Fire and Water: Environmental History at Pinnacles National Monument

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As anybody who works in the National Park Service (NPS) soon discovers, the objectives of cultural and natural resource managers are often at cross-purposes, or seem to share no common ground at all. However, I would like to discuss an example where these two divisions of the NPS have been able to work together, and where the prospects for future cooperation seem especially bright. I am thinking of the environmental history program, which was initiated within the Park Service's Pacific West Region only a few years ago.

Environmental history is a relatively new discipline in American academia, emerging only just after the Second World War.[1] Its purpose, put as succinctly as possible, is to ground history in place. Environmental historians investigate how the physical environment affects human culture over time, and how our actions in turn affect our environments. An environmental history describes the reciprocal relationship between nature and culture. You can see, then, why this might be an appropriate method for the NPS, where we are concerned with both natural and cultural resources but often fail to appreciate or understand their connection to one another.

Pinnacles National Monument became interested in an environmental history several years ago, when natural resource managers there were confronted with questions they were not able to answer on the basis of scientific data alone. Pinnacles lies within the arid Gabilan Mountains in the central coast range of California, about 120 miles south of San Francisco. The environment is mostly rugged hills dominated by chaparral but the monument also includes valley bottoms where oak woodland and grassland occur. The entire monument lies within the upper reaches of the Chalone Creek Watershed, a mostly seasonal stream which flows south and west to the Salinas River. In the bottomlands of the monument and adjacent Bear Valley, this stream meanders through broad floodplains in braided channels of gravel or cobble with relatively sparse, shrubby vegetation. During summer months, when stream flow diminishes or ceases altogether, standing pools often persist late into the season, creating ideal habitat for breeding populations of many amphibians. During the early 1990s, park resource managers proposed reintroducing to this habitat the foothill yellow-legged frog (*Rana boylii*, a California Department of Fish and Game Species of Special Concern) after finding evidence that this species had been present here as recently as 1940, although it is now no longer found. Nobody knew why it had disappeared. Although the present habitat seemed appropriate for the foothill yellow-legged frog, the likeliest explanation for its demise was environmental change. If the original population had been extirpated as a result of degrading habitat conditions, any efforts to reintroduce the species were likely to fail, because the conditions which limited its success probably still prevailed.

But if the foothill yellow-legged frog's habitat had degraded as a result of human activities, park staff might also be obligated to reverse these changes whether they reintroduced the frog or not, since NPS management policies state that "biological or physical processes

altered in the past by human activities may need to be actively managed to restore them to a natural condition. . . ."[2] If nothing else, the foothill yellow-legged frog was an indicator of changes in the environment which park staff needed to understand in order to guide their management practices. But reliable scientific data on natural processes within the Upper Chalone Creek Watershed only dated back a few decades—to the 1950s at the earliest. This was long after the putative changes affecting foothill yellow-legged frog populations would have occurred. There were no baseline data against which to measure anthropogenic impacts which may have initiated these changes. But park staff had become aware of anecdotal evidence suggesting that such change had occurred, and describing—albeit rather vaguely—conditions which existed in the watershed prior to the frog's disappearance.

For example, local ranching families are almost unanimous in believing that the valley was wetter and greener when the first American settlers—their ancestors—arrived during the middle of the nineteenth century. "In the early days," writes one resident, Bear Valley was "covered with luscious grass and green the year round." Others say the valley used to be swampy in places, with springs rising to the surface. Nowadays, the valley is green only during the winter rainy season. The annual forbs and grasses which constitute its dominant vegetation have usually turned brown by late March or early April when the soil dries up and the creek stops flowing. Although the water table remains relatively high, no springs reach the surface within the valley itself.

Park staff wondered what to make of these local stories. On the one hand, they could dismiss them as idle romanticizations. Or they could take them seriously and investigate the possibilities which might account for such changes. The monument's physical scientist chose the latter alternative and proposed researching the historical record to see if further information could be found. A project request was made to the history division, and eventually I was given the task of researching and writing an environmental history of the Upper Chalone Creek Watershed.

The challenge, as I saw it, was to see whether the environmental changes which local residents claimed had occurred were possible, not whether they had actually happened. What I proposed was a comprehensive account of all past land use practices associated with the study area which might have affected the central question of changing water availability. I began by assuming that the settlers' accounts could be trusted and that conditions within the Upper Chalone Creek Watershed had become drier over the course of the historic period. My objective was to describe a plausible scenario based on known historic events which might have produced the hydrologic changes responsible for the foothill yellow-legged frog's disappearance. Only if the historical evidence would not support such a scenario, could we entirely dismiss the possibility that these changes had occurred as a result of human actions. Since human influence was the single greatest factor affecting change in the natural environment during the historic period, the absence of any anthropogenic cause for hydrologic change would probably mean that such change had not occurred.

In order to test what I considered the most likely scenario, I adopted a methodology combining two very different types of evidence. One, the historical record, is mostly anecdotal in character. It includes everything which has been documented about human activities. Very little of this record directly addresses the natural environment, and practically none

of it contains systematic or scientifically verifiable observation, but it does tell us a great deal about what people were doing at various times and places. Extrapolating from this information, we can deduce how early settlers might have altered their environment. The other body of evidence is analytical. It represents the knowledge which natural scientists have accumulated about the ecology of the local region—its vegetation, wildlife, fire regimes etc. This scientific knowledge provides the principles from which we can interpret the ecological significance of historical events and activities and allows us to infer how these actions might have affected natural habitats within the study area.

The history of land use within the Upper Chalone Creek Watershed predates the period commonly known as "historical" (1769 to present), although most anthropogenic impacts are typically—and mistakenly—associated only with the historic period. This part of California has been occupied by humans for at least 10,000 years, possibly longer. Sometime between 2,000 and 3,000 years ago, the ancestors of the present Ohlone Indians migrated into California's central coast region, bringing with them new technologies which included the processing and storage of durable grains and nuts, especially acorns, which became a staple of their civilization. These innovation allowed them to evolve a complex social structure which was capable of supporting a relatively large population. It also resulted in a more intensive management of the landscape. A subgroup of the Ohloneans, known as the Chalon, occupied the region which now includes Pinnacles National Monument and the Upper Chalone Creek Watershed.

Recent research has shown what nineteenth century American homesteaders could never have known, that the Chalon Indians, like most of their Native California cousins, had actively manipulated the land through a variety of management techniques to create a landscape which uniquely supported their interests.[3] The Chalons' most effective tool was fire, which they had learned to use with considerable skill. Numerous testimonies from early explorers, naturalists, and Spanish colonialists provide evidence of the widespread use of fire in aboriginal California and suggest how and where it was applied. Above all, fire was used to maintain grassland and oak woodland in valley bottoms. It was also used to manage woody vegetation in riparian corridors and kept these otherwise overgrown communities relatively open. Fire was used far more sparingly on the chaparral in surrounding hills and mountains, where the Indians spent less time. The attractive, grassy prairies of Bear Valley in the Upper Chalone Creek Watershed, which the Americans first saw around 1865, were a product of these management practices, but the people who had created and managed them were largely absent by this time. Most of the Chalon had either been inducted into Spanish missions or had died of European diseases by about 1810. Those who survived the mission period were absorbed into European society as ranch hands or mine laborers, with very few returning to their ancestral homelands. When American homesteaders arrived several decades later, they understandably mistook the landscape of the Chalons' homeland for pristine wilderness.

The Americans' own land use practices, learned in more humid environments in the eastern United States and in Europe, would not have preserved the same ecological regime. For instance, the Americans needed to maintain leafy vegetation as late as possible each summer to provide pasturage for their livestock and therefore would not have burned valley

grasslands. Since the Indians were interested in seed rather than leaf (having no livestock to pasture), they burned as soon as they had finished harvesting seeds in late spring. This did no harm to the native bunchgrasses which once probably dominated these environments, since bunchgrasses concentrate their resources in a dense underground root structure safely insulated from the heat of most fires. Fire would have actually stimulated the following year's seed growth by burning off unnecessary chaff and scarifying the grass tussocks' crown tissue. The Americans, however, probably extirpated these perennial grasslands by suppressing the Indian fire regime, by increasing grazing pressure through the introduction of livestock, and by introducing agriculture, which mechanically replaced native grasses with exotic annuals like wheat, barley, and rye.

The American impact on the landscape was markedly different than that of the Chalon. For example, fire was applied relatively frequently within the chaparral by American livestock drovers, who hoped to convert the brush to grassland in order to increase the area of forageable habitat for their animals. But fire was applied far less commonly within the riparian corridors and bottomland valleys, where the Chalon had once practiced their most intense landscape management. Although American homesteaders continued to burn within these bottomlands, they did so in a much more restricted manner, using fire only to burn off post-harvest chaff and slash piles. This was also typically done late in the season. In short, the American pattern of fire use was an inversion of Indian burning practices, both in timing and distribution.

How would this inversion of the fire regime have affected the ecology of the watershed? Might it have reduced water availability to streams and bottomlands? Experiments conducted in the San Gabriel Mountains of southern California within a similar chaparral-dominated habitat during the early twentieth century demonstrated that changes in the vegetational pattern can result in substantial variations in water availability. In one study, after all woody vegetation was removed through fire, average streamflow within the watershed was found to increase by close to 500 percent. Some streams, which had previously flowed only seasonally, now flowed perennially for several years after the burn and did not diminish until native vegetation began to grow back. Later experiments showed that the principal cause of the increased streamflow was the reduction in riparian vegetation, not hillside brush.[4]

Applied to the history of the study area, these findings were significant, because they *did* suggest that the contrasting land use practices of the Chalon and the early American settlers might have accounted for at least some of the hydrologic changes observed by later ranchers. Increased burning within the chaparral probably had a negligible effect, but suppression of burning within the valley bottomlands, and the abandonment of riparian corridors along the mid- to upper-reaches of Chalone Creek and its tributaries, would have had substantial consequences. After the disappearance of the Chalon, the latter region was allowed to revert to wilderness, possibly for the first time in millennia, and remained in this state even after the arrival of American homesteaders in the 1860s. Since these tributary canyons contain substantial amounts of riparian woodland growing upstream of the principal valley bottoms, their re-vegetation might well have contributed to the decline of downstream water availability during the historic period.

This is only one among several changes in land use practice associated with the transition from Native American to Euro-American dominance. Other examples support the same conclusion. The historical documentation of these changes demonstrates that the proposed scenario of diminishing water availability in the Upper Chalone Creek Watershed during the latter half of the nineteenth century is plausible, even if it does not provide a definitive answer to the questions asked by modern physical scientists. This methodology makes it possible for us to work backward through time, reconstructing past environmental conditions based on an ecological interpretation of known historical activities, which the historian can elucidate.

Apart from the implications for greater collaboration between natural and cultural resource managers, environmental history also suggests some provocative conclusions. The history of the Upper Chalone Creek Watershed reveals that the supposedly natural conditions for which the park has been managing are, in fact, cultural artifacts. Up until very recently, most natural resource managers have assumed that the California landscape prior to European settlement in the late eighteenth century was pristine wilderness and could be used as a baseline for determining natural conditions as the object for restoration projects. But historical research suggests that natural conditions may not have existed more recently than 10,000 years before present (and possibly earlier). Climate and other macro-environmental conditions were so markedly different at that time that restoration to this period is essentially impossible. But as the present study indicates, restoration to the conditions prevailing just prior to European contact requires managing for a cultural, rather than a natural, environment, and the implications of this conclusion have not yet been adequately explored.[5]

Endnotes

1. Thomas R. Cox, "A Tale of Two Journals: Fifty Years of *Environmental History*—and Its Predecessors," *Environmental History* 13:1 (2008), 9–40.
2. National Park Service, *Management Policies 2006*, Sec. 4.1.
3. M. Kat Anderson, *Tending the Wild: Native American Knowledge and the Management of California's Natural Resources* (Berkeley: University of California Press, 2005); Jon Keeley, "Native American Impacts on Fire Regimes of the California Coastal Ranges," *Journal of Biogeography* 29 (2002), 303–320.
4. W.G. Hoyt and H.C. Troxell, "Forests and Stream Flow," *Proceedings of the American Society of Civil Engineers* 99 (1934), 1–111; Lawrence Hill and Raymond M. Rice, "Converting from Brush to Grass Increases Water Yield in Southern California," *Journal of Range Management* 16:6 (1963), 300–305.
5. The full study by the author, *Fire and Water: An Environmental History of the Upper Chalone Creek Watershed*, is pending publication by the National Park Service, Pacific West Regional Office, Oakland, Calif.