

# Grazing to Biodiversity



PHOTO BY JAYMEE MARTY

**While some considered cattle grazing an adversary of biodiversity, a recent California study on cattle grazing in vernal wetlands says otherwise.**

by **Ed Haag**

**C**entral California's vernal wetlands are considered by many in the scientific community as one of the most threatened ecosystems in the continental United States.

Designated by the U.S. Fish and Wildlife Service (FWS) as critical habitat for threatened and endangered vernal pool species in 2003, approximately 740,000 acres

in 30 California counties and one Oregon county were affected by the decision.

The designation, in response to a court settlement with the Butte Environmental Council, which sued the FWS in 2000 for failing to designate critical habitat for four vernal-pool crustaceans, now includes four types of freshwater shrimp (the Conservancy

fairy shrimp, longhorn fairy shrimp, vernal pool tadpole shrimp and vernal pool fairy shrimp) and 11 plants that depend on seasonally flooded wetlands known as vernal pools.

The FWS lists as the No. 1 threat to the continued existence of these vernal pool species the loss of habitat, especially due to residential or commercial development and lands converted to agricultural uses. Until recently, cattle grazing was lumped in with the latter, but a 2005 study funded and conducted by The Nature Conservancy (TNC), has turned that premise on its head.

"Cattle are usually thought of as a threat to biodiversity," says Jaymee Marty, project ecologist for The Nature Conservancy. "But in regions threatened by exotic species invasion and lacking native wild grazers, however, cattle may produce the type of disturbance that helps maintain diverse communities."

## Systems compared

Marty bases these conclusions on the data she collected from a three-year study on vernal wetlands in the Central Valley of California. The ranch site on which the study was conducted was a 12,000-acre parcel of land in eastern Sacramento County. Flat, with low-lying hills that rise from 165 to 525 ft., the vernal pools encompass roughly one-third of the ranch's lowest elevations.

Because well over 90% of the average annual rainfall of 22 in. occurs between October and May historically, the site has been grazed by cattle from October through June at a stocking rate of one animal unit (AU; cow-calf pair) per acre.

Marty adds that the site has been seasonally grazed for more than 100 years — most recently by the same rancher for more than three decades.

In 2000 she began her study by dividing a portion of the wetlands into 24 separate groups of pools. These groupings were based on soil maps, aerial photographs and available geographic information system mapping of vernal pool occurrence.

During the next three grazing seasons — 2000-2001, 2001-2002 and 2002-2003 — she applied four grazing treatments to the study groups: (1) ungrazed, released from grazing; (2) dry-season grazed: October through November and mid-April through June; (3) wet-season grazed: December through mid-April; and (4) continuously grazed over the entire historical grazing season: October through June.

"Because of the way the study was



PHOTO BY JAYMEE MARTY

► Researchers sample vernal pool for native fauna.

structured, the pools that were grazed continuously were the control,” Marty says. “Then for the ungrazed pools I set up enclosures that completely excluded the cattle from the area.”

For the wet season, grazing cattle were allowed to graze while the pools contained water, and for the dry-season grazing they were allowed to graze when the pools were dry. Electric fencing was used to exclude cattle from the ungrazed and seasonally grazed treatments.

She notes that the stocking rate for all applicable treatments was 1 AU per 6 acres.

### Grazing under microscope

Because the objective of the study was to determine exactly how grazing or a lack of it affected biodiversity in the vernal pool ecosystem, Marty established a set of data collection procedures designed to minimize error.

To monitor species composition in plant communities, she set up a series of permanently marked 35×70-cm (13.7×27.3-in.) quadrants after the pools had dried and the majority of the plant species were flowering (April-May).

“Quadrants were randomly located and sampled along three transects for each pool in three different pool zones,” Marty states in her study report. Each plant species occurring in the quadrant was recorded.

Soil compaction was measured, and Marty established a procedure to assess the relative effect of grazing and non-grazing treatments on native species in relation to exotic species.

When pools filled with water in the fall, Marty took weekly depth measurements at a permanent marker located in the deepest part of each pool. She notes that the weekly presence or absence of water was used to calculate total and maximum inundation period for each pool and the number of dry-down periods during the grazing season.

All pools that held sufficient water were sampled for aquatic invertebrates once in January and once in March of each year. Each one was proportionally sampled based on the surface area of water in the pool estimated in the first year of the study with a global positioning system.

All aquatic invertebrates and vertebrates were collected, then consolidated and surveyed for threatened and endangered species before preserving the sample in

70% isopropyl alcohol. All threatened and endangered species were recorded, removed from the sample, and returned to the pool.

### Proof in the data

While anecdotal evidence already indicated that removing grazing would negatively affect plant species diversity, the data collected during the three-year study period presented a far more dramatic picture than was originally hypothesized.

In her study abstract, Marty notes that after three years of treatment, ungrazed pools had 88% higher cover of exotic annual grasses and 47% lower

relative cover of native species than pools grazed at historical levels (continuously grazed).

Species richness of native plants declined by 25% and aquatic invertebrate richness was 28% lower in the ungrazed compared with the continuously grazed treatments. Release from grazing reduced pool inundation period by 50% to 80%, making it difficult for some vernal-pool endemic species to complete their life cycle.

“My results show that one should not assume livestock and ranching operations are necessarily damaging to native communities,” she says. “In my central-California study site, grazing helped maintain native plant and aquatic diversity in vernal pools.”

To ranchers and environmentalists in California’s Central Valley this is welcome

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**— Jaymee Marty**

news. Marty points out in the introduction to her study report that in the last 20 years more than one-third of the vernal pool habitat in Sacramento County alone has been lost to development. “It is a matter of urgency that the last remaining vernal pools be protected, and until now the science informing these conservation efforts has lacked an experimental foundation,” she says.

Jack Sparrowk, owner and operator of Sparrowk Livestock, a multifaceted cattle operation with headquarters in Clements, Calif., concurs. He notes that what Marty and The Nature Conservancy have done by conducting their study is provide a set of scientifically based guidelines for the preservation of the remaining vernal pools.

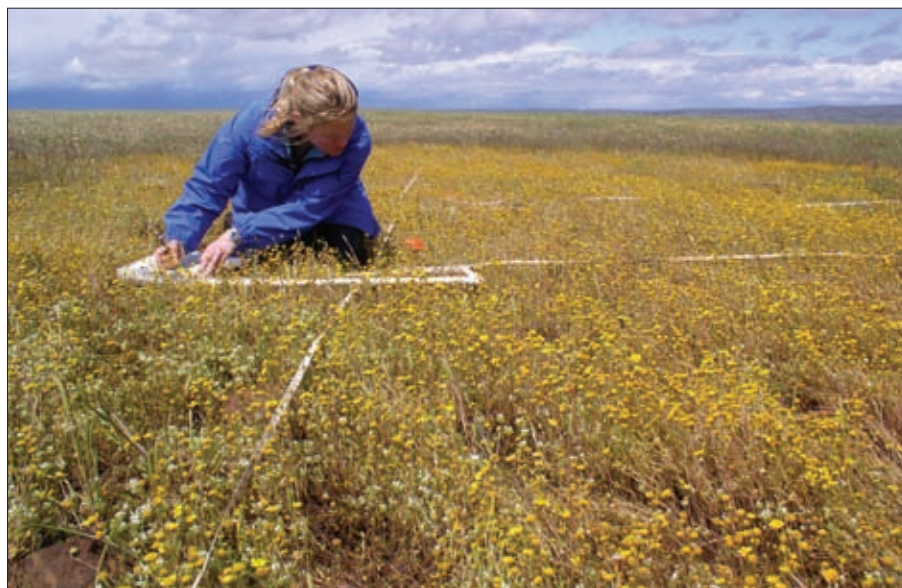
For the past 30 years Sparrowk has leased the 12,000-acre site, first from private owners and then from the conservancy after it acquired the ranch.

“The TNC purchased the property for its conservation value and to preserve the vernal pools,” Sparrowk says. “Because of its close proximity to the city of Sacramento — around 30 miles — had they changed the zoning laws it would have development potential.”

Over the period of its ownership, TNC placed conservation easements restricting development on the property and recently resold it to a private third party. Sparrowk continues to maintain grazing leases with the new owner.

“The ranch has always been vital to my cattle operation,” he says, adding that the conservancy, his cattle operation and the new owner have always been on the same page regarding the preservation of the pools.

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► Researcher takes plant sampling at a grazed pool.

PHOTO BY JEFFREY COX



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### What is going on here?

To understand the role cattle grazing plays in maintaining the native biodiversity in the vernal pool ecology one must consider the hydrology of the site — water being a finite seasonal resource — and how these pools are affected by aggressive nonnative species when the grazers are removed, Marty says.

She points out that the duration that water remains in the pools is cut in half when grazers are removed. Without cattle continuously grazing on the more aggressive species of grasses, they quickly begin to take a dominant role in the ecology, crowding out the less-aggressive native species.

“The changes in hydrology occur because you have more vegetation sucking up the soil moisture,” she says. “The grazed pools were inundated for 120 days while the ungrazed pools were inundated for 60 days.”

Marty notes that this reduction in the time the pools contain water makes it difficult for many of the site’s invertebrate and vertebrate species to complete their life cycle.

She adds that because most native plants in the vernal wetlands are annuals, the buildup of grass thatch that occurs when

grazers are removed can be particularly detrimental to plant diversity.

“Even if the seeds for the annual native plants do germinate, they don’t get much light, so they end up dying,” Marty says.

So if grazing is so important to the biodiversity in California’s vernal

wetlands, what about the argument that these ponds were at their healthiest before the arrival of cattle?

Marty responds to this question in her research article published in *Conservation Biology* in October 2005.

“California grasslands have a long history of extensive grazing dating back to the Pleistocene but were most recently grazed by herds of tule elk (*Cervus elaphus nannodes*) and pronghorns (*Antilocarpa americana*) before livestock introduction in the late 1800s,” she says. “Hence, the pool species are adapted to some level of grazing. In addition, the plant species composition of California Central Valley grasslands



PHOTO BY MIKE EATON

► Vernal pools are an integral part of California’s Central Valley.

has changed significantly since European settlement and is now dominated by exotic annual grasses.”

For Marty and others studying the vernal pools and wetlands of California’s Central Valley, the transition during the last century and a half from wilderness to ranch land is a very definite game changer as it applies to native species diversity.

“A long history of grazing coupled with the altered plant community yields a system that is now adapted to the changes brought about by cattle and one that becomes quickly degraded when cattle are removed,” she says.

