and support to propose study questions that delay decisions for change.
- 61 There is always some "young, hungry" academic or agency researcher willing to take on a study, exacerbating the issue. Some of Schmidt's colleagues wondered why he still worked in Grand Canyon, considering such intractable issues.
- 62 Stakeholders ask nuanced questions as a delaying tactic, research money is hard to come by, but there are always researchers willing to study any question. GCMRC had to try to steer toward big questions. It also had to move away from being an entity whose staff simply wrote contracts for research. "You can't manage excellent science unless you yourself are an excellent scientist."
- 63 One of Schmidt's former students was a finalist for a job at GCMRC, which was concerned that the candidate wanted to do science himself rather than contract research out. One of Schmidt's objectives as GCMRC Chief was to convert the contracted scientists to Research Grade Evaluation (RGE) positions, similar to an academic tenure system.
- 64 This took evaluation of research goals out of Schmidt's hands. He was GCMRC Chief at a time when financing was ample.

- 65 This made the job easier when Schmidt was doing it than it is now. He was able to hire numerous post-doctoral researchers. He saw this as a way to inspire staff, especially federal employees whose positions were secure.
- 66 **Q:** It seems to me that you are very aware of and concerned about the tension between making difficult administrative decisions and working within collaborative, democratic processes. Do you think we need to bite the bullet more often, be less conflict-averse, and worry less about the satisfaction of every stakeholder?
- 67 **A:** To some extent, yes. "There are big realizations that I came to in that position." One was that "Grand Canyon, as a segment of the river, is trapped. It is prisoner of the fact that, if you think of the big map of the Colorado River watershed, you essentially have-- everything in the Upper Basin is the land where the water comes from, and everything below Hoover [Dam] is the land where the water goes, the land where the water is used."
- 68 The connection between those lands is the "bottleneck." All of the water going from one to the other must go through it. "Your management options in Grand Canyon are tiny." This became clear to Schmidt during the development of the Long-Term Experimental and Management Plan (LTEMP) EIS.
- 69 The LTEMP EIS limited available management decisions, making "every water supply agreement that is in place untouchable."
- 70 Many pieces of the management puzzle are off-limits to managers.
- 71 The only manipulable component left is hydropower, which becomes "everybody's whipping boy." Schmidt describes himself as no apologist for hydropower, but believes it "always has to make the compromise" in the current management situation.
- 72 Colorado River management in Grand Canyon is "stuck on hydropeaking." Schmidt's work currently focuses on making sure that the river environment is part of the conversation when the Interim Shortage Guidelines come up for renegotiation in 2020. For the last twenty years, "every deal is cut among the water-supply players," who hand it off the GCMRC with the attitude of "make the best of this." **Q:** What do you think we want for the river and the river ecosystem besides hydropower? How would we get it?
- 73 **A:** Given the fact that we are locked in--[Schmidt pauses and takes some time to collect his thoughts]. Different stakeholders want different things, and the National Park Service (NPS) just wants some level of control, although since all decisions are essentially made by water-supply concerns they will never have it.
- 74 Stakeholders almost universally agree that endangered species cannot be allowed to approach extinction. That would result in court-ordered environmental compliance.

- 75 The status of species protected by the Endangered Species Act (ESA) stands above all other stakeholder concerns. Preserving sandbars for camping and tailoring the ecosystem to the viability of endangered species are arguably on the second tier of stakeholder priorities. "To me, what's not on that list is a natural, native river ecosystem."
- 76 **Q:** Does that come automatically? **A:** No. "The Grand Canyon ecosystem is a fundamentally damaged, fundamentally screwed-up, artificial Disneyland ecosystem. And for me to say that, after spending thirty years of my life there, is tragic. And it is heartbreaking for me to say that. But it is not a real river." Although you have to go elsewhere to see a real river, being in Grand Canyon is still a transformative experience.
- 77 The tourist experience of Grand Canyon is based on rapids, the landscape, and being alone with a small group of friends for several days. The river and ecosystem do not look or behave as they naturally should, but "in the eyes of most people, that's just fine." Humpback chub have learned to thrive at "this one natural place, the Little Colorado River."
- 78 If the Little Colorado River remains viable, humpback chub will survive regardless of dam operations decisions. The Little Colorado, however, is subject to development and environmental pressures. The artificiality of the river environment is not an issue to stakeholders unless it begins to threaten endangered species with extinction.
- 79 **Q:** Would you like to see a broader vision for river restoration? **A:** No, I don't think it's possible. Schmidt believes managers do the American public a disservice by not telling them how compromised the Grand Canyon ecosystem has become. **Q:** Because they are given false hope? **A:** Exactly.
- 80 "We failed to tell the citizens of Arizona--the Grand Canyon State--that there was an irreversible cost to the construction of Glen Canyon Dam" and to large-scale water development in the Colorado River. Great care must be exercised in making future decisions because of the potential irreversibility of their effects.
- 81 Millions of dollars are spent every year, and the public is still largely unaware that the canyon is damaged beyond help. This does not mean that nothing should be done: "we have a moral obligation to one of the greatest places on planet Earth, but we're also not going to decommission Glen Canyon Dam." Managers and stakeholders fall victim to fuzzy thinking and pretend the situation is better than it is.
- 82 Money is spent to research issues that are "completely intractable." Climate change will force managers to action.
- 83 Operational flexibility has to be increased.
- 84 Climate change is an issue that GCDAMP and GCMRC are not giving enough attention. GCDAMP's annual plan is based on implementing the LTEMP EIS.

- 85 In likening management to skiing a slalom course, Schmidt says, "focusing the work plan on how to implement LTEMP is like focusing on the gate you just passed. The next gate is climate change and decreased runoff, and changing water temperatures released from a much lower Lake Powell." The science program needs to focus on answering upcoming climate change questions.
- 86 Schmidt explains how science needs to be managed in the face of climate change with an imagined scenario in which Lake Mead is kept at a higher level than Lake Powell. Some decisions could have irreversible effects, and could effectively negate the previous work of GCDAMP.
- 87 Good decision making in this scenario depends on climate change-focused science being started now. Schmidt and three current members of the GCMRC staff developed models and wrote an article (now in review at the journal BioScience) that makes this case.
- 88 The factors seem simple, but making decisions about them can have long-term effects. Warm water and sediment coming out of Lake Powell would seem to correlate with pre-dam conditions on the Colorado River, but most fish biologists at GCMRC would prefer to make decisions within current, known parameters.
- 89 Grand Canyon now has the world's largest population of humpback chub. If the river grew warmer, conditions could be bettered for predatory or competing fish like largemouth bass.
- 90 Schmidt cautions researchers to nuance their article discussions on Grand Canyon conditions. He remembers that he and Larry Stevens collaborated on an article about the high biological diversity of Grand Canyon marshes.
- 91 The marshes are an artifact of the absence of natural flooding due to the presence of the dam. In their discussion, they revealed that they disagreed on the relevance of the marshes and the biological diversity they support.
- 92 Schmidt would love to see an unobstructed Colorado River, but it is not his mission to get that back. His mission is to try to make decision-making in Grand Canyon transparent. **Q:** You said earlier that there is a set of factors that go into influencing the Grand Canyon ecosystem that are off-limits. Hydropower is easily modified, but there are other, more important factors that are off-limits.
- 93 **A:** They are total flow; total monthly flow; sediment supply; temperature; and a "new" one, nutrients. **Q:** If someone said you could adjust any of those factors in order to get more of what we want for the Colorado River ecosystem, which of them would you adjust? **A:** The first thing Schmidt would do is get a preliminary engineering analysis to assess the cost of redrilling the diversion tunnels.
- 94 The cost may be reasonable in the context of existing operational costs.
- 95 He would arrange research on the possible effects in Grand Canyon of a natural temperature and sediment regime.

- 96 Schmidt wants to know if it is possible to both allocate water to where it is most needed and have a more natural Grand Canyon. This would require moving more sediment, and bigger floods, through drilled-out diversion tunnels. A declining water supply might provide the opportunity to do this. Still, science might conclude that maintaining a full Lake Powell is the best public policy decision.
- 97 Greater flows, more sediment, and the right temperature are what the ecosystem needs.

End of Interview

Paul Hirt: 00:00:01 This is Paul Hirt of Arizona State University with Jennifer Sweeney, research associate at Arizona State University. And we are interviewing with Jack Schmidt in Logan, Utah on June 11th of 2018. Jack, thanks for joining us today.

Jack Schmidt: 00:00:18 Thanks.

Paul Hirt: 00:00:19 Can you just start out by giving us your full name, the positions that you held in the adaptive management program over time, and the years in which you were involved?

Jack Schmidt: 00:00:31 Well my legal name is John C. Schmidt. I go by Jack. I only served, I served in an official capacity with the program as Chief of the Grand Canyon Monitoring and Research Center from August 2012.

Paul Hirt: 00:01:04 2011, right?

Jack Schmidt: 00:01:05 Two--August 2011.

Paul Hirt: 00:01:07 I saw your memo.

Jack Schmidt: 00:01:08 I know I, I just, I'm going through the numbers (unintelligible, both talking at once). August 2011 until November first of 2014.

Paul Hirt: 00:01:19 But you were involved—before that.

Jack Schmidt: 00:01:20 Yeah, but I have long--so, the longer involvement (pause) I did my first river research trip in, uh, spring of 1984--

Paul Hirt: 00:01:37 Colorado River?

Jack Schmidt: 00:01:38 My first river research trip in Grand Canyon, with the USGS to help and look for a research opportunity. I was subsequently funded. That's its own story. And I did my first research trip affiliated with the USGS in the sp--in May of 1985. I pursued my dissertation, completed that in 1987, stayed working for the USGS another approximately nine months. Took my, an academic position. Uh--

Paul Hirt: 00:02:40 Was that here at Utah State?

Jack Schmidt: 00:02:41 Middlebury College in Vermont. Stayed active, at a time when I was not getting any direct funding from the program in the late 1980s. And that's its own story. Served as a sediment, as an advisor on sediment and geomorphology issues to Duncan Patten who was senior scientist--

Paul Hirt: 00:03:18 A fish biologist [Dr. Patten is a riparian ecologist].

Jack Schmidt: 00:03:19 Right. And so--

Paul Hirt: 00:03:21 Are you a geologist, by the way?

Jack Schmidt: 00:03:22 I'm a geomorphologist. Yeah.

Paul Hirt: 00:03:23 Geomorphologist. Okay.

Jack Schmidt: 00:03:25 So I did have an active position then, but that was before, um, the adaptive management program existed.

Jack Schmidt: 00:03:36 I guess to back up, in the late 1980s before I went to Middlebury, I was part of the team that wrote the Phase One final report of the GCES program. So I was that sediment guy. So then I served as an advisor to Duncan [Patten] in the early 1990s so I was involved extensively in the development of the interim flow recommendations in the early 1990s, (pause) the conception of the Grand Canyon Protection Act, the discussions that went on behind the scenes that ultimately led to the creation of the adaptive management program. I was one of a group of probably five people who originally thought of the idea of controlled floods, and worked extensively in the early 1990s to get that implemented. Once the adaptive management program was created and GCMRC was created, and after the first flood was, occurred, I actually had more mod--more limited involvement. I would occasionally, I mean, I knew what was going on, my grad students (pause) I mean I've been involved in lots of ways and continued to write papers. And so, I had probably a reduced involvement as somebody who was, um, part of the academic, the funded academic group, until I became Chief. Um, yeah.

Paul Hirt: 00:05:48 When you were, I forgot my question. I had a question right in my mind and it, and it just slipped out the window. So we'll just go to question number two then.

Jack Schmidt: 00:05:58 That happens to me all the time.

Paul Hirt: 00:05:59 Yeah (laughter). Um, so, oh I was going to ask you when you came to Utah State University for the first time.

Jack Schmidt: 00:06:05 In, uh, September of 1991.

Paul Hirt: 00:06:08 Ninety-one.

Jack Schmidt: 00:06:09 Yeah.

Paul Hirt: 00:06:09 And, were you doing research along the river in the Canyon when the floods of, I think that was 1993, there were some large floods that came

through. Is that about the time that you started thinking that we should maybe create some artificial floods because of your observation of the effects of some of those large El Niño-type flood events?

- Jack Schmidt: 00:06:34 No, that, that's not really how it worked. Um, so (pause) God, this is so hard to tell this the, oh, it's such an involved--give me like two or three, I'm tempted to just tell you the historical story from the start.
- Paul Hirt: 00:06:55 All right. Well, the next question was, which of the three main components of the program were you mostly involved in, that scientific research would be, and then policy and management as the second component, and social and institutional engagement, like stake represent--representing stakeholders as the third. Did you do all three?
- Jack Schmidt: 00:07:15 Certainly the first two all the time. Um (long pause) let me just try and tell you my story.
- Paul Hirt: 00:07:29 Yeah, yeah. Yeah.
- Jack Schmidt: 00:07:37 You know, the program has evolved. When the program, um, I gave a, I gave a talk this--in Flagstaff just last month on sort of the history of scientific ideas in Grand Canyon and how they've evolved, and what there was that research foc--
- Paul Hirt: 00:07:55 Was that written out?
- Jack Schmidt: 00:07:56 No, but I can give you the PowerPoint slides.
- Paul Hirt: 00:07:58 That'd be great.
- Jack Schmidt: 00:07:59 Um, so if you look back at the 1970s and you look at the inception of GCES, it was focused on the effects of hydropower generation on the downstream environment. Um, and the lawsuit that created GCES was all about what's going to be the effect of bigger fluctuations. You know, and then it morphed into what are the large-scale operational effects of the dam.
- Jack Schmidt: 00:08:45 The most notable incident that I remember from going, well, I was just a guy who had gone back later in life to get a PhD. I was going to do a dissertation in Montana and I wanted to go back home to Montana after I got my dissertation done, and through a set of connections, an influential fellow in the USGS, and friend of mine, when I said to him, well are there any other dissertation topics you can think that I might want to work on? And he said, well, I think we can get you and, we could get you involved in this brand-new program that the USGS is going to get involved in, in Grand Canyon. And um,

Paul Hirt: 00:09:28 Was that before the GCMRC? This is in 1990?

Jack Schmidt: 00:09:30 No, this is way-- this is, uh, this is a decade before.

Paul Hirt: 00:09:35 OK.

Jack Schmidt: 00:09:36 And I never looked back. And that's what I did. You know, and at that point in the program in the early 1980s when GCES was created, you basically had this, um, unwanted irrelevant fish biologist who they sent down, who they let go to Flagstaff to go run something that Reclamation considered harmless.

Paul Hirt: 00:10:07 Was this Duncan Patten?

Jack Schmidt: 00:10:08 No, no. Wegner.

Paul Hirt: 00:10:09 Oh, Dave Wegner.

Jack Schmidt: 00:10:11 Yeah, of course. I mean--

Paul Hirt: 00:10:13 He was a fish biologist.

Jack Schmidt: 00:10:14 Yeah. And meanwhile, because all of that would be harmless, and stuff that really mattered, like modeling sediment transport or something, was going to be done by the USGS in the old traditional alliance between Reclamation and USGS that has been part of those agencies' history for a century. And it's a testament to the fact that Reclamation thought every, this was all pretty irrelevant by the fact that they would let somebody go to Flagstaff and create an office.

Jack Schmidt: 00:10:51 Little did they know what would happen. So to placate the um (pause) environmental interests, there were nominal questions listed, like what will be the long-term fate of sandbars. But, and so I showed up at the USGS and they said, well, we don't know what you would do, but here's some questions we're supposed to answer. And so I said, "Okay, I'll work on the sandbar question." I, after I looked around Grand Canyon, I (pause) wrote a grant proposal, submitted it to Wegner, Wegner said he would fund it. Then the USGS said, "Well, if you're going to be funded to work on this, then you'll work for us." So I, as a graduate student out of Johns Hopkins, ended up saying, "Okay, I'll do my dissertation through the USGS," not because they cared, I mean, just because they demanded it. And so I did my dissertation as a hydrologist for the USGS as a graduate student completing this dissertation. And I had, um, and there was a USGS scientist who was nominally my boss. And we were, I mean, she administered it. And we did, there's all sorts of, you know, we wouldn't get out of here if I started telling you (laughter).

Paul Hirt: 00:12:34 Was that all in Flagstaff?

Jack Schmidt: 00:12:36 Ironically, when I headed back to Arizona to start that, I assumed I'd be living in Flagstaff. But the state office of the USGS was in Tucson. And so I was told that I was living in Tucson. Which is something about sort of the control and sensitivity of these things. But we're, so, with that woman I'm out on the river one time and what was distinctive about it, is that we had the great 1983 floods. And then we hit really high releases in 1984 and 1985 and (pause) I was down on a U—on somebody else's USGS trip, just helping. And I [remember] making some comment after a couple of days about our need to study what this 45,000 cubic foot per second flow was doing to the river. And this person dressed me down. And in no uncertain terms, she said to me, we will not study this. We have a responsibility to study what is the effect of increasing the range of power peaking from a high, high releases of 31,000 to high releases of 33,500 cfs. And that's what we'll study. So--

Paul Hirt: 00:14:04 Why do you think she was that rigid about the parameters of the study--

Jack Schmidt: 00:14:08 Because that was, that was what Reclamation said. I mean, so it's a reminder that the focus was on hydropeaking and the high flows of the eighties were, um, not understood--well, were viewed as a, um, an anomaly and not, and really just an impediment to study what needed to be studied. That's how much the issue has moved over time. And, so, I mean, I did my thing in the, in the midst of that in late 1985 and early 1986. Reclamation had to schedule a special period of hydropeaking so that we could measure what its effects were. And they didn't want to hydropeak. They didn't want to (pause) they didn't want to hydropeak because they had so much water they wanted to get out of the reservoir, and they had so much snow in the mountains. And they scheduled this four-month period and we measured it and studied it. And in fact, they bailed three and a half months into the study because it was snowing again and they needed to abandon it. So the important thing is that those studies went on explicitly to study the effects of hydropeaking and the issue was too much water and it completely changed the operations. And, but it's a focus that everything was about hydropeaking. Of course, the other goofiness, it was about how do we preserve a trout fishery? You know, it was, you know, there's all, you know, and oh, "hydropeaking must be bad for trout because trout spawning is adversely affected when the redds [spawning nest with eggs] are dried every--" So this complete hodgepodge of different values. So, anyway, it was the National Research Council, well, so I, like other scientists at that time, although we were increasingly aware of what had the floods done, there was this drive that we're focused on hydropeaking.

Jack Schmidt: 00:17:04 And so there was a drive that we looked at and understood our science in the context of, what would limiting hydropeaking do to make for less

erosion. And there were lots of studies done by lots of people that sort of looked at, at those issues. It took some external reviewers from the National Research Council to point out that the issues of erosion and maintaining sandbars can't just be about limiting hydropeaking, you've got to also rebuild those deposits. And I mean my research contributed, you know, um (pause)-- Let's stop for a minute. This is the problem with Mesa [a dog in the recording area]. She's just completely ramped. Let's just take a quick second. I'm going to take her...

Paul Hirt: 00:18:05 [Speaking to Jennifer Sweeney] You want to hit pause?

Jennifer Sweeney: 00:18:05 Okay.

Pause in recording

Paul Hirt: 00:18:06 Do you remember where you were?

Jack Schmidt: 00:18:08 Um, floods.

Paul Hirt: 00:18:10 Okay.

Jack Schmidt: 00:18:10 So the National Research Council observed that—um, reminded us all that any geologic deposit and its status at any time is both the result of the history of erosion but also the history of deposition, and that river deposits do have to go underwater at some time if they're going to ever be rebuilt. And in the early nineties, the, the innovative discussions were held in Duncan's offices amongst some key people. And, um, those people were Ned Andrews of the USGS, Jim Smith of the USGS, Dick Marzolf of the USGS, uh, Dave Rubin of the USGS, and myself. And I would say that probably at the beginning, Rubin and I were the most skeptical and I would say the, Andrews and Smith and Marzolf were more, um, strongly advocating for floods from the get-go. And, um, so I'm always careful to say I'm lucky enough to be part of a group of people who conceived of this, and nobody, and no one person ever dreams these things up. I'm not going to go through the history of all that went on in the early nineties. Are you familiar? There's a book called *The Controlled Flood in Grand Canyon* that is an AGU [American Geophysical Union] monograph that is Robert H. Webb. It's Webb, Schmidt and Valdez, I think, I'm not sure. It's something like that. Published in 1999. It's an AGU monograph. I mean, it's certainly one of the seminal publications of the controlled flood in Grand Canyon. It's certainly one of the seminal publications of the program.

Jack Schmidt: 00:20:45 And, um (pause) I wrote a chapter in that book called "The History of the Controlled Flood," you know, how it came to be. And everybody's a coauthor, including Wegner. And so rather than walk through all of that, I mean, that's published and that's gone through peer review. But

what's important there is, is that, you know, I tell the story. That's an idea that came out of scientists. And the guys at the USGS in the early nineties would propose that every year, uh, Larry Stevens was very much against the idea of the flood. Dave Wegner was very much against the idea of the flood and they fought it behind the scenes relentlessly every year.

- Paul Hirt: 00:21:40 Is that because they assumed that floods would only cause erosion and not deposition, do you think?
- Jack Schmidt: 00:21:45 It was a mix of, of well-intentioned scientific reasons and, p--who was in political control. And, when it was proposed as a USGS-led science effort, Wegner fought hard against it. And so we were almo--and, we would used to, in the early nineties, we would sort of year after year, we would sort of conceive of who was going to do what. And so, um--
- Paul Hirt: 00:22:24 And the funding at that time was coming from where?
- Jack Schmidt: 00:22:28 It was helter-skelter.
- Paul Hirt: 00:22:30 OK.
- Jack Schmidt: 00:22:31 USGS was investing money. Some of, I mean I, in, in the late 1980s, I led two winter research trips to measure sandbar erosion in the late eighties, funded on the backs of tuition from kids at Middlebury. Because Wegner wouldn't give me a dime. Because you know, it's this sad thing about Grand Canyon. I mean, everybody fights for the money. The agencies all want to be in control. You know, there's a difficulty of who's going to be, just who, political control is just the big thing. Whatever the case, I think that I write about that in a more politically acceptable way, you know, in this article that I wrote. But the reality is after two or three years of failed efforts to get the flood implemented, because you had to line up all the politics and all that, finally enough people thought it was their idea. And how do you get anything done in the world? You've got to convince other people that it's their idea. And if you go around now, I could tell you NGO [non-governmental organization] people who think they dreamed up the flood and different people in agencies, who used to run agencies, for all I know they think they dreamed up the flood, and that's all fine.
- Paul Hirt: 00:23:59 And that's... (unintelligible, both talking at the same time)
- Jack Schmidt: 00:24:00 But we're on, we're on record that, that flood idea arose probably in '92 or something. And it took us four years to get that implemented. And, you know, and it occurred in '96.
- Paul Hirt: 00:24:13 So that was the first, quote unquote, "high flow event"?

Jack Schmidt: 00:24:16 Yes. Which is just administrative gobbledygook. It's a controlled flood. But for-- The one other thing that just in the past that's not written about, I should say, is that in the late 1980s, one of those win--on the first winter trip when we were down there after the high flows of the eighties, we'd gone into high hydropeaking in the late eighties, I mean I couldn't get any money out of Reclamation to work there any more so I would go there in the winter because I still cared about it. And, there was lots of erosion going on. And so, one night sitting at Eminence Break camp in Marble Canyon after days of, you know, a week of measuring this stuff, we got, sitting around the fire, we got worked up and so we sort of conceived of and wrote in my field book, the "Beach Bill," we called it, to protect the beaches of Grand Canyon. And that was me and my students: Dave Rubin, Johnnie Moore from University of Montana, Tom Moody, uh, Dan Dierker, both river guides. And we sort of collectively wrote this thing.

Paul Hirt: 00:25:53 How long, when was that (both talking simultaneously)?

Jack Schmidt: 00:25:55 That was like, that would have been in, probably, January of '89.

Paul Hirt: 00:26:00 And for how long had you known that the dam operations were leading to the loss, the erosion and loss of beaches? Was that just a few years?

Jack Schmidt: 00:26:11 No, no, no. No, no, no. That's a longer history. I mean, the first scientific article that, the first scientific article that described that erosion was published in 1974.

Paul Hirt: 00:26:24 Wow.

Jack Schmidt: 00:26:25 So the perception that hydropeaking played a role in that erosion went way back. The issue is now very nuanced in that we now understand that hydropeaking plays some role, but it's also clear, you know, it's bigger issues of sediment mass balance, the absence of supply, things like that. But you, just to go back, just because these pieces of the administrative history are important, we came out of that, and I got back to my office at Middlebury, got on the phone to Ed Norton, the head of the Grand Canyon Trust. He told me to get lost, that they didn't need any legislation, that they were going to work with Reclamation to get an environmental impact statement produced. So I don't take no for an answer. So then I contacted Tom Jensen, who was the Chief of Staff for the Senate Natural Resources Committee, and said, "You know, this is, uh, this is what's needed." He was sympathetic. I wrote him a letter, typed up the whole thing from my field books, corresponded with him, and then worked all of that spring to write a report, you know, Middlebury College Department of Geology Series Number One or something, describing all that. And then, um, it turned out, ironically that Bill--Senator Bill Bradley was the convocation speaker at Middlebury that spring. So we all waited around--

Paul Hirt: 00:28:13 Was he on the Natural Resources Committee?

Jack Schmidt: 00:28:16 He was the Chair of it—

Paul Hirt: 00:28:17 He was the chairman?

Jack Schmidt: 00:28:18 He was (unintelligible—both speaking) Jensen's boss. And Jensen of course, goes on to become, he leaves the Senate and becomes head of Grand Canyon Trust after. But, so anyway, and this was all led out of, by Dan Beard and Tom Jensen to get the Grand Canyon Protection Act. Anyway, so in May at Middlebury, we had the glossy report and we, and the pre--and the university, college let us do this. And I had three students, you know, with me and we stood behind the bleachers, and Bradley gets out of the limo coming down from the Burlington airport and, you know, we all shake hands and he, you know, Bill Bradley's a big imposing basketball player. And at some point, you know, I just, you know, everybody sort of stammers for a minute. And then I sort of kick the kid next to me and, "Well, Senator Bradley, we know you're a great friend of the environment and we've been working in the Grand Canyon, and we wanted to share with you this report in which we describe the sandbar erosion in Grand Canyon. We'd like you to be--" And so then we said a few things and Bradley said, you know, some nice things, and on we went. And little did I know that within the month he flew out to Grand Canyon to do a field review with Grand Canyon Trust. And he got off the plane with our report having been circled and said, "What's going on?" And I have somewhere in my files a letter of thank you from Tom Jensen telling me, you know, I, when the Grand Canyon Protection Act was passed, knowing that I played a role in getting that going. Now it's like everything else. Everybody else claims their own credit for it. But I know that in the late eighties, I kept the idea alive. And that's my style. My style is that I call it the way I see it, but I just don't write a science report. I go somewhere with it. Anyway. So that's just that piece of that story.

Jack Schmidt: 00:30:40 So, so, um (pause) the other thing that went on in the mid-1990s as the adaptive management program was being created was that (pause) those of us who were senior scientists at that time began to realize that the program was pretty aimless and trying to be all things to all people. So we got together and wrote what is surely one of the most influential papers that guides the program, called "Science and Values in the Grand Canyon" or "Science and Values in Restoring the Grand Canyon," that was published in *BioScience* in 1998. And, you know, that was, it's Schmidt et al., but it's Schmidt and Webb and Valdez and Marzolf and Stevens. And it basically says, we can give you any kind of Colorado River in Grand Canyon that you want. And the problem isn't science, you just have to decide what you want. And we don't think you know what you want. And, that paper is still read, I mean, that paper is read around the country by classes still, and that paper is read by people who

understand the history of these issues ever since. Um (pause) so in some ways--

- Paul Hirt: 00:32:36 Can I go back to that quote for a second?
- Jack Schmidt: 00:32:38 Yeah.
- Paul Hirt: 00:32:39 Because I had, I read that in the memo that you sent me, that you wrote in 2014 as you were leaving [as chief of GCMRC], and I was struck by that quote. I think it's really, uh, profound, and I was going to ask you if you would elaborate a little bit on that. When you were there in the early years, what did people want from a program and how did that change over time? Did we ever get clarity? Or was it always a muddle? Did it change as values or policies changed? Well, how do you see the evolution of that whole challenge?
- Jack Schmidt: 00:33:21 You know, it's interesting when I teach courses in this stuff, I often say that, um, when you tell the history of water development in the West and you tell the story about how in the 1950s the key decisions about building dams and diversions were made by the technical elite. Technical elite of engineers, lawyers, civic boosters, corporate agriculture. Isn't this a much better world, that now everybody's at the table. And then you turn it on students and say, "Well, is it really a better world? Or have we just made the world infinitely more muddled?" At the ti--in, in the (pause) Wegner had a clear directive that I think came out of administrative guidance, and maybe even out of court rulings. I'm not sure. He surely knows this stuff by heart. So the issues were sandbars, trout, endangered fish, maybe riparian vegetation. I think those are the four, or no, or maybe it's recreation. It's uh, you know, maybe rip—maybe it's four, maybe it's five. It's damn simple. Now. There was, now, you know, probably the GCES Phase One taught us more about what we didn't know than what we knew.
- Jack Schmidt: 00:35:00 Well, whatever the case, we were forced to make little matrices where you had some kind of operational decision, some environmental outcome, and you had pluses or minuses or you don't know. And I think that that's where the perception that not everything benefited by the same operational decision started to, like, become clear to people. But it wasn't until that *BioScience* article that we made a huge table and systematically plugged pluses and minuses, and then it became clear there was no operational scheme that benefited everything. And if there was no operational scheme that benefited everything, then you'd darn well better know what you wanted.
- Jack Schmidt: 00:35:52 And so then an idea that's in that article that I get credit for because I'm the senior author and I've got a lot of mileage at it, but the idea was Dick Marzolf's, not mine, was he coined the terms "relict resources" and "artifact resources." Relicts of the past and artifacts of dams. And Dick

thought this up. And then I, you know we all jumped--you know how we all work in academia, right? I've gotten so much mileage out of this and so many slides and so many talks, I can't even keep track of them, in which you--so we had those ideas, right? That you know folks, some of the environmental resources down there are the relicts of the past and other resources are artifacts of dams, the most obvious being trout, recreational trout fishing as an artifact of the dam. So then, I will confess, um, that I got quite frust--when the adaptive management program was first created, I got, from afar, I got quite frustrated by it because it just instantly wanted to make everything more complicated. And so then, you have all these stakeholders, and all of these stakeholders have their pet resources they care about. And then I--(at 00:37:31 Schmidt speaks briefly and very quietly to his dog in the interview room, then laughs at the interruption). There's a focus in these adaptive management programs and these stakeholder processes in people getting along. And I used to flippantly criticize the program because I would cynically say that, you know, it became this whole trust-building exercise, and fall backwards into each other's arms to learn to trust the other person, and all this stuff that goes on, and nobody would make hard-nosed decisions. And so what happened was a set of obje--and then let's get all the stakeholders to write objectives for the program and they, so this became cannon fodder for me giving talks because I would show a slide in which all these objectives would be listed, all written by the stakeholders and there was sixteen or twenty of them or something, I don't know. And then the next slide I would just have the same list except, you know, in one color would be relicts of the past and the other color would be artifacts of the dam. And under artifacts of the dam would be a recreational trout fishery and maximum hydropower production and secure water supply, and, and then it was just like, and then you know well folks, you can't do this, this is not a hard problem. We can do really sophisticated science. But it isn't actually that hard a problem. For starters, we can't do all this. We need to make a tougher decision--

- Paul Hirt: 00:39:13 Because you're saying basically there are tradeoffs--(both talking at the same time)
- Jack Schmidt: 00:39:15 You, you can't have it all--
- Paul Hirt: 00:39:16 Somebody's going to win, somebody's going to lose.
- Jack Schmidt: 00:39:19 Yeah. And what, and what, yeah. And so, so where I began to, so I became, I guess, a critiquer of the program. Um, to go back--
- Paul Hirt: 00:39:35 Is that because you wanted them to start making trade-offs and making decisions, and it was taking too long to establish a collaborative--(both talking at the same time)

Jack Schmidt: 00:39:45 All I, all I, I don't--I mean I have, I have my personal biases of what I'd like planet earth to look like, but I don't get to choose how many (pause) billion people live on the earth's surface or how many hundred millions live in the United States. And I mean, you can't have this, you know, magical, natural paradise and have however many people we have, so trade-offs are going to have to be made. Um, I just felt like tough decisions weren't--there was tough thinking that was, we had made such progress in the early nineties to get to the idea of the controlled flood, and then we were losing it because everybody cared about just how they all got along. And--

Paul Hirt: 00:40:40 Which was delaying decisions like--(both talking at the same time) delaying the process.

Jack Schmidt: 00:40:42 No, I uh--I don't know. Yeah, government moves so slow. I don't know, I just, I just wasn't a big fan of that. But I would say that, you know, my experience and the experience, the early 1990s were a unique time. They were a unique time because, um, I flippantly sometimes refer to that as, those were the years when the traditional water managers and Reclamation lost control of the dam. And this small group of scientists, sitting in Duncan Patten's office, actually just sat around and dreamed up, oh, let's have interim operations. Let's reduce the range of fluctuations. And the political forces largely set up by Wegner pushed those things through, and Reclamation and the traditional stakeholders hated it. And so, by the time the adaptive management program was created in '96 or '97, um, it was like, we're doing this as a formal process. This is going to be formal. This is a Federal Advisory Committee. We're not going to have this tyranny or anarchy of scientists running the show.

Jack Schmidt: 00:42:18 And you know, if I sat in a room with Rick Gold who was the Commissioner then, you know, or the regional Director then, I mean, I don't think actually that it would be all th--I think everybody would sort of agree with that. So there was something, the adaptive management program transformed what some might call anarchy into a very formalized process. Others might say stultifying, others might say ossifying (laughs), you know, and so, you know, who am I to, who am I? I mean this is what happens with any government agency. EPA was a wonderful place the first couple--you know, then it becomes a more, a different kind of a place. The Office of Surface Mining, I had worked the first years it was organized in the Carter Administration. It becomes a much more re--I mean this is just what happens. So the fact that that's what happened when the adaptive management program was formalized, is not, um (pause) I don't know that that's good or bad. It's just what happens. (Long pause)

Jack Schmidt: 00:43:44 In the legislation that--in the record of decision of the EIS [Environmental Impact Statement], what was created was a formal

adapt--it was formally called an adaptive management program. After the first hiccup, the first head of, Chief of GCMRC, a guy named Dave Garrett, who wasn't there very long before he to leave for health problems.

- Paul Hirt: 00:44:16 We're meeting him in August and at his home in Colorado.
- Jack Schmidt: 00:44:19 Send him my regards--yeah, he runs a winery.
- Paul Hirt: 00:44:22 Really?
- Jack Schmidt: 00:44:22 Yeah. If you don't--you might do it, stop and go here [in Logan, Utah]. But for heaven sakes, don't make the same mistake in there, make sure you tell your families you need to spend two full days talking with Dave on his back deck, having a glass of rosé or whatever. [PH: Alright] Yeah, don't waste that trip. Anyway. But then the, after Dave had health problems and had to leave, the second Chief, Barry Gold, was a real disciple of adaptive management. And then they brought in, you know, the international expert on adaptive management, what could possibly be wrong with that? And so they bring in Carl [Walters]. And, you know, Carl's a pretty strong-headed, my way or the highway kind of guy, doesn't take guff from anybody, and he's a real straight shooter. He's internationally respected, written books. I mean, he's a--he's a force. And he had a vision of how everything was going to work. And that vision of how it was going to work, was that they could create models of all these trade-offs. And then if you made everything transparent, of course stakeholders are going to make the informed decision and you can start to evaluate the trade-offs, and you can start to evaluate whether you really need to know X or Y or Z. And so, they went down the path of building a big ecosystem model. And, um, you know, and the metaphor I use is that, you know, so they invited a whole bunch of experts in every different field and they locked them in a room, and Carl and his crew would say, "Okay, well what's this relationship between flow and fish populations or sandbars or something."
- Jack Schmidt: 00:46:54 And if the scientists would say, "Well, we can't tell you that one," then they'd say, "Well, okay, well, you know, we're lock, no, we're locking you in. I don't care how long it takes you, but you're not getting out of the room. You're not getting another hamburger until you tell me whether it's going up or down." And so, you know, and so out of that, you know, it's just like, we're not going to just let scientists just forever, you know, study things, like, damn it! we're going to get something out of you. And so they did it and they built an ecosystem model, and you could run trade-offs and do whatever. And as soon as that came out, the stakeholders, you know, immediately ignored it. And it had no impact on decision making.
- Paul Hirt: 00:47:41 Why, why did they ignore it?

Jack Schmidt: 00:47:45 Because you can't, you cannot practice adaptive management in Grand Canyon. In the literature, and I wrote about it in one of those memos I sent you, in the literature, the circumstances in Grand Canyon are at best described literally as "adaptive management light," which means you're trying to, you're either trying to practice adaptive management or you're pretending to practice adaptive management in a context in which there are major societal actions that cannot be experimentally adjusted.

Jack Schmidt: 00:48:33 The most fundamental in Grand Canyon is that you must pass a lar--an explicit amount of water from the Upper Basin to the Lower Basin, from Lake Powell to Lake Mead. And you're-- you can't tweak that. And there are large external forces relative to water supply that, um, must be acknowledged and respected and cannot be manipulated. And there are large institutional forces that control those decisions, and those institutional forces of water supply are never going to let go of their control and give it to the issues of Grand Canyon. And so you're never going to be able to practice adaptive management.

Paul Hirt: 00:49:42 Because that requires experimental research and there are certain experiments that are out of the realm of possibility, you're saying.

Jack Schmidt: 00:49:49 And not only that, you can't ada--you can't, you cannot (pause) you cannot maintain a fixed experimental program, you know, for ten or twenty years because the world changes. We go into a protracted drought, we have five years of, of wet years in the eight--and everything goes right out the window. Yeah. But anyway, that's, yeah. So that went on and then, the tension, just to finish the thought, then the um-- There was a focus in adaptive management, GCMRC as an agency was viewed as, its objective was to be a small contracting agency that led contracts for academics and consultants to do applied research, that the role of GCMRC was to write guidance documents in planning and adaptive management. That was certainly the paradigm of Gold. The whole GCMRC gets absorbed into the USGS, there is intrigue with all of these things and long stories. And, and then all the way through my predecessor, um, that was the focus of the agency. That's the focus of GCMRC. And (pause) and then I came in and said, well, that's great, but we're not going in that direction anymore. We're going in this direction. And then--

Paul Hirt: 00:51:56 And that new direction was--?

Jack Schmidt: 00:52:05 Um (pause) I guess twofold, I'd said, the science questions that GCMRC is asking, that are coming from the stakeholders, are myopic, unanswerable, complex, and intractable. And, um, I viewed—I mean, I would go to occasional meetings of GCMRC, annual reporting meetings of the adaptive management program in the years before I became Chief, and people would come up to me in the back of the room and

say, you know, "Jack, it's great to see you. Yeah. Isn't this just crazy what it's become?" And it was just a demoralized (pause) it was just a demoralized operation, which people said, and--

- Paul Hirt: 00:53:03 What was the source of that demoralization?
- Jack Schmidt: 00:53:06 Nobody knew what the questions were. Nobody knew what they were supposed to be working on. Nobody knew where they were going.
- Paul Hirt: 00:53:13 So there was no direction. There was just (unintelligible) research (both talking at the same time).
- Jack Schmidt: 00:53:14 (Unintelligible.) No, no, no. This is the adaptive management program. I'm not--the science (unintelligible), I'm not talking about, I'm talking about the program itself. Because, so I just went in and said we can't articulate--that's not how it can work. The way it has to work is that the job of GCMRC is to rearticulate science questions as big, simple questions, so that every stakeholder, if asked, "What are you studying and why do you exist?" Every stakeholder will tell you basically the same thing because everybody understands it. And um, so--
- Paul Hirt: 00:54:05 What would be an example of that kind of simple direct kind of question?
- Jack Schmidt: 00:54:10 Can we maintain--so, I used to put them up in all my talks, it was like, this program is about answering these three questions or these two questions. This is all we're trying to do. If it's not relentlessly fixed on this, where do, we've got to reth--we've got to ask ourselves why did we do this? Yeah, the two fundamental questions for Grand Canyon are, um, is it, I mean every one is a nuanced question, but the first one is, "is it possible—" no, "What is the maximum size of sandbars that can be maintained with the existing tremendous deficit in sand supply and given the operational rules that exist, and is that size acceptable (pause) to society?" And the other question is something like (pause) "What is the maximum population of the endangered humpback chub that can be maintained given the fact that soc-- that we have made a societal decision to also maintain a recreational trout fishery when those trout eat the endangered fish?" Now there are, the fish one is much more nuanced now. Now there's razorback suckers along with humpback chub. Now it's brown trout rather than rainbow trout. Now, it might be that [dam] operations don't make a hill of beans of difference, but it's just that. And, um--you work with the administration and, you get guidance. Well, what you do is you sort of clue the admini--high administration that like, "we'd like to receive a memo that says this." And they say, "Well, would you like to share with us any paragraphs that you'd like to, wouldn't mind seeing show up in a letter on this?," you know, and that's the game you play. But, um, we would get memos from the Assistant Secretary that said, "Well, we know you have a lot of

things to work on, but just to be clear, it's sand, fish, fish, fish. That's what you're working on." So that effort was simplified, those would come in the time I was there.

Paul Hirt: 00:57:16

In the, so in the 2-- like 2011 to 2014?

Jack Schmidt: 00:57:19

Yeah. And um, so anyway, so one thing is make this question, make it simple, make it so everyone can articulate it, and that the job of GCMRC is to listen in a sensitive and caring and careful way to the expression of stakeholders, what they're saying are their concerns, and then to be able to be clear enough to tell, talk back to a stakeholder and say, "Okay, I hear your concern and this is the scientific question that I think you're asking." Or to say back to a stakeholder, "Well, what you're asking is a really hard and nuanced question." And anytime you're trying to answer a hard and nuanced question in science, then it will cost you much, much more to answer it. It's just how it works. And you need to understand, you need to ask yourself whether you really need that question answered. Because what you're, what it would, the resources it would take to answer that are probably not reasonable. Or to say to a stakeholder, "That's a great question. That's exactly tractable." Or to say, "I don't think that's a question you really want to ask. Here's a question and this is a tractable one." Or perhaps even just as important it is to say, "I hear your concern, but we can't tell you any more than we have told you already. You need to make a decision." We're past the point--because what happens in these programs is that--(pause) you know, I keep going in these segues.

Jack Schmidt: 00:59:30

Okay, so one big, one big thing is the resources that people care about in Grand Canyon, they're artifacts or relicts, right? Another big categorization is the categorization, the stakeholders. The stakeholders, some of the stakeholders represent institutions and perspectives for whom their agendas and goals are met if radical and big change occurs in operating rules. And the other group is those institutions and groups who benefit because the status quo is maintained. And so when you have a program that has two fundamental groups and the groups for whom this, if the status quo is maintained, they benefit, happen to also be the most politically powerful people sitting around the table, and those are the people who are paid real salaries to sit there at the table. Right? Then what's the game you play? "Well, I'm not convinced. I think we need to study that some more. Here's another alternative that might be plausible. We really should study this other possibility before we take an action." And you endlessly delay decisions because you can always come up with some other question or some other nuance. And the problem in Grand Canyon is that, um, there's always some young hungry academic or some young hungry agency person who will say, "You bet, I'll go--I'll take that on."

Paul Hirt: 01:01:26

Yeah. More research.

Jack Schmidt: 01:01:29 I have colleagues, I mean, I'm an old guy, I have colleagues who are my ilk who would look at me in years past and say, "Shoot, I can't believe you still work in Grand Canyon. You figured it out. You know what the solutions are. There's not a societal will to solve the problems. Why do you take their money? Can't you--are you incapable of coming up with anything else to work on?" You know, just have enough nerve to walk away and go study in something else. And one of the dilemmas in Grand Canyon is that the game of stakeholders asking ever more nuanced, silly questions is perpetuated. And in a world in which research money is hard to come by or just maintaining GCMRC as an institution, somebody says, "Oh, I'll take that question on." So anyway, this whole, so my agenda in GC--that's one thing was big questions.

Jack Schmidt: 01:02:34 And then, um, the other one was internal to GCMRC. I said, um, GCMRC cannot be an agency staffed by people who write contracts. That if that's what you do--you can't manage excellent science unless you are yourself an excellent scientist. And so, I remember one of my former students who is down there [GCMRC] now, when he was hired down there, I was a prof, he left here [Utah State University] to go down there and he was the finalist for the job. And at the time, tum, he biggest concern within GCMRC about whether to hire that guy is they were concerned that he might be too much of a scientist, and he might want to actually do science. And he needed to understand that, no, he's coming down to run a program and write contracts.

Paul Hirt: 01:03:38 Contracts for research.

Jack Schmidt: 01:03:41 Yeah. For someone else to do it. Yeah. And so I just said, we're not doing that. And so the other big change that I made at GCMRC was saying no, we're going to convert all of these people to um, what are called RGE scientists. They're basically within the USGS you're a Research Grade Evaluation scientist. I would not, as Chief, control whether you get a promotion. You are evaluated for promotion by an external, national committee of your peers and they could care less what you do in your day-to-day work. You're either producing at the rate at which you would justify tenure or promotion in an academic arena, or you're not. And so I took it out of my hands and then I just said, "Well, you're on your own now. You better produce." And then the other one is that, you know, in GCMR-- so there are multiple people who come up to me and thank me for having, in their words, saved their career, put them on a path of research.

Paul Hirt: 01:04:53 At GCMRC?

Jack Schmidt: 01:04:53 At GCMRC. And the other one was that I happened to be Chief at a time of financial relative abundance. Anybody looks good in a time--right?--a rising tide floats all boats. So my job was a hell of a lot easier than the job now. But because of that I was able to hire a number of postdocs

because that was based on the philo--I had, my philosophy was, it's hard to reinf-- you know, I was trying to inspire people. I couldn't inspire everybody. You can only pull that off--so if they're federal employees, you can't fire them, you know, all that sort of stuff. And so in an effort to inspire the place, I filled it with postdocs.

- Paul Hirt: 01:05:50 Young, hungry--
- Jack Schmidt: 01:05:52 And it was just like, okay, get some people, get some people, um, swimming fast and then maybe other people will swim fast. And, anyway, so those are the two-- I mean those are the two big changes that I'm proud of. It was easier because there was money available to do it. Yeah.
- Paul Hirt: 01:06:17 So it sounds to me a little bit like, um, you're very aware of and concerned about the tension between administrators needing to make important decisions about dam operations, trade-offs between resources, while at the same time attempting to be collaborative and democratic and participatory, that there's a tension between those two, and that you feel that maybe we need to bite the bullet a little more often, be less, like, conflict averse and be more willing to just say, "Okay, this is what we want. These are the decisions we're going to make," and, not like sort of endlessly worry about all stakeholders being represented and satisfied. Is that--
- Jack Schmidt: 01:07:10 To some ex--yes. To some extent, yes. Um (long pause).
- Paul Hirt: 01:07:24 It's a universal challenge, and every agency--
- Jack Schmidt: 01:07:27 Oh, oh, yeah, I'm trying to--(pause) There are big realiza--um (pause) There are big realizations that I came to in that position.
- Jack Schmidt: 01:07:47 One of them was the realization that Grand Canyon as a segment of the river is trapped. It is prisoner of the fact that if you think of the big map of the Colorado River watershed, you essentially have, everything in the Upper Basin, the land where the water comes from, and then everything below Hoover is the land where the water goes, the land where the water's used. And connecting those two is the bottleneck. Every drop of water from the land where the water comes from to the land where the water is used must pass through Grand Canyon. And so, your management options in Grand Canyon are, are tiny.
- Paul Hirt: 01:08:49 Very constrained.
- Jack Schmidt: 01:08:50 Tiny. And that all became clear to me in the development of the Long-Term Experimental Management Program [LTEMP], the EIS, the LTEMP EIS. When well-intentioned personal friends of mine, who I like and

remain friends with today and who were my bosses in Washington, DC, right?, just completely took off the table every fundamental decision that would really affect the place. You're not going to mess with the [1922 Colorado River] Compact. You're not going to mess, you know, with any Law of the River administrative agreements, you're not going to touch the 2007 Interim Shortage Guidelines. You're not, you know, and so, every water supply--every water supply agreement that is in place is untouchable. Then for good measure, they said, and you're not going to touch sediment augmentation. We would never get that. You're not going to touch temperature manipulation. You would never achieve that. Now make the best of it. (Laughter) So what happened? So--

Paul Hirt: 01:10:08 But they'd let you let you mess with hydropower generation?

Jack Schmidt: 01:10:11 Of course, so that is—so, so the irony is that in the long arc of this issue, this issue started with a focus on hydropower because nobody understood it to be anything other than hydropower. We then came to realize, no, it's sediment supply, it's the lack of sediment supply. It's the absence of floods. It's the absence of rebuilding of the deposits. Hydropeaking is one part of it, but it's a small piece of a bigger, harder puzzle. But then it turns out that every other piece of the puzzle—water supply routing, sediment trapping in Lake Powell, temperature modification—are all off limits. And so the only whipping boy you're left with is hydropower is everybody's whipping boy. And so ironically, no one, no one who knew me would ever perceive me as an apologist for hydropower. And yet I actually believe that hydropower now always has to take, make the compromise because they're the easy fall guy for much bigger problems. And that's the crazy--so my big thing now, what I work on and work on with trying to do grants and writing articles and stuff is--and I've given these talks in lots of places in which I sort of talk about what are the big changes we're willing to make? What are the big changes we're not willing to make? The problem in Grand Canyon is we're stuck on hydropeaking. And so that's a problem. And so, I'm focused now in my work at trying to make sure that when the Interim Shortage Guidelines are reopened for renegotiation in 2020 the river and the river environment is on the table.¹ It is the, a clear piece of the conversation because the way things have worked over the last twenty years is every deal is cut amongst the water supply players.

Jack Schmidt: 01:12:46 And then after you cut all the deals, then you get on the phone to GCMRC and say, "Okay, we cut all the deals, now (both talking simultaneously) make the best of this, but you can't touch the deal we just cut."

¹ Because of extreme persistent drought and low reservoir levels the renegotiation of the 2007 Interim Guidelines was completed in 2019: the Drought Contingency Plan. It must be updated again by 2026.

Paul Hirt: 01:13:00 Yeah. So what do you think we want for the river and the river ecosystem?

Jack Schmidt: 01:13:06 Yeah, so that's a great-- (Both talking simultaneously) Yeah, I get, yeah OK. [PH: How would we get--]. Yeah, I get, yeah. Okay. So given that, given the fact that we're locked in right then, um, what do we want? (Long pause, tapping of pen on table.) Well, I still do think that different stakeholders want different things. I think the National Park Service just wants control, I'm not even sure they care what they want. They just want to feel like they're in control, and they're never going to be in control because it's the states' water managed by the national government to allocate for forty million people, and so they just want some say. So that's sort of--but they just are insulted by the fact that they manage the sides of the ditch in the bottleneck. It's clearly understandable how, the most important thing that the stakeholders almost universally agree on, is they can't allow any endangered species to blink out. Because that would bring compliance from, um, that would bring on court-ordered environmental compliance. So there is, so um--

Paul Hirt: 01:14:46 One more reduction of flexibility.

Jack Schmidt: 01:14:49 There's, that is myopically first among equals. So ironically you might've thought it was sand or something. It's the population of humpback chub, and now it's also potentially, you know, this population of razorback suckers. But it's ESA [Endangered Species Act] compliance species. That is head and shoulders above anything else. It's not about, it--well that's it. Then, I think it's arguable whether the next tier down is sandbars for camping or it's just whatever kind of a river ecosystem makes sure that those species don't blink out. But to me, what's not on that list is a natural, native river ecosystem. That's--nobody--

Paul Hirt: 01:16:01 Does that come automatically?

Jack Schmidt: 01:16:04 No, no, no. The irony is it doesn't come or--the Grand Canyon ecosystem is a fundamentally damaged, fundamentally, um-- screwed up artificial Disneyland ecosystem. And for me to say that after spending thirty years of my life there is tragic, and it is heartbreaking for me to say that. Um, but it's not a real river. You go to the Yampa River, if you want to see a real river. You go to Desolation and Gray Canyon if you want to see a real river. Grand Canyon is this fundamentally screwed up river ecosystem, which is still life's greatest recreational experience, where people's lives are transformed just because they go through what they perceive as death-defying rapids in the most awesome landscape on Earth and they're alone with their friends for seven or eighteen days and they do whatever screwy stuff goes on, on river, you know. And all of that, but it's, it's got a screwed up temperature and empty, empty eddies from sand, and riparian vegetation that doesn't look anything like what it should, and the whole

thing is screwed up. And I believe that in the eyes of most people, that's just fine. Just so, because ironically the humpback chub have figured out a life history in which they can exploit this one natural place, the Little Colorado River. If it--and as one GCMRC scientist said to me years ago, you know, it really--we can't really tell them this, but it really doesn't matter what we do with the dam. I mean, so long as the Little Colorado River is there and it's viable and all of that, it's going to be okay. Now the reality is the Little Colorado River is subject to lots of development pressures itself. What if the monsoons are failing? We don't have floods. There's a lot of bad things can happen there. But, um, so, so I, I honestly believe, I'm being expl--or particular with my words, whatever kind of a river ecosystem, however artificial it is, who cares just so long as these target populations of endangered species don't blink out.

- Paul Hirt: 01:19:03 And that's what you're saying is the current sort of core--(both talking simultaneously) objectives.
- Jack Schmidt: 01:19:05 I, that is the curr--I believe that is the consensus. Now--(pause)
- Paul Hirt: 01:19:12 And you'd like to see a much broader vision for river restoration. Do you think it's even possible?
- Jack Schmidt: 01:19:20 No, I don't think it's possible. No, I, I, I believe that the--(pause)
- Paul Hirt: 01:19:24 What should we want for the Colorado River? (both talking)
- Jack Schmidt: 01:19:31 No, no, uh-- Here's what I, I believe that that may be all that's possible in Grand Canyon. What I believe deep down inside is that we do the American public a disservice by not telling them how screwed up it is. I believe that--
- Paul Hirt: 01:19:51 Because they're given false hope, (both talking) or for some other reason?
- Jack Schmidt: 01:19:53 Exactly. No. Simply that. I believe that where we have made the mistake is that we failed to tell the American people, we failed to tell the citizens of Arizona, the Grand Canyon State, that, um, there was an irreversible cost to the construction of Glen Canyon Dam. And there's an irreversible cost to large scale water development in the Colorado River. And, um, and we're never going to get that back. And therefore, as we proceed into the future, we should be very careful about what new developments we make on the d--on the river. We should be very careful about which places we do want to protect. And that the disservice that we pay to the American public is that we pretend that Grand Canyon is restorable. And that that is, that is wrong. And that then what do we do now? We just absorb ten million dollars a year of a budget as the cost of doing business. And we never just say, "You know

what? This place is really completely artificial and screwed up now, and we're going to continue to make it the best we can.”

Paul Hirt: 01:21:24 Yeah, you're not saying we should just treat it as a sacrifice area--(both talking simultaneously)

Jack Schmidt: 01:21:27 No, we have a moral, we have a moral obligation. It's one of the greatest places on planet Earth, but we're also not going to decommission Glen Canyon dam. So--

Paul Hirt: 01:21:41 Never say never (laughs).

Jack Schmidt: 01:21:44 Well, that's a different topic. I mean, I've written that, I've written on that as well. But the point is, I don't, I think that we have fuzzy logic or fuzzy-headed thinking, whatever it is, and we don't talk about the real issues in front of us. And we just pretend this feel-good, we're going to make everything a little bit better, and we're going to spend this much of our budget to study how much the wind blows up and buries archeological sites on hillsides, and we're going to, you know, and stuff that's completely intractable. And that's crazy. No, I don't (pause) um, I would say that the brave new world of climate change and the brave new world of decreased runoff in the Colorado River system will force our, um, forces our hand. That's how I end my talks, is I show those graphs and I say, “Okay, so we've got to think big. We've got to think like maybe, it doesn't make sense to equalize the storage contents of Powell and Mead.” Maybe it makes sense that we ought to re-drill out the river diversion tunnels around Glen Canyon Dam so that, um, you know, we—(pause) that there's some--that maybe it's better to fully drain Powell and, and keep Mead full. But I will also recognize that one can make utterly rational and reasonable statements about why it makes more sense to keep Mead full, or Powell full and Mead empty. And I mean, well-intentioned, smart people make those arguments. And, and I'm not kidding, but we need to increase operational flexibility. So that's the other big, that's the other big enormous issue. (Lowers voice) This is so wandering. That's the o--this is the other big enormous issue that the adaptive management program and GCMRC are not doing now. They (pause) You know, the-- the signposts saying, you know, we've got a crisis coming are just all, they're all blazing, right? And, the Interim Shortage Guidelines are coming in 2020. I mean that, that, this is what I'm working on. I've got collaborators [who] are working on this now. And so instead-- so the stakeholders in the program sort of pushed GCMRC to develop an annual work plan that they're in now that's all about how to implement the LTEMP EIS when, you know, it's like, how do you ski? You ski through the slalom gates. As soon as you know you're past the gate, you're looking, where the hell is the next gate down the slope? And, you know, focusing the adaptive--the work plan on how to implement LTEMP is like focusing on the gate you just passed.

Jack Schmidt: 01:25:22 The next gate is climate change and decreased runoff, and changing water temperatures released from a much lower Lake Powell. And that's the big scepter(?), and the science questions that are going to be asked by, of GCMRC two years from now are going to be all about that brave new world. And the science program needs to be focused on answering those questions. And, um, that's--and that's all going to be about questions like, um, okay, we're now in the twentieth year of drought, um, maybe we want to selectively store all of our water in Mead to preserve Vegas's water quality. I'm just making things up, okay? If we do that, then the water released out of Powell is going to be really, really warm. If the water coming out of Powell is really, really warm, is that going to constitute a short-term, easily reversible temporary inconvenience to the ecosystem, or is it going to cause an irreversible tipping point that will change the ecosystem forever after, such that everything that we've done in the adaptive management program for the last twenty years is irrelevant?

Paul Hirt: 01:27:07 Would we get more of a river like it used to be?

Jack Schmidt: 01:27:10 Well, so the arguments you're going to get from different people, well, the answer is people will say to you, we don't know the answer to that. And so I would submit we need to, we need to get our asses in gear and be doing the science to figure this out. Because, um, we just, so we finally--so, I'll just take partial credit, you know, we all are--you know I'm not unique in figuring this out. And so we, working with three of my old staff, three people who work at GCMRC right now, they figured out the models. We got three GCMRC staff, me, and a fish biologist in the Upper Basin, and we get an article that's in review in *BioScience* that says how we make decisions about water storage will set the fate of all these river ecosystems and we better be thinking about that. And if we don't have the science ready to go, we better get-- because here's, here are the arguments: You might say the envi--the most environmentally oriented among us would say, "Oh no, warm water coming out of the Grand Canyon, that, that's just like it was in the old days. That's just the river of the 1950s. That's wonderful, that's what we want."

Paul Hirt: 01:28:42 With sediment in it.

Jack Schmidt: 01:28:43 And okay, and let's put sediment in it. They would say that's the most wonderful thing. That's what we want. And ironically, every fish biologist at GCMRC plus (pause) a whole bunch of other people in Flagstaff who, I don't need to make any more enemies on this tape, you know, are all, would all say no, no, the devil you know is much better than the devil you don't. We know that humpback chub are--the largest population of humpback chub on Earth is in Grand Canyon. And it might be the most screwed up ecosystem, but that screwed up ecosystem keeps the warm-water predators away from the humpback chub. And it would be worse if the river was warm, because then the river is not only

good for natives, it's good for non-natives, and the non-natives will eat the natives.

- Paul Hirt: 01:29:46 Non-natives being trout, or something else?
- Jack Schmidt: 01:29:51 No, the trout are cold water predators. (Both talking.) Small mouth bass, large mouth, striped or stuff like that. So that's the problem.
- Paul Hirt: 01:30:00 And they could move in if the water warmed up.
- Jack Schmidt: 01:30:03 They always--now, there's different ways to argue this. And so the point is when you put like-minded people as a-- (pause) we've, I've had a couple of these wonderful experiences in which we would write a scientific article, and then, so for us it was like, I mean those guys did great modeling. I helped them with the sort of, "so what?" of it and how do you write the discussion and all, and we had to nuance the discussion to not say that potential--they, because their original draft of the article was the rivers are going to get warmer and that's terrible. And I'm saying, "Well, you can't say that because that's like, what? You know, you've at least got to say we don't know and we had better get better science. Same way when Larry Stevens and I wrote an article back in the late nineties, and we wrote it about marshes in Grand Canyon, and as the most biologically diverse place in Grand Canyon were the freshwater marshes, except that they're an artifact of, of the absence of floods. And so we wrote in the discussion, well, the authors of this article actually disagree with whether this article is a big deal or not, because you can either argue that this is the most biologically diverse and wonderful part of the Colorado River and Grand Canyon, or it actually shouldn't even be there because they never were there before. They only are artifacts of the dam and who the hell cares about them?
- Jack Schmidt: 01:31:40 So it's fun. Those are fun. Those are fun when you do that. But no, I would say, I know we're out of time, but (pause) I think that what I'm, my mission is all about making decisions transparent. I mean I, I mean I personally would love a world that there wasn't a Glen Canyon Dam and I could float a boat all the way through, and--but that's not a world that I'm going to, I've never-- you know, that, that's, my mission is not to get that back. My mission is to try to make all these decisions transparent in a democracy. So that people make intelligent decisions about them and, yeah. So anyway, yeah what else—
- Paul Hirt: 01:32:31 Well, um--
- Jack Schmidt: 01:32:32 We're out-- We've got, you've got to go. (Both talking simultaneously)

Paul Hirt: 01:32:33 Yeah, a few more minutes, that--you did say, one last question I want to follow up on. You said earlier that there's a whole set of factors that go into influencing the ecosystems through the Grand Canyon that are off-limits. [You] said, basically, hydropower is a whipping boy because [JS: Yes] it's the only thing [JS: Yes] that you can actually modify [JS: Right], but that there are other more important [JS: Yes] things that you can't modify. Could you, could you--

Jack Schmidt: 01:33:04 Total flow [PH: Yeah], total monthly flow, sediment supply, temperature, and the new one that nobody had thought of, that might be, is nutrients.

Paul Hirt: 01:33:17 And if, and if somebody said to you, you know what, we're going to rethink everything [JS: Yeah]. You can adjust any of those factors in order to get more of what we want for the Colorado River ecosystem. Which of those factors would you go and adjust and what would be the effect on the river?

Jack Schmidt: 01:33:39 Well, so, okay. See, I always go back to the very practical thing. The first thing that I would do is we need to have a preliminary engineering, a formal preliminary engineering analysis of what it would cost to re-drill out the river diversion tunnels. So we at least know what the hell is the number. Is the number seven billion dollars or its seven million dollars? It'd be nice to know. For instance, we know what sediment bypass with an existing reservoir would cost. There is a preliminary engineering analysis done by Reclamation. It's a number like ten or fifteen million d-- no it's 250 or 400 million [dollars] depending on how you design it. I mean, it's a big number, but it's not billions [PH: Right]. And the annual operating cost for that pipeline is essentially the same as the budget of GCMRC, of the adaptive management program. Right? So, right, so it's a big number, but you know, right? So, okay, so I would create operational flexibility. I would, um, I would somehow get the brightest minds on the planet to figure out whether it really is true that it would be terrible to reinstitute a natural temperature regime and a natural sediment regime in the Grand Canyon. Because, I don't want to sound stubborn, but I just don't want to take that as the answer. It seems like a ludicrous answer. And yet I understand why so many aquatic ecologists and fish biologists say that. I understand their argument.

Paul Hirt: 01:35:43 And not just the ones that want to preserve [JS: No] non-native trout fishing.

Jack Schmidt: 01:35:47 No, no, no, no. These are well-intentioned people who care about endangered species. It's kind of crazy, and I understand their argument. I just keep saying really, how can that be? Because no, deep down inside I would like to see the Grand, in an imaginary world, I would like to know whether it's possible that we can meet society's needs for water supply, allocated to the most economically important places in the

watershed, and have a more natural Grand Canyon. But what that would take would be the ability to bypass sediment and bigger floods, in drilled-out diversion tunnels. Short of that, you can't do it. But I'd like to believe that's possible. And I think that a declining water supply might give us the opportunity, but at the same time I recognize that you might do all that science and you might conclude that the thing that is the best public policy decision is the one that in my heart I don't really want, which is, you know, keeping Powell full and Mead. But I, if it comes to that, I mean, you have to make decisions with your head. I mean, so I'm willing to let the chips fall where they may, but I just don't think we're working on enough. So, so, getting bigger flows of the right temperature with an abundant sediment supply is the ultimate, is what you need. And all this tweaking with all this other stuff is largely just going through the motions.

Paul Hirt: 01:37:43 Ahaa. That seems like a great place to end.

Jack Schmidt: 01:37:46 I'll never be--yeah, (laughs) yeah, thank God I'm sixty-seven and not looking for another job (laughter).

Paul Hirt: 01:37:54 I think it'd be great if we could follow up with you a little bit later, and maybe see if we can drill down a little deeper on some of these issues that we touched on, but I think this is a good place to end. We've covered almost everything on the list.

Jack Schmidt: 01:38:12 Okay. And I apologize if I talked too long [PH: No, no] or if this isn't-- I don't know how you make sense of this.

Jennifer Sweeney: 01:38:20 I'm going to turn it off.

End of interview