

Water, Climate and Uncertainty Conference Summary

The swollen creeks of Boulder, Colorado provided a fitting backdrop for the “Water, Climate and Uncertainty” conference at the Natural Resources Law Center of the University of Colorado in June 2003. Recognizing the importance of providing a forum for discussions between water managers, policy makers, and scientists, Doug Kenney, the conference's organizer, assumed the responsibility of master of ceremonies, providing thoughtful transitions between speakers and sessions while throwing some humor into the mix. Under his direction, luminaries in the fields of science and policy engaged a wide range of issues related to the future of water management.

The twenty-fourth annual conference was divided into five sessions. Session One was given the thought-provoking title “The Future Isn’t What It Used to Be,” echoing the words of the inimitable Yogi Bera—the wisdom of the baseball legend with a penchant for paradox was repeatedly invoked during the conference. This first session was to be further divided into two parts: *Western Climate History* and *Western Climate Future*. Session Two, entitled “Science, Policy, Law and Extra-Strength Tylenol,” considered current and future applications of science in policy and law, as well as the headaches attending these applications. The simple title of Session Three, “Basins and Borders,” belied the complexity of issues facing communities from the municipal level up to the international level. The Keynote Lecture that served as an intermission was delivered by the Assistant Secretary of the Interior for Water and Science, Bennett Raley. Session Four, “Additional Perspectives,” aimed at identifying oft’ overlooked voices and issues with respect to water management decisions. Finally, the ambitiously named Fifth Session, “Tying It All Together,” promised as much as it delivered.

Session I., Part 1

The daunting task of launching the conference was entrusted to Kelley Redmond, a Regional Climatologist and Deputy Director at the Desert Research Institute in Reno, NV. With an array of slides, Redmond reminded the audience that the West was a place of extremes, possessing the hottest, coldest, wettest, driest, and snowiest climates in the United States. Because of the extreme variations in climate from region to region, he underscored the difficulty of decision making in the West, going on to show that many natural resource management decisions had been made in response to climactic anomalies. At the same time, he pointed out that extreme variations in climate were what concerned resource managers the most, as they are the most costly.

Following Redmond’s lead, Justice Gregory Hobbs, Jr. delved deeper into the major events that shaped western water institutions. With citations from Wallace Stegner to Mary Austin, Justice Hobbs reminded the audience of the importance of water to the West, and not just to its white settlers. Reservoirs, Hobbs recalled, were invented by the Native Americans to store both grain and water. Faced with the prospect of population growth and new constraints on water institutions, the people of the West might gain a lot by looking back, according to Hobbs. The history lesson served as an illuminating reminder that, when custom and necessity conflict, institutions can produce innovation.

Session I, Part 2

Jerry Mahlman, Senior Research Fellow at the National Center for Atmospheric Research, opened with another of Yogi Bera's famous sayings: "Prediction is exceedingly difficult, especially when it comes to the future." He then proceeded to discuss one of the major obstacles to collaborations between science and policy: time; indeed, Mahlman observed that, since life systems are not immediately affected by climate changes, there is little incentive for politicians to reduce greenhouse gas emissions, a measure many scientists have called for in light of the trend in global warming. The NCAR scientist provided a number of slides suggesting that human activity was to blame for increasing temperatures worldwide, cautioning the audience that the task of undoing what humans have done so far becomes increasingly difficult over time.

The gloomy picture of the task ahead was further reinforced by the presentation of Mike Dettinger, Hydrologist for the USGS and Scripps Institution of Oceanography. Dettinger shared the results of tree ring research, which revealed that temperature and precipitation had been consistently warmer, persistently drier, then wetter than the previous 1,400 years. In the past thirty years, this trend has been confirmed by the earlier runoff of snowmelt—a trend that will continue into the future. Dettinger concluded with a caveat, warning that enough water to get through the 20th Century will not be enough to get through the 21st Century.

Senior Research Scientist at CSU's Natural Resource Ecology Laboratory, Dennis Ojima began his presentation by noting that climate change means different things to different people. Given stakeholders' different concerns, Ojima stressed the importance of identifying 'win-win' situations, whereby implemented changes would benefit all stakeholders even if predicted climate changes did not occur. He also emphasized the importance of extreme events to the future of water management, as well as the need for scientists and water managers to understand extra-regional forces, since they can exacerbate vulnerability to climate change.

Session One concluded with a panel discussion that considered the question: How seriously should we take the information models, projections, and probabilities provide? The panelists were Kelley Redmond and Dennis Ojima, as well as Roger Pielke, Sr., State Climatologist for Colorado and Professor of Atmospheric Research at CSU, and Marty Hoerling of the Climate Diagnostics Center. Martyn Clark of the University of Colorado's Center for Science and Technology Policy Research, served as the panel's moderator. Clark opened the discussion with a question fielded from the audience: If more funds or more time were available to climate researchers, would we become less uncertain? First to tackle the question was Pielke, who claimed we would probably be less certain, more uncertain. Ojima responded by noting that we need dual tracks, considering implementing changes while pursuing more accurate observations to improve model data. Hoerling cautioned that we cannot overlook the current importance of model spinoffs. Next, questions centered on our ability to implement changes in the face of uncertainty, with Pielke opposed to acting without reasonable certainty and Hoerling in favor of acting now. Finally, Redmond responded to the tough question of how to change our policy thinking when political terms are not in sync with the time scale of climate change, proposing a problem-oriented mentality that would break down boundaries between institutions, forcing them to act on problems.

Session II

Session Two kicked off with Harvey Hill of NOAA's Regional Integrated Science Assessments. First, Hill explained what RISA is and does, revealing the group's focus on economic development and social science decisions, with 70% of its budget dedicated to water issues. After rehearsing RISA's objectives, he discussed some of the improvements in recent forecasting history. Then, he examined the historical model of integrating research, information, and policy, which, he noted, was a less than ideal model; indeed, collaboration between scientists and policy makers was nearly non-existent until recent times. According to Hill, RISA was dedicated to breaking down this relationship and fostering greater cooperation between the multifarious groups concerned with climate, water, and policy.

The discussion of applied research continued with a presentation by Lee Rozaklis of Hydrosphere Resources Consultants. Rozaklis, who has been working with the Western Water Assessment team, offered the audience insight into the multitude of factors water managers take into account, from climate to economics to population growth. These 'large-scale drivers' needed to be understood in light of Colorado's water supply, whose complexity rivaled that of the demands placed on it. Once the factors of supply and demand were more or less agreed upon, then scenarios would be devised and tested. Rozaklis's presentation, if nothing else, underscored the sheer scale of the task before scientists, managers, and policy makers alike.

Pinch-hitting for Kathy Jacobs, Barbara Moorehouse of CLIMAS discussed the challenges and successes of drought planning in Arizona. Once again, the importance of coordination between groups involved in water management and use was emphasized. Moorehouse particularly stressed communication as a key tool in bringing together the social and physical sciences. A big hit with the audience was Moorehouse's "Hydro-Illogical Cycle" cartoon, which lent an air of humor to a conference whose subject matter was anything but humorous.

Dan Cayan of the Scripps Institution of Oceanography presented next, looking at Arizona's big neighbor to the west, California. Cayan opened with some staggering facts indicating that the population of the state with the world's fifth largest economy will double by 2050. Much of that population will be concentrated in the region with the least amount of water; indeed, 75% of the state's surface runoff comes from places north of Sacramento, while 72% of California's water is used by places south of Sacramento. Compounding the state's trouble with water supply is the problem of water quality, as well as the problem of generating electricity for this fast-growing region. Cayan closed by calling for sequential decision making under general uncertainty.

Moving north, Doug McChesney of the Washington Department of Ecology introduced the audience to the water considerations of the Pacific Northwest, where the possibility of drought is just as pressing a concern as the possibility of flood. McChesney started off with facts that were fast becoming familiar to the audience, particularly the studies showing a significant decline in runoff in the past 40 years, as well as a tendency toward drier summers and possible floods in winter. Furthermore, McChesney offered a familiar caveat: in spite of water users' desire for certainty, water supply will become more variable in the future. He did have some advice for planners, too, suggesting that planning take place at the local level, that education and outreach efforts be redoubled, and that cooperative efforts such as those in the Northeast be mimicked.

Another panel discussion punctuated the end of Session Two. This discussion focused on the usefulness of applied climate research. Doug Kenney moderated the discussion, while panelists consisted of Lee Rozaklis, Barbara Moorehouse, Dan Cayan, and Doug McChesney. The first question came from an audience member who wanted to know why water quality was not focused on as much in the presentations. Cayan quickly pointed out that, with respect to water demand and supply data, water quality data are even less reliable, for records have not been kept long enough. Moorehouse concurred, further calling attention to the difficulty of obtaining information from Mexico, since its waters flowed into the US too. Rozaklis pointed out that climate change can have a very direct effect on water quality, mentioning fish and aquatic life's dependence on fairly constant temperatures for survival. McChesney chimed in by reminding the audience that other factors such as power generation render the water quality assessments all the more difficult. Many of the ensuing questions had to do with cooperation on the state and federal levels. Panelists seemed to agree that, while improvements should continue to be made, cooperation is fairly good thus far.

Session III

Session Three brought legal and political issues to the fore. James Lochhead, Senior Counsel at Brownstein, Hyatt & Farber P.C., examined the phenomenon of compacts and concentrated his discussion on the Colorado River Basin. As he explained, a compact was a binding contract between states that was enforced federally by Congress. With regard to water, compacts aim to establish the apportionment of water between states in terms of flow rate. Compacts are not without controversy, however. To illustrate this, Lochhead talked at length about the disputes between the states in the Colorado River's upper and lower basin. Lochhead concluded by saying that he felt as though the current system was flexible enough to deal with future changes.

The next speaker, Alberto Szekely, Ambassador for Border Water Affairs in Mexico City, engaged and entertained the audience while affording them some insight into the problems facing our neighbors to the south. Szekely stressed the impact of the recent drought on Mexico's water infrastructure and supply. Furthermore, he informed the audience about the dearth of laws and management plans in place in Mexico, citing this lack as a failure on the part of the Mexican government. One of the main international obstacles to responsible water management he identified was the reticence of governments on both sides of the border to impose limits on growth. Since both Mexico and the United States share the same problems and much of the same water, he called upon the US to set up a bi-national council to collaborate on drought and water matters. Though fully aware of the scale of the task at hand, Szekely was hopeful for the ever-intertwining future of the two countries.

Stan Bradshaw, formerly of Trout Unlimited in Montana, followed the ambassador's engaging presentation with some audience engagement of his own, surveying to find out who came from where, both in terms of location and perspective. With the diverse range of perspectives in mind, he asked the audience: What would be an appropriate response to global warming? His simple answer was informed by the Central Great Plains Assessment's call for a "least regrets approach," where actions taken are agreed upon by and benefit all stakeholders, even when predicted climate changes do not materialize. As a positive example, Bradshaw spoke of his

own experience with the Blackfoot River, where a bottom up approach to decision making seemed to have benefited all stakeholders.

After being furnished with surprising news, Denise Fort, Professor at the University of Arizona, stepped to the podium somewhat flustered. In spite of her curiosity about the court decision, Fort picked up with some of Bradshaw's observations about the importance of stakeholders in management decisions, especially of those whose voices were underrepresented in most policy forums. Furthermore, Fort expressed concern with the tendency of many policy makers to point to untapped water sources in the face of drought. Instead, she proposed that efforts to conserve water be fully and thoughtfully explored—efforts ranging from personal changes to institutional reforms.

Keynote Lecture

Delighted by the invitation to speak at his alma mater, Bennett Raley, Assistant Secretary of the Interior for Water and Science, impressed the audience with his willingness to entertain questions and criticism. In his speech, Raley declared that policy decisions under this administration would be made from the center, with groups and agencies at the extremes being ignored. The reason for this approach, according to Raley, was to avoid the lengthy debates that have heretofore stymied progress in terms of policy decisions. Thus, Raley unveiled his department's hot-off-the-press report, *Water 2025*. This report, he claimed, would avoid the litigation and despair that have characterized natural resource policy decisions in the past. Raley shared the beginning of the report with the audience, pointing out potential water supply crises by 2025 with the aid of a display identifying and categorizing potential hot spots with varying degrees of color. He concluded the talk by noting that the administration will continue to optimize available technologies while exploring new, more promising ones.

Raley then fielded questions from the audience, even opting to stay and answer more questions after his hosts offered him a quick out. Before responding to any questions, he made it clear that he reserved the right to duck questions if he so chose, an option he took up on a few occasions. When it came to questions about finances or the future of water banks, Raley avoided speculating, saying only that he did not know what the future would hold. He did, however, address a question very much germane to the conference: How is climate variability factoring into the decision making process? Raley replied by citing the President's Rose Garden speech, where the challenge to incorporate climate change research in decision making was put to federal agencies. The challenge, according to Raley, was to make climate change research more reliable.

Session IV.

With the many parties interested in water management decisions, those who do not have a strong voice are often overlooked. This includes fish. John Volkman, Attorney with Stoel Rives LLP, filled the audience in on the historical and current disputes in the Pacific Northwest between salmon, electricity, recreation, irrigation, and so on. Both salmon and hydroelectricity are vital parts of the region's economy, but balancing the harvest of these two resources is a tricky issue, the more so since salmon are more than just an economic boon—they also serve as a cultural

icon and a central focus of a wide range of treaties. While Volkman was at ease in elucidating the complexity of the debate, he offered no easy solutions, closing his talk by echoing another of Yogi Bera's famous statements: we're coming to a fork in the road, and we'll have to take it!

Carl Ullman with Water Adjudication for the Klamath Tribes of Oregon further stirred the murky water surrounding resource management decisions. First, Ullman noted that there were multiple, conflicting ways in which the Klamath River Basin's water was committed. Federal promises made to the indigenous population were at odds with those made to Oregon, which were at odds with those made to California. In spite of the seeming precedence of their claim to the region's water, indigenous people stood to lose the most, for there is a diminishing counter-majoritarian role in our courts today, according to Ullman. Nevertheless, he was optimistic, citing one example where governmental mandates were invoked to secure indigenous claims to land.

Returning to California, Jeffrey Kightlinger, General Counsel for the Metropolitan Water District of Southern California, furnished the audience with a water manager's perspective. Surprisingly, California only holds about 40-50% of the water it needs. Imported water, therefore, is crucial to the region's sustainability. But, conditions and constraints are forcing the state to look elsewhere for water. Kightlinger mentioned some very intriguing possibilities such as satellite controlled sprinkler systems and ocean desalinization, but stressed the importance of demand management and other more direct methods like lining canals. Regardless, what was critical was maintaining the flexibility of the system while appeasing as many stakeholders as possible.

Not to be forgotten, economics snuck into the conference in the form of a presentation by Bonnie Colby, Professor of Agricultural and Resource Economics at the University of Arizona. Colby began by listing a number of sources of risk, as well as several hidden costs, facing water managers today. One of the greatest risks cited was illustrated by a cartoon she shared with the audience, whose caption read: "Typical responses to drought can be characterized as short-term panic followed by long-term inertia." Colby then offered a variety of solutions to guard against the risk of inertia—solutions ranging from the use of spot markets to the authorization of dry-year surcharges (both urban and agricultural). Finally, she revealed what was keeping her upbeat throughout some of the conference's more depressing moments: the fact that climate change research had seemingly supplanted economics as the "dismal science."

Session V.

Bravely, Professor David Getches of the University of Colorado School of Law (where he will soon be Dean) accepted the challenge of "tying it all together," although he cautioned right away that he could not fulfill this obligation. Beginning with an historical example from Bali, Getches drew some lessons to be learned from clashes between new and old technologies. In the main, he warned that water policy cannot expect too much from nature, as nature is inherently uncertain. With that in mind, present day water policy makers should reexamine the social goals of water policy and further open the decision making process to climate change information. Above all, current management systems will need to be better equipped to deal with surprises.

The final panel discussion was led by Doug Kenney, while the panel included familiar faces such as those of Harvey Hill and Denise Fort, as well as the new faces of Sean McGrath from the

Western Governors Association, Roger Pulwarty of the Climate Diagnostics Center, and Roger Pielke, Jr. of the University of Colorado. Kenney decided to break down the discussion into two parts, with the first considering questions he had drafted earlier and with the second entertaining questions from the audience.

Kenney's first question was "Where should climate concerns be on the priority list of western water issues?" Fort responded by asking scientists what we know enough of about climate change in order to make decisions. Not liking the question, Pulwarty rephrased it: How does science allow us to question decisions we have made? Pielke chimed in, saying that we don't get rid of uncertainty with science but with decisions. Eventually, this line of thought led the panel to consider whether or not institutions were up to the challenge of championing calls to change. Pielke was doubtful, noting that preemption is an admirable goal, but we need something in place right now that works. According to Pielke, we're not facing a climate problem but rather a scarcity problem. McGrath then noted that it was unfortunate that water management has always taken place in an *ad hoc* fashion in the West.

Opening questions to the audience, Kenney was surprised to find himself interrogated but tried as best he could to redirect questions to the panel. An audience member then asked panelists how they thought it would be best to align policy maker timelines with those of longer-term phenomena like climate change. Fort conceded that there was a tangible concern, but most agreed with Harvey's observation that politicians are afraid of problems they can identify but cannot solve. Pulwarty urged the audience to consider this not just a policy maker issue but a public issue.

As the discussion drew to a close, Kenney thanked the panelists, presenters, and audience for participating, whereupon everyone thanked Kenney for organizing the conference. The need for continued dialogue was agreed upon by all.