

HOW TO SAVE A DYING MARSH

Restoring critical habitat for the endangered Amargosa Vole

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Wetlands, in the Mojave Desert? When we tell people we are working to protect and conserve the endangered Amargosa vole and its critical wetland habitat, this is the first question we are often faced with. The answer to that question is, “Yes! Wetlands in the Mojave Desert!”

Though folks often think of deserts as incredibly dry, rather inhospitable places, the Amargosa Wild and Scenic River proves that desert ecosystems can be filled with life. Groundwater from the Death Valley Regional Aquifer generally flows southward and eastward from the Nevada National Security Site and the Spring Mountains toward Death Valley, until the water finally pops up along a shift in the underlying geology and forms a string of beautiful spring-fed wetlands with surface flows throughout the year. These wetlands form a hotspot of biodiversity and provide important habitat for coyotes, bobcats, migratory birds, wetland plants, several species of pupfishes, and the Amargosa Vole.

The Amargosa vole (*Microtus californicus scirpensis*), a federally and state listed endangered small mammal, inhabits these three-square bulrush (*Schoenoplectus americanus*) dominated wetlands

Three-square bulrush (*Schoenoplectus americanus*) in bloom. Three-square bulrush dominates Amargosa wetland ecosystems and provides a primary source of food and cover for Amargosa voles, as well as important habitat for migratory birds and other desert wildlife.

along the Amargosa Wild and Scenic River near Tecopa, CA. The vole is completely dependent upon bulrush, and its subspecies name even reflects that dependence. In an effort to reverse the population decline of the Amargosa vole, the Bureau of Land Management (BLM), UC Davis, California Department of Fish and Wildlife (CDFW), US Fish and Wildlife (USFWS), US Geologic Survey (USGS), UC Berkeley, the Amargosa Conservancy and Shoshone Village partnered to form the Amargosa Vole Team, implementing long-term population monitoring, a captive breeding program, habitat monitoring and adaptive management actions to restore declining habitat, and conserve and protect the existing vole population.



DON PRIESLER, UC DAVIS

One of the Amargosa voles (*Microtus californicus scirpensis*) being raised as part of the captive colony at UC Davis

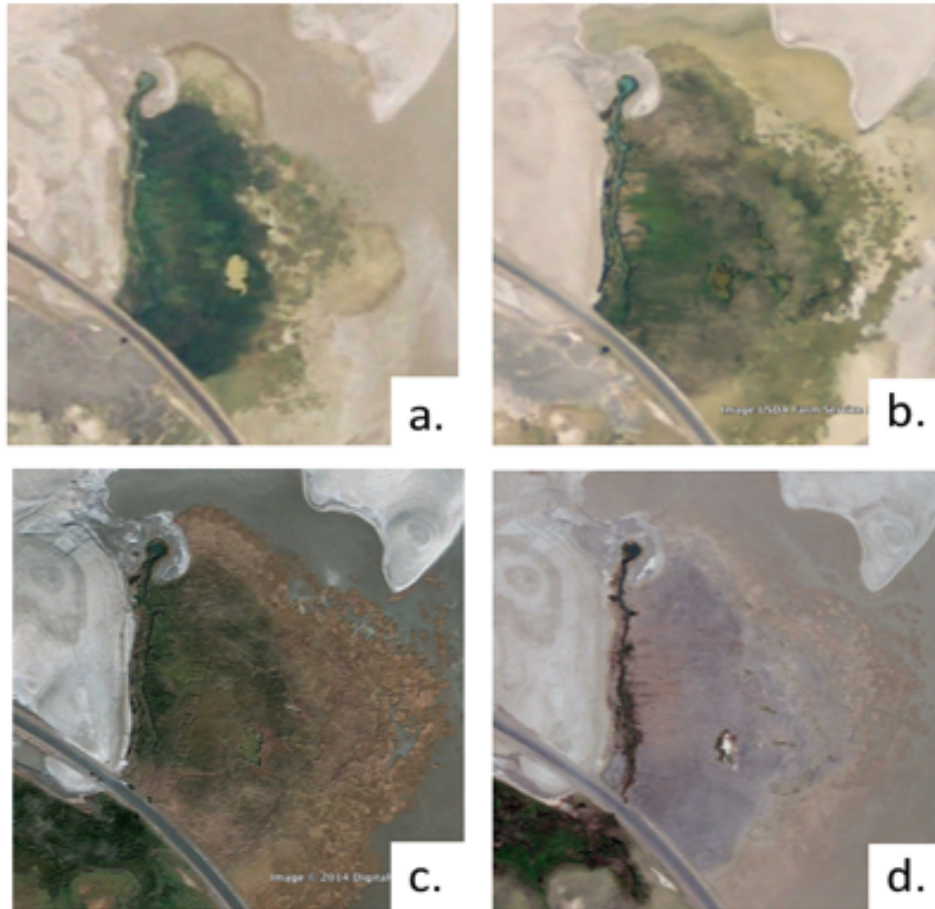
Harsh drought conditions in California over the last few years, paired with long-term water management issues in the area have dramatically reduced the quality of habitat for the Amargosa vole and other species in these wetlands. One habitat patch (Marsh 1), which once housed up to 80-90% of the entire known population of this species, was hit particularly hard by these stressors and experienced a major die-back by 2013. Because this marsh housed such a large proportion of the entire population, efforts to restore this particular habitat became critical.

Investigations into the plant and marsh ecology of the vole habitat started in earnest in 2014. Studies conducted by UC Davis doctoral student Stephanie Castle showed that not only was the marsh very limited by water, but the shift in groundwater conditions and hydrology allowed dead plant litter from this stressed marsh to accumulate and form a dense mat which prevented new bulrush from growing. Over time, this impenetrable layer of litter caused the plant community to decline further and further, eventually resulting in marsh collapse.

“These wetlands form a hotspot of biodiversity...”

Preliminary experiments showed that removing the accumulated litter significantly promoted live plant growth, and if you supplemented water in addition to litter removal, the result was doubled! Over the course of 2014-2015, small test plots of bulrush litter were removed from the marsh and efforts were made to manage the water level in the marsh as well.

But while the grand vision was to restore the entirety of Marsh 1 for the vole, restoration efforts were constrained by the need to safeguard any voles remaining in the degraded habitat. Because the only remaining voles resided in a narrow strip of habitat along the



Satellite images showing the die-back of Marsh 1 between (a) 2005, (b) 2009, (c) 2010 and (d) 2013. Water source and spring run north-south along edge of marsh. Image (d) represents degraded state of Marsh 1 prior to any restoration efforts.

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creek, water levels could only be raised by centimeters at a time. Eventually, understanding the importance of this marsh for the overall health of the vole population, and the limits to restoration of the habitat imposed by the animal residents themselves, the interagency Amargosa Vole Team formulated a detailed plan to restore the entire marsh while minimizing impacts to the the few remaining resident voles.

With cooperation and approval from the BLM, USFWS, and CDFW, restoration of Marsh 1 could begin in earnest! First, the few remaining voles in the degraded marsh were translocated to healthier marshes nearby, so they wouldn't be impacted by restoration efforts. Pre-restoration monitoring of the marsh was performed, so researchers could compare conditions before and after their restoration efforts. Employees from CDFW (Bishop and Rancho Cordova offices), the Amargosa Conservancy, and other friends of the vole team volunteered their time and HARD work over several days to help clear the marsh of the dense litter layer by hand. The restoration volunteer crew started with the sunrise each day, trudging back and forth through the marsh gathering enormous piles of dead litter

and removing it from the marsh. Because the marsh sediments are so soft, all of the material needed to be cleared and removed by hand.



SCOTT HOFFMANN, USFWS

Left: Volunteers Ceal Klingler and Hilary Parish (CDFW) removing and hauling dead bulrush litter out of Marsh 1 by hand. Right: Stephanie Castle (UC Davis) and Nicholas Shirkey (CDFW) oversee disposal and transport of litter material offsite with assistance from the Inyo County Road Department and the Bureau of Land Management.

In the end, with an enormous pile of litter removed from the marsh, the BLM along with the Inyo County Public Works and Road Department helped to move the material offsite, and the team was ready to increase the water level of the marsh. Steve Parmenter (CDFW) concocted and installed an adjustable standpipe to raise or lower water level in the marsh according to management needs. After restoration work in the marsh was complete, that water level was raised to allow flooding across the entire marsh to promote regrowth of bulrush in newly thinned conditions.

With two months passed since the restoration work was completed, huge changes in Marsh 1 can already be seen. Green bulrush shoots are poking through the soil and growing with unexpected vigor! In areas where bulrush rhizomes are slower to re-sprout, blankets of seedlings beginning to flourishing. Though the results of restoration are above and beyond what the team's



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Views of lush bulrush regrowth in Marsh 1, two months post-restoration.

expectations for year 1, progress must be monitored through the year. Summer temperatures can be brutal in the Mojave, but water levels and marsh health will be monitored through the season. Additionally, the standpipe that allowed the restoration team to re-flood the marsh will also allow them to further adjust water levels in the marsh as needed. Monitoring and adaptive management of the habitat will be ongoing over the next year or two to optimize this important marsh and help keep the overall ecosystem and the Amargosa vole population healthy



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Views of Marsh 1 (a) immediately following restoration work 1; dark brown patches show newly exposed marsh sediment after removal of bulrush litter, and (b) marsh regrowth after only 2 months post-restoration.

The cooperative team, including federal and state agencies, universities, non-profits and private partners, continues to work together to complete population surveys, habitat monitoring, habitat restoration, enhancement and protection, and other important research in support of the vole. Join us in celebrating this major milestone in the conservation and protection of this charismatic desert mammal, the Amargosa vole.

About the team: Stephanie Castle (Doctoral Student of Ecology, UC Davis) and Steve Parmenter (California Department of Fish and Wildlife, Bishop) led this habitat restoration. They are two of the members of the Amargosa vole team working toward conservation, protection and restoration of the Amargosa vole and its habitat. Other restoration team members include Janet Foley, Risa Pesapane, Arielle Crews and Alexa Lindauer from the School of Veterinary Medicine at University of California, Davis, Deana Clifford and Austin Roy from the California Department of Fish and Wildlife (CDFW), Chris Otahal and Russell Scofield from the Bureau of Land Management (BLM), partners at USFWS,

and collaboration from the Amargosa Conservancy. Funding for this project was provided by BLM through a variety of sources (California State Office and Washington Office through the Soil Water Air, Threatened and Endangered Species and NLCS programs) and CDFW (Drought Response Implementation Funds). All data will become freely available and results published in peer-reviewed journals or as government reports.

More information can be found at: http://www.vetmed.ucdavis.edu/foley_lab/vole/index.cfm