



the Owens Valley Committee

# the RAINSHADOW

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The Rainshadow is the newsletter of the Owens Valley Committee. OVC is a 501(c)(3) non-profit citizen's action group dedicated to the protection, restoration and sustainable management of water and land resources affecting the Owens Valley.

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### The Owens Valley Committee needs your help!

The date on your mailing label is when you last made a donation to the OVC. If this date is less recent than October 2009, please renew your membership. If it is less recent than August 2009, please consider making an additional contribution. Donations are tax-deductible.

## Ranchers Have a Say

### Environmental Mitigation & the ad hoc Process: an Alternative to Litigation

Carla Scheidlinger



Photo: Mike Prohler, 2008

THE OWENS VALLEY COMMITTEE HAS BEEN REPORTING REGULARLY on the progress of the ad hoc process that has resulted in the development of a set of projects to mitigate the loss of multiple spring-fed wetlands caused by the increased groundwater pumping initiated by the Los Angeles Department of Water and Power (DWP) in the early 1970's since the completion of its second aqueduct.

These projects will result in a total of 1600 acre-feet of water per year remaining in the valley for environmental benefit. The ad hoc process has proven to be a valuable tool. Included in this informal decision-making process were not only the major parties to the 1997 Memorandum of Understanding (MOU), but also the holders of the land leases on which the projects were to be developed. By bringing these important ranching stakeholders into the decision-making process, the resulting projects have received approval and even some enthusiasm from the ranching community that has in the past been rather hostile to the environmental agenda.

I spoke to Ron Yribarren, a long-time rancher who leases DWP land between Bishop and Big Pine. One of the proposed mitigation projects is on his lease. Ron, who has been involved in the ad hoc process from the beginning, is the owner-operator of a cow-calf operation, which means that he has a herd of mother cows that produce a new crop of calves for market each year. He manages his lease for grazing, moving the cattle as necessary to keep the land in good condition. He has been on the land since 1974, on the acreage formerly known as the Partridge Ranch. Having previously ranched down in the Mojave Desert region, Ron says that this lease is like paradise. "I thought I'd died and

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# Green Power Turns Brown

## Pumping at Coso Hay Ranch: Creating a Working Hydrologic Model?

Sally Manning, Ph.D.

IN MAY 2009, THE INYO COUNTY BOARD OF SUPERVISORS voted to issue a Conditional Use Permit allowing Coso Operating Company to pump and export about 4,000 acre-feet of water per year out of Rose Valley to feed Coso's ailing geothermal power plant in another basin. (See "When Green Power Turns Brown" in the *Rainshadow*, summer 2009.) Local land owners, ranchers, Indian tribes, environmental groups, and even the Los Angeles Department of Water and Power raised objections to this ill-conceived project. Within one month of Inyo County's decision, Little Lake Ranch (LLR) filed a lawsuit challenging the county's findings on the adequacy of the Environmental Impact Report (EIR) for the project.

LLR's legal brief contained a long list of faults with the EIR. Therefore, it came as a surprise when, in August 2009, local media reported that LLR and Coso had settled the lawsuit. A spokesperson for LLR emphasized the confidentiality of the settlement. Apparently, only LLR and Coso know the details.

A ceremonial groundbreaking took place at the Hay Ranch in late September. Coso announced it hoped to complete the nine-mile pipeline by the end of 2009. In a



Photo (before alteration): Chuck Brill

**What's wrong with this sign? Apparently Coso's water grab hasn't even increased their production of geothermal energy.**

feat analogous to the LA Aqueduct, Coso completed its pipeline in record time.

A link to Coso/Hay Ranch Hydrologic Monitoring Data was posted on the Inyo County Water Department website (<http://inyowater.org/coso/default.html>). Periodic visits to this site typically show that accessible data are out of date by several weeks.

Two days before Christmas, Inyo County Water Department (ICWD) Director Bob Harrington decided on baseline water levels for the numerous test wells to be used as "trigger" wells in Rose Valley. Contrary to the guidelines presented in the project's EIR (specifically, its Hydrologic Monitoring and Mitigation Plan or "HMMP"), Harrington employed no analytical techniques to characterize water levels or trends. Instead, he defined baseline levels as the deepest depths in the recent record. The HMMP set trigger water level depths for management actions as certain amounts of decline below whatever was designated as the baseline depths. Thus, setting reasonable baselines was one way some environmental protection might have been achieved. Unfortunately, the baselines set by Harrington allow the maximum extent of water level drawdown before ICWD would be obligated to take action under the HMMP.

Within the next week, Coso turned on the Hay Ranch pumps (on Christmas Day), and objections were raised about Harrington's baselines and the methods used to

select them. One objection was that the HMMP indicated an independent consultant would be hired and he or she would develop baselines using a scientific approach.

In response to the objections, Harrington agreed that Coso's hydrologic consultants could select the baselines. In short order, those consultants generally agreed with Harrington's baselines, but they also recommended against using some of the wells as trigger wells.

Meanwhile the pumps were pumping, and the extraction rate was gradually (but not smoothly) increased. Monitoring wells in the vicinity of the Hay Ranch showed groundwater decline in response to the pumping. In March, the water level in one of these wells dropped below what had originally been designated as its "maximum allowable drawdown," but because Coso's consultants threw it out of consideration, ICWD was not obligated to take action when this occurred. When questioned, Harrington responded that, despite the HMMP's designation of "maximum allowable drawdown" assigned to wells near and far from the pumps, the only obligation ICWD has to reduce (not stop) pumping is if a well more than 9,000 feet from the Hay Ranch hits its maximum allowable drawdown.

For reasons not explained in the available documentation, the rate of pumping peaked in mid-March and has gradually (but not smoothly) declined. Regionally, water levels show a response to the change in pumping rate. It is unclear if pumping is being altered simply to ward off

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### the RAINSHADOW

A PERIODIC NEWSLETTER OF THE OWENS VALLEY COMMITTEE

Send suggestions and corrections to the editor. For more information about the OVC, previous newsletters, upcoming events, and environmental issues in the Owens Valley, please go to [www.ovcweb.org](http://www.ovcweb.org).

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# OVC Update & Financial Report

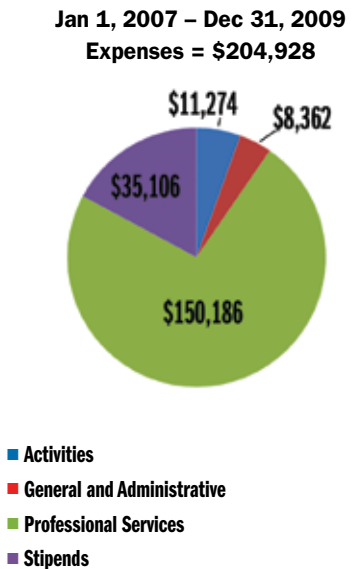
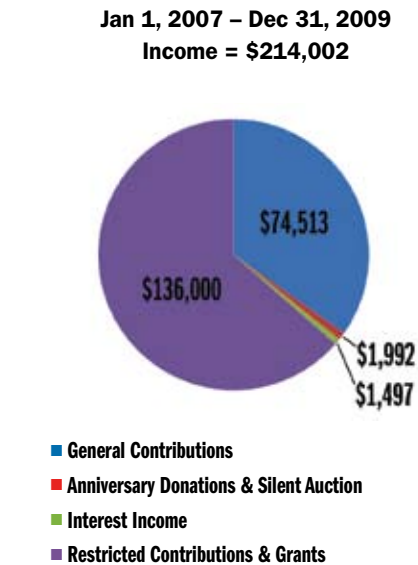
John Williams, Ph.D., Chairman of the OVC Board of Directors

For its financial resources OVC depends on individual donations and grants from foundations. Historically foundation grants have been the larger income source, but both sources have been essential to OVC's continued existence. Unfortunately, many foundations are moving away from funding organizations that sometimes must, as a last resort, take legal action. In the future we will depend more and more upon individual donations as grants shrink and become harder to obtain.

For a relatively small environmental organization, OVC has been extremely effective. We have never had an "excess" of funds. We have always kept administrative costs low and spent almost all of our funds directly on achieving our mission of protecting and restoring the water-dependent ecosystems of the Owens Valley.

As our front-page article on an inclusive, cooperative approach to resolving issues ("Ranchers Have a Say") illustrates, OVC strives to avoid expensive litigation. When we must sue to protect the valley, however, we have been very successful. Most notably, our suits against the Los Angeles Department of Water and Power (DWP) finally compelled the rewatering of 62 miles of the Lower Owens River in 2007. A Court Order now requires DWP to meet certain river flow and reporting criteria. Our final two lawsuits against DWP were concluded in 2010—one through the cooperative approach that resulted in plans for additional mitigation projects and Yellow-billed Cuckoo habitat enhancement that were required by a 1997 Memorandum of Understanding (MOU). The other suit was concluded by Judge Cooper's decision and subsequent judgment that, among other points affecting the Lower Owens River, (1) DWP must consult with the California Department of Fish and Game (DFG) on the amount, ramping, duration, and timing of seasonal habitat flows and (2) the need for an adaptive management measure to augment the seasonal habitat flows below the aqueduct intake. (These increases in river flow are an attempt to partially simulate natural seasonal runoff and are essential to the production of healthy riparian ecosystems.)

Recently we regrettably were compelled to sue DFG over its Fish Hatchery and Stocking Program Environmental Impact Report (EIR) that inadequately addressed the destruction of critical alkali meadows as a result of groundwater pumping to supply the Black Rock Rearing Ponds and Fish Springs Hatchery after the springs that originally supplied them were dried up as a result of DWP's pumping. Groundwater pumping to supply these facilities, both located in the Owens Valley, is exempt from the on-off provisions of the Long-Term Water Agreement, and for the past 40 years has far exceeded the former natural spring flows that supplied them. DFG



**Categories listed for Expenses include:**

**Activities:** Membership (postage, stationery & ink), Newsletter (design, printing, postage & envelopes), Travel (mileage & reimbursement), and Website (hosting & design).

**General and Administrative:** bank charges, filing fees, meetings, PO Box rental, and outside accounting & tax services (starting in 2009 when we switched from volunteer to paid professional services).

**Professional Services:** attorneys and consultants (legal & policy liaison and hydrologist).

**Stipends:** membership coordinator, newsletter editor, treasurer & internal accounting, and webmaster. For the time required, stipends tend to be less than minimum wage for professional-level work. We have discontinued paying stipends for treasurer & internal accounting and webmaster.

**Important Notice:**

The mailing label on your newsletter should indicate when you last donated to the OVC. Please renew your membership, if the date is less recent than October 2009. Please consider making an additional donation, if the date is less recent than August 2009. And of course, please join if you have not already. If you would like to donate without "joining," or if you prefer not to receive the newsletter or mail, just tell us your preferences. We need your faithful annual support to protect and restore this valley we all love.

Please use the enclosed envelope or mail to Owens Valley Committee, P.O. Box 77, Bishop, CA 93515. You can also donate online at [www.ovcweb.org/ContactUs.html](http://www.ovcweb.org/ContactUs.html). Contributions are tax-deductible. (We are charged a 3% fee for online donations.)

in its draft EIR acknowledged that these facilities need far less water than was being pumped, but back-pedaled in the final report, presumably in response to pressure from DWP. After the water is pumped to the facilities, it flows into the LA Aqueduct system for export to Los Angeles—which gives DWP an incentive to pump more than is needed.

We thank all our donors and hope that you will continue to support our work. We continue to advocate for proper adaptive management of the Lower Owens River to ensure the restoration of healthy ecosystems in its wake, restoration of critical alkali meadows seriously damaged by excessive groundwater pumping, restoration of springs and other habitats under the terms of the 1997 MOU, and protection and proper management of

wildlife habitats on the Owens lakebed. We'll continue to do what we can to prevent and address violations of DWP's legally binding commitments under the Long-Term Water Agreement.

Herewith we begin an accounting to you our donors of OVC's financials. Since financial reports have not been appearing in the newsletter, our original thought was to present six charts providing income and expenses data separately for each of the past three years. Although six charts would show the year-to-year variation, we quickly realized that two charts—income and expenses for 2007 through 2009—would be more digestible and actually provide a better summary of our activities. More details and regular annual financial reports will appear in future issues of this newsletter.

# Another Owens Valley

John Walton, Ph.D.

ON APRIL 23, 1991 THE *NEW YORK TIMES* ran a front-page story entitled “Battle Lines Drawn in Sand: Las Vegas Seeks New Water.” The article explained, “Seventy years after the City of Los Angeles grabbed control of the water rights in the Owens Valley of California, with raw chicanery chronicled in the film ‘Chinatown,’ rural Nevadans say history is about to repeat itself. They fear that their land, like the Owens Valley, will dry up into a parched dust bowl, its water diverted to build a vast city in an arid basin.”

From its western terminus in Bishop in Owens Valley, U.S. 6 heads northeast, climbs the White Mountains, then follows the basin-and-range topography across central Nevada to Tonopah, Ely, and eventually the hamlet of Baker in Snake Valley, near Great Basin National Park and 230 miles north of Las Vegas. Spanning 100 miles of the Nevada-Utah border, Snake Valley is one of a series of inter-range basin aquifers that the Southern Nevada Water Authority (SNWA) hopes to tap for the further development of Las Vegas and urbanized Clark County. Still in the planning stages after years of negotiation, the SNWA (usually pronounced “sun-wah”) pipeline has thus far acquired a number of ranches and water rights in key locations as far north as Spring Valley west of Snake Valley and near Ely. Further SNWA initiatives are underway seeking new water permits from the State Engineer and defending in court those they have been awarded in contested proceedings. Partially funded by Las Vegas building permit fees, SNWA recently has suffered from the housing collapse. But they remain determined to build a pipeline, motivated perhaps by a growing scarcity of water in the West, especially declining Colorado River flows and reservoirs.

Reminiscent of the Owens Valley rebels of the 1920’s and environmentalists of the 1970’s, Nevada citizens have organized in the committee to Protect Snake Valley (<http://protectsnakevalley.com>) with support in the region from the Great Basin Water Network (<http://www.greatbasinwater.net>).

Resistance to the Las Vegas water grab in central



FIGURE 1. Route of the proposed 285-mile SNWA pipeline connecting Las Vegas with central Nevada aquifer basins at a cost from 3 to 12 billion dollars. (Image courtesy of PLAN)

Nevada is the work of a variety of citizens, ranchers, environmentalists, lawyers, scientists, and journalists. Some of the inspiration behind this movement, as the *New York Times* noted, derives from the history of Owens Valley. In 2006, the Progressive Leadership Alliance of Nevada (PLAN) published an attractive booklet entitled “Las Vegas and the Groundwater Development Project” (by Cristina Roessler) that recalls the story of the Los Angeles Aqueduct and its consequences for the Eastern Sierra communities and environment. Greg James, retired head of the Inyo County Water Department and long-time Bishop resident was invited to meet with the Snake Valley community for advice about parallel experiences and protective strategies. Slogans, banners, and spoofs began to appear in Snake Valley equating history and the present, LADWP and SNWA.

Dean Baker is a rancher who lives in the coincidentally named hamlet of Baker, Nevada, headquarters of the 12,000-acre family ranch he established with his father and now operates with his four sons. Baker is a graduate of the University of Utah, a pilot, and citizen politician who describes himself as “just an alfalfa farmer.” But a very smart one, as becomes apparent when he talks about Snake Valley, the rancher’s lot, and the threat posed by SNWA’s pipeline. Since 1989, SNWA has been seeking water rights in the valleys to its north totaling some 100,000 acre feet per year (AFY), including 50,000 in Snake Valley. Some of these claims have already been established through million-dollar ranch purchases in Spring Valley. But the citizens of Snake Valley are resisting the water grab. Baker says that SNWA claims far exceed the actual amount of water available. Since electrical pumping was installed in the 1970’s, their own modest irrigation causes the water table to drop noticeably. Exporting large amounts of groundwater would destroy the ranches, communities, natural springs, and wildlife habitat of Snake Valley.

Baker’s assessment is shared by hydrologists John Bredehoeft, former U.S. Geological Survey chief of water



FIGURE 2. Protest sign and section of corrugated iron pipe that draw symbolic comparison of the Snake Valley and the Owens Valley experiences. (Image courtesy of the Great Basin Water Network.)



FIGURE 3. Dean Baker (right) and Bob DuBois survey irrigated fields of corn and new alfalfa on the Baker Ranch. Looking SW: ranch headquarters and the Snake Range.

resources for eight western states, and by Timothy Durbin, once the head of Nevada’s USGS office. Both experts say hydrological models show that the amount of water claimed just isn’t there. SNWA, they say, relies on bad science or “political science” while excluding the testimony of independent analysts.

Despite the long western drought and dwindling Colorado River, Las Vegas’s “need” for other people’s water is debatable. The city of 2 million is legendary in the annals of urban sprawl. New subdivisions spread over the surrounding desert far in advance of any effective demand. Urban planning is unfamiliar and unlovely to the powerful development and gaming industries. Water use is profligate, given the physical setting. Las Vegas consumes 174 gallons per person per day, excessive when compared to other southwestern cities such as Albuquerque (110), Tucson (114), or even the national average (153). Some California coastal towns manage with 70. Although Las Vegas has recently adopted a system of water credits and rebates for residential conservation, the casino fountains, artificial lakes, and golf course sprinklers continue to flow. A Pacific Institute study entitled “Hidden Oasis: Water Conservation and Efficiency” shows that a series of relatively simple system improvements and water-rate incentives could save SNWA some 86,000 AFY—nearly the amount the multi-billion dollar pipeline is (over-) estimated to deliver.

Among the communities that would be affected by the SNWA pipeline, Snake Valley boasts the most energized resistance movement. Like Owens Valley in the early years, citizens are mobilized and participate in a variety of ways. Dean Baker and his son-in-law, White Pine County Commissioner Gary Perea, joined a SNWA-sponsored Integrated Water Planning Advisory Committee until they found that their suggestions about the need for hydrological studies prior to decisions about building a pipeline were ignored. Although SNWA promised them “a seat at the table,” the seat came without a voice. Baker and Perea declined to be token participants in a predeter-

mined outcome, and Las Vegas learned that co-optation would not work.

While distressed ranchers in Spring Valley succumbed to generous buy-outs, the residents of Snake Valley refuse to sell and abandon their preferred way of life. The community turns out for meetings, public hearings, fund raisers, and political picnics. Cecil Garland, a rancher from Callao in the Utah portion of Snake Valley says, "We will resist because it is morally correct to resist. It's a choice of crops or craps." The controversy generates favorable publicity, including a series of articles by Emily Green in the *Las Vegas Sun* and the film "Desert Wars: Water and the West" produced by the University of Utah KUED public television station. Snake Valley's citizens' movement is explained by a higher proportion of family ranches, committed leaders, legal talent, and political experience acquired in the 1970's struggle against the ill-fated MX Missile scheme. Equally important is organizational assistance from environmental groups in Nevada and Utah such as PLAN and the Great Basin Water Network. John Huntsman, the popular Utah Governor (and now US Ambassador to China) spoke out in support of Snake Valley.

Another parallel between the struggles for survival in the Owens and Snake Valleys is the impressive success of legal action. In Owens Valley, it was the protracted Inyo v. Yorty lawsuit that established the applicability of the California Environmental Quality Act to deprecations stemming from the Los Angeles Aqueduct (followed by key "public trust" decisions on Mono Lake). In 1989, LADWP was required to reduce groundwater pumping and mitigate environmental damage. In October 2009, the Nevada District Court, in a case brought by Atty. Simeon Heskovits's Taos firm Advocates for Community and Environment, vacated the State Engineer's ruling that gave SNWA rights to 18,775 AFY in the three valleys closest to Las Vegas. Without those rights, and with others sought farther north in potential jeopardy, this decision could render the pipeline financially infeasible. Emily Green calls it "a phenomenal reversal for Las Vegas in its 20-year quest for water from the Great Basin Aquifer." Of course, SNWA will appeal to the Nevada Supreme Court.

The story of western water wars continues to unfold. The Owens Valley-Los Angeles conflict has long been the familiar model, popular legend, and recusant inspiration. New citizen movements and rural rebellions continue to arise, each with its own special circumstances and energy. Snake Valley belongs in the Owens Valley tradition. Revealingly, only SNWA insists there are no similarities.

Author's note: A new (October 2009) 2-disk DVD of *Chinatown* is now available. Special features include interviews with various people connected with OVC.

Part 1 of this article appeared in the summer 2009 issue of the *Rainshadow*. The two parts can be read independently.

John Walton is the author of *Western Times and Water Wars: State, Culture, and Rebellion in California*, University of California Press, 1992.

## Green Power Turns Brown

*—continued from page 2*



**Portion of Little Lake and wetland vegetation, B.C. (before Coso).**

*Photo: Steven McLaughlin*

hitting a trigger point, or if the reason is to derive some parameter of a hydrologic model. Regardless, with the variable pumping amounts, the hydrologists will have reams of complicated data to sort through to attempt to identify cause and effect. If this is how Rose Valley is managed, and if there is any merit to the EIR's hydrologic model, then prolonging the time until a distant well reaches a trigger will mean that, even if pumping is stopped, water levels in sensitive areas of Rose Valley will continue to decline, then take decades to fully recover, if ever—to their low baselines.

Reliable sources have stated that the imported water has failed to increase geothermal energy production at Coso's facility on the Navy base. Why continue to pump Rose Valley if extra power generation is not being realized?

It's difficult to access timely factual information on the Hay Ranch project; this means there's undoubtedly more to the story, and the story will ultimately be told in degraded ecological conditions in Rose Valley.

*The Owens Valley Committee supported LLR's objections to Inyo County's conditional 30-year permit and Coso's proposed water grab in our front-page feature, "When Green Power Turns Brown" (D. Pritchett and S. Manning), in the summer 2009 Rainshadow. For this update, we just removed "When" from the title, since the when is now.*

*OVC seriously considered joining LLR's suit as a co-plaintiff. We did not do so, because Rose Valley isn't Owens Valley, and we prefer to avoid litigation, if possible. OVC thought that LLR had a good case, and they were the obvious stakeholders. Now, amidst the confidential deal struck between LLR and Coso, the poor reporting of timely information on this project, and Inyo County's seemingly cavalier regard for baselines, triggers, monitoring locations, and pumping rates, groundwater is being depleted, springs may dry up, and we may never know if impacts were the result of the faulty modeling and monitoring agreed to by Inyo County or some other confounding factors. The public and the ecosystems affected deserve better.*

## Ranchers Have a Say

*—continued from page 1*

gone to heaven when I came up here!" he exclaimed.

Ron says that at the time he was invited to join the ad hoc meetings, the ranching community was about to hire their own lawyers, as the two consultants engaged by the MOU parties had produced plans that the community felt were no good and could hurt ranching interests. "At the beginning, I thought this could be a big wreck. We didn't want this project to just develop the flowing wells by the river. We wanted some real benefit to the valley, something that would work." Although he'd had low expectations of the process, he says that from the beginning he felt that the point of view of the ranchers held equal weight to the other interests in the room, even though the ranchers were not parties to the MOU. "We had the most to lose, but the least power," he recalls. "But we felt included, and I felt good about that."

The project proposed for his lease is the Freeman Creek project. "This project will help everything," he says. It will help wildlife, and it will help ranching. In this project water will be released from Freeman Creek to continue down an historic channel, where it can spread out into a meadow that has been cut off from water for many years due to the channeling of the water into a ditch. "It will take a while," he notes, as the water has to "sub out" up high on the slope and travel down through the soil to get to the meadow. But the trees will benefit first, and he expects that some old alfalfa plantings lower in the meadow from back in the 1950's that have been lying dormant in the ground for decades may come back as well, which would benefit his stock.

Ron recalls that an important part of the ad hoc process was getting to know some people who had previously just been names to him. He realized that "a lot of us are all on the same page, we want the same thing. We just do different things for a living." This is the part of the process that he liked the best. As far as using this kind of informal but serious negotiating for future projects or decision-making, he says, "If you want to talk to the ranchers, this is a great process. This has really been for the benefit of the valley."

Although Ron felt that everyone involved in the ad hoc process contributed to its success, he particularly singled out the OVC's Derrick Vocelka as helping to keep the project on track. "He's a really great guy," Ron commented. We at the OVC agree and hope that we can continue to nurture this kind of positive energy and collaborative approach for decision-making in the future.

*Carla Scheidlinger has been involved with the OVC since 1989 and twice served as president, completing her second term in January 2010.*

# Meadows Rare and Wide in the Land of Little Rain

## Alkali Meadows – Part 2

Sally Manning, Ph.D. (Dr. Manning retired in 2008 from a long tenure as Inyo County Water Department Research Scientist – Vegetation.)

*In the summer 2009 issue of the Rainshadow, Dr. Manning described the distribution and biologic characteristics of Owens Valley alkali meadows. In this article she talks about how they evolved and persisted in our arid region. Understanding the shallow groundwater zone of Owens Valley is key to understanding the vegetation and all the life forms it supports.*

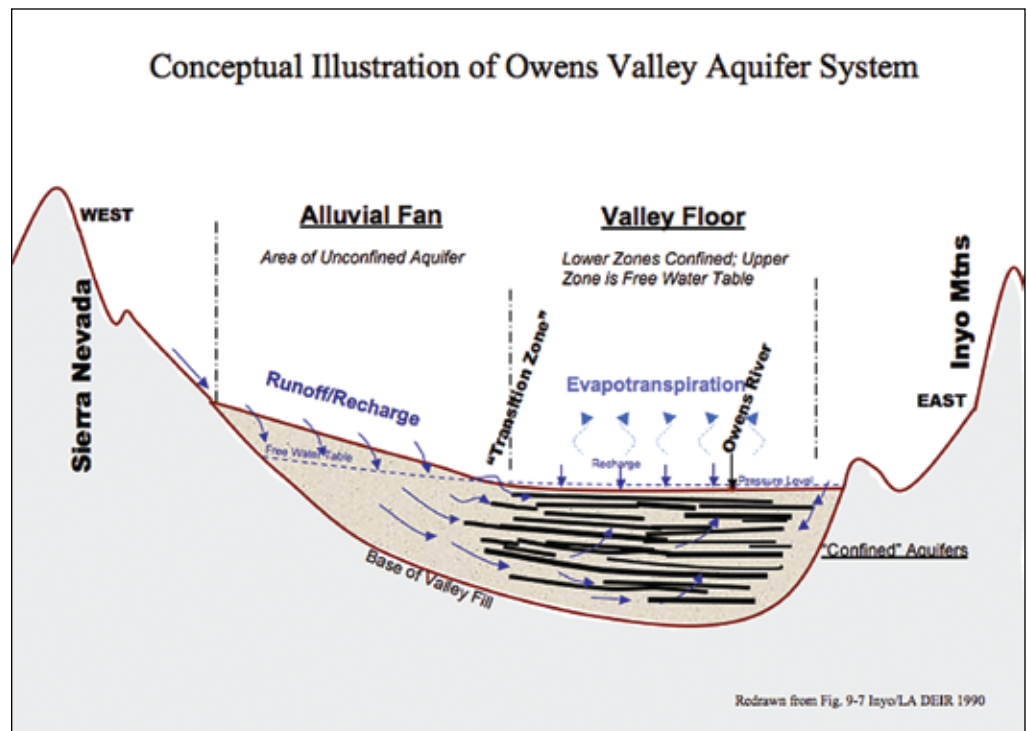
**A**LKALI MEADOW IS A MAJOR HABITAT TYPE in Owens Valley. But how can meadows—lush, moist, green grassy places—persist in a climate characterized by an average annual precipitation amount of 5½ inches? By definition, such meager precipitation qualifies Owens Valley as a desert. Ironically, millions of tourists visit the Eastern Sierra to trout fish or ski, two activities requiring an abundance of fresh water. This landscape we find so appealing and may not think of as desert results from the collision, integration, and equilibrium of powerful forces.

Proximity to the Pacific Ocean, a wall of high mountains, and internal drainage make Owens Valley the repository for large volumes of fresh water. The north-south trending Owens Valley trench is flanked by the Sierra Nevada on the west and White and Inyo Mountains on the east. Both mountain ranges rise to over 14,000 feet in elevation; the floor of Owens Valley averages about 4000 feet. The Sierra is the first major obstacle encountered by eastward-flowing Pacific moisture. Winter weather patterns wring great quantities of water from the moist air mass, and a considerable amount surges through the Sierran passes or over the tops onto the higher elevations east of the divide. (See Powell and Klieforth, 2000, for a more detailed explanation.) As temperatures warm in spring and summer, the mountain snow melts, and water flows into Owens Valley. Because Owens Valley is the western-most basin of the internally-draining region known as the Great Basin, the water accumulates, with no outlet to the sea.

Long-term climatic patterns result in a hydrologic cycle in Owens Valley that gives rise to two distinct ecosystems: groundwater-dependent meadow and precipitation-dependent shrubland. The generalized cross section in Figure 1 illustrates the two hydrologic regimes. Faulting on the eastern escarpment of the Sierra Nevada as well as on the west side of the White/Inyo Range created the down-dropped graben of Owens Valley, where bedrock is reported to occur as much as 10,000 feet below the current ground surface. Over geological time, the low, flat parts of the valley were occupied by lakes during pluvial periods. Ancient layers of dense lacustrine deposits (shown as the horizontal black lines in Figure 1) were



An alkali meadow in Owens Valley



**FIGURE 1. Schematic cross section of Owens Valley, showing valley floor and alluvial fan sediments and water flow characteristics. The Sierran slopes efficiently drain water to Owens Valley basin every spring and summer. In the absence of human intervention, the groundwater level in the basin would remain close to the surface throughout the year and from year to year, because the only escape for this water was plant transpiration. The black lines under the valley floor represent layers of impermeable deposits that constrain groundwater movement.**

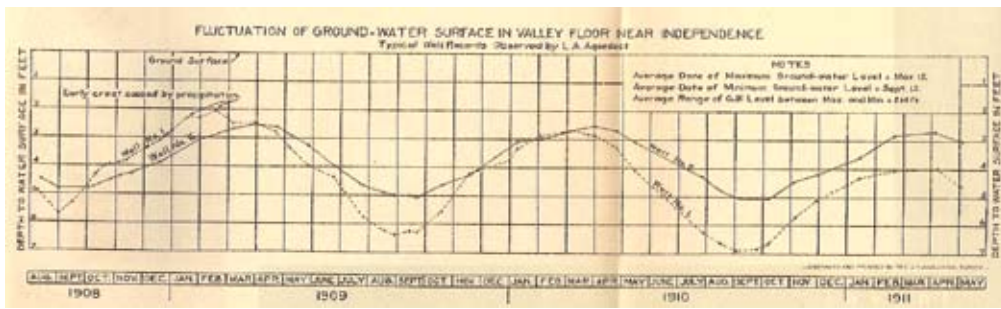


FIGURE 2. Graph photocopied from Lee (1912) showing natural seasonal water table fluctuations, from 2 to 7 feet below ground surface, as measured in two observation wells beneath Owens Valley alkali meadow from August 1908 to May 1911. For centuries before LADWP began exporting pumped groundwater to the City of Los Angeles, the groundwater table remained within reach of grass roots, even during droughts.

interspersed with coarser sediments, which periodically flowed to the valley floor. Then and now, the entire valley fill is saturated with water, and because the water doesn't drain from the Owens basin, the valley floor exhibits low hydraulic conductivity.

Upslope (Figure 1), the shrub-dominated alluvial fans along the Sierran escarpment are predominantly composed of coarse, poorly-sorted sand, gravel, and rock. Water from rain and snow flows from the high mountains into the porous alluvial fan material, where flow toward the valley floor continues beneath the surface. Precipitation that falls on the massive alluvial fans is also captured and channeled, over the surface or under it, downslope to the valley floor. Water tables under the alluvial fans are too deep, and annually too unpredictable, to support anything but a low cover of desert shrub species.

An abrupt change in hydrology and ecology occurs at the toe of the Sierran alluvial fan (Figure 1). When snowmelt water approaches the saturated, ancient lake-bed sediments of the valley floor, flow rates decrease and the change in hydraulic conductivity at the fan/fill contact zone results in resistance to water flow. Water thus backs up, or "mounds," at the contact, creating a zone of shallow groundwater (i.e., water close to the surface). The hydraulic engineer Charles H. Lee observed this mounding effect in 1912 and referred to the area as the "backwash" zone; more recently it has been labeled the "transition zone" (Figure 1) (Hollett et al. 1991; Danskin 1998). Throughout Owens Valley, groundwater-dependent alkali meadow communities are encountered abruptly at the transition zone, where they have persisted for eons, deriving sustenance from the predictable shallow groundwater from annual snowmelt recharge.

Lee (1912) astutely noted that grass-dominated meadows occurred where water tables were 8 feet or shallower. He further documented that groundwater within 8 feet of the surface occurred all along the toe of the Sierran alluvial fan and across the valley floor. Lee showed that the groundwater hydrology throughout this zone exhibited a seasonal fluctuation pattern that remained

constant and predictable from year to year (Figure 2). By taking monthly measurements in numerous observation wells, he showed that water tables were drawn down, gradually, from April through September, as the valley's herbaceous groundwater-dependent vegetation absorbed and transpired the water during its growing season. Then, as cold weather set in and plants entered winter dormancy, transpiration ceased and water tables began a recovery phase, October through March, driven by flow processes shown in Figure 1. The water table rose until temperatures induced plant growth at the onset of spring, when meadow vegetation once again drew upon groundwater for sustenance. Lee understood that hydrology and vegetation went hand-in-hand in the arid Owens Valley.

Organisms evolve; here it can be reasoned that an entire ecosystem was the result of natural selective forces. The scientific literature shows that, as the climate east of the Sierra crest changed from wetter to drier from the Pleistocene into the Holocene, increasing aridity resulted in extirpation and upward migration of tree species and the proliferation of desert shrub species. Meadows in Owens Valley were places where the more water-loving, predominantly herbaceous, species held ground as the climate changed. These species found a dependable water source near the valley floor. Declining precipitation and high evaporative demand likely resulted in further species losses as soils grew more saline, creating new stresses. Nevertheless, the shallow groundwater areas would have provided suitable refugia for non-woody perennial species that could access and use groundwater as a primary water source.

Evidence that alkali meadow habitat has persisted in Owens Valley for thousands of years comes from the presence of a number of locally or regionally endemic species that evolved in situ. Plant species such as *Sidalcea covillei* and *Calochortus excavatus*, the rare plants I monitored each spring, and animals such as Owens Valley Vole, *Microtus californicus* ssp. *vallicola*, occur only in alkali meadow habitats of the Owens River watershed. A phylogenetic analysis of the genus *Sidalcea*

showed that speciation leading to *S. covillei* is probably relatively recent and could be due to geographic isolation (Andreasen and Baldwin 2003). Hydrologic isolation of the Owens River watershed since about 11,800 years ago, or perhaps even longer (Bacon et al 2006), resulted in other endemic species or subspecies differentiating from nearby relatives. Locally endemic fish (e.g., Owens Pupfish, *Cyprinodon radiosus*) and invertebrates (e.g., Owens Springsnail, *Pyrgulopsis owensensis*) require constantly wet or moist conditions. They are thought to persist in areas that have been perennially wet since first being isolated (Sada et al. 2001). The fact that full or partial speciation has occurred among several life forms suggests both a long period of isolation from congeners and that suitable habitat, here in the form of a continuous water supply, has existed for the taxa throughout the millennia of physical isolation.

When white settlers arrived in the arid Owens Valley, the ground beneath the valley floor was saturated with water. That water had few outlets: It flowed from springs, it seeped into the Owens River and flowed to Owens Lake where it evaporated, and it was transpired by plants. Prior to water exports from the valley, deluges and droughts affected conditions at the land surface, but had little effect on water amounts stored in valley floor aquifers. Drought on the valley floor (defined as multi-year stretches of below-average precipitation) primarily manifested itself at the land surface with diminished spring and surface water flows, reduced seasonal growth of vegetation, and perhaps shrinkage in the surface area of lakes and ponds. Although the depth to the water table on the sides of Owens Valley, beneath the shrub-dominated alluvial fans, would fluctuate depending on prevailing weather conditions, the water table beneath the valley floor would remain static and thus dependable habitat for meadow species. In contrast, heavy precipitation caused flooding, increased spring and creek flows, and probably expansion of lakes and ponds. Many are surprised to learn that, when not affected by human manipulations, water tables on the valley floor respond hardly at all to years with massive runoff or to periods of drought; they simply decline a little bit with plant transpiration in the spring and summer, then recharge as usual during the dormant winter months.

The regular fluctuations shown in Figure 2 are reminiscent of a heartbeat. The pattern signals a viable habitat, enduring the seasons, droughts, and blizzards, and providing refuge for species that otherwise would have no chance of surviving on rainwater from the sky. Meadows are a gift from the past, populated by species that have persevered.

*Part 3 of this series will describe how water tables have been altered by groundwater pumping, and how meadows have responded to the alteration.*

*For the 7 references cited in this article, see [www.ovcweb.org/OwensValley/Flora.html](http://www.ovcweb.org/OwensValley/Flora.html).*

# OVC Mission

OVC is a non-profit citizen action group dedicated to the protection, restoration and sustainable management of water and land resources affecting the Owens Valley. The Committee oversees compliance with the implementation of appropriate water management policy, educates the public, encourages participation in local government, and advocates an inclusive and open decision-making process.

# OVC Goals

1. "Watchdog" the 1991 LTWA between Inyo County and L.A.
2. Oversee the implementation and management of the Lower Owens River Project (LORP).
3. Educate the public and promote its involvement with water issues.
4. Seek a dual use designation for dust control water at Owens Lake for wildlife as well as dust.



*Peter Knapp*

# YES!

I would love to join the Owens Valley Committee and help with protection, restoration and sustainable management of water and land resources in the Owens Valley.

- \$25            Speckled Dace
- \$50            Tui Chub
- \$100          Owens Pupfish
- \$250          Brook
- \$500          Spring
- \$1000        Aquifer
- Other

Name \_\_\_\_\_

Address \_\_\_\_\_

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Volunteer Skills \_\_\_\_\_

## OWENS VALLEY COMMITTEE

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