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## TOWARDS A GREENER FUTURE:

### ARCHAEOLOGY AND CONTEMPORARY ENVIRONMENTAL ISSUES

by Torben C. Rick



The secret is out! Archaeologists have something to say about contemporary environmental issues and the sustainability of our planet Earth. This is not surprising to archaeologists who have long known the importance of deep time perspectives for shedding light on issues ranging from the beginnings of plant and animal domestication and agriculture to the origin of states and political hierarchy. Archaeologists and anthropologists working from an ecological perspective also have helped illuminate the eternal questions: Who are we? Where did we come from? Why do we exist?

Yet archaeological contributions to contemporary environmental issues are far from mainstream. Archaeologists continue to fight an uphill battle to get environmental archaeology recognized by ecologists, biologists, resource managers, and especially the general public.

The tide, fortunately, is turning. There are new collaborative studies between archaeologists and ecologists; ecologists increasingly recognize the value of long-term historical perspectives in their own work; and collaborative environmental funding initiatives from the National Science Foundation and other agencies are growing in number. Today we find archaeologists' publications appearing in ecological or interdisciplinary scientific journals. Such publications provide important deep time context for current environmental issues such as global warming.

The public and probably K-12 students and teachers have yet to fully appreciate archaeology's ever-increasing relevance to understanding modern day environmental problems. Jared Diamond's successful book *Collapse* (2005) helped increase knowledge about archaeological data and its relevance to understanding ancient human environmental relationships.

But for many the relevant questions are not yet completely clear. Can archaeologists provide cautionary tales about the environmental mistakes of ancient peoples? Can they generate information on sustainable ways of living in the past that may help us transcend current problems? Can archeologists provide the context for how environments function over centuries, millennia, or more, which can help us project into the future? The answer is yes, all of the above and more (Costanza et al. 2007; Redman 1999; Rogers 2004).

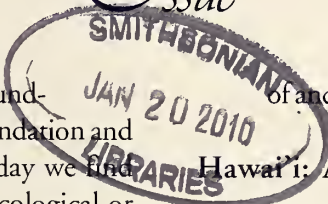
Three case studies—the Hawaiian Islands, France's Rhône Valley, and California's Channel Islands—illustrate archaeology's many contributions to understanding the range of ancient human environmental interactions.

#### Hawai'i: A Human Modified Paradise?

Anyone who has been to the Hawaiian Islands can attest to their incredible natural beauty and their remarkable Polynesian cultural heritage. Some of the most compre-

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hensive studies of ancient human environmental interactions come from Hawai'i and other Pacific Islands.

Once these islands were viewed as a paradise free from human intervention but research over the last several decades has shown that ancient maritime agriculturalists actively modified and degraded Pacific Island land and seascapes (Kirch 2004, 2007). Pat Kirch, a leading Pacific Island archaeologist, and his interdisciplinary team have gathered archaeological and ancient environmental data that improves our understanding of past and present Hawaiian environments, shedding light on how best to manage Hawaiian ecosystems into the future (Kirch 2004, 2007). Kirch and his team have used Hawai'i as a model system for understanding human ecological dynamics. This model demonstrates the interplay of climatic events, human agricultural activities, and landscape transformation in shaping both the social and natural worlds.

Though the initial date of human colonization of Hawai'i is still under investigation, Polynesians probably arrived around A.D. 800. At that time, they likely found a tropical island archipelago populated with forests and birds

that had evolved in the absence of humans and other common predators. Driven by an expanding population of ancient Hawaiians totaling as many as 400,000 people, Hawaiian agricultural and other human activities had a variety of impacts on island landscapes, plants, and animals (Kirch 2007). Human hunting and landscape clearing, for example, caused the extinction of some terrestrial birds. Sediment cores document dramatic alteration of Hawaiian island vegetation communities over the last 1000 years, including widespread burning that resulted in human modified landscapes largely used for agriculture (Kirch 2007: 15).

Intensification of agricultural systems over several centuries, including the use of irrigation, continued to modify and transform the Hawaiian Islands. These changes placed increased pressure on the landscape and influenced sociopolitical developments including the formation of Hawaiian polities. The rise of some Hawaiian island chiefs, for instance, correlated with environmental variables, with some leaders seeking to increase agriculture and other resources to offset famines and other downturns (Kirch 2007: 22).



Ancient dryland agricultural field system with embankments as visible from the cinder cone of Pu'u Kehena in Kohala district, Hawai'i (Photo by Patrick Kirch).

Rat remains in Hawai'i and elsewhere in the Pacific Islands help tell us that not all human environmental impacts are intentional or direct. Rats, after all, probably were unintentionally introduced as stowaways on ancient Polynesian canoes. On Hawai'i and other islands, rats likely were responsible for the extinction of some bird species by causing a decline in dry-land forests through consumption of massive quantities of seeds, fruits, and seedlings, and also by preying on eggs and young birds.

The Hawaiian data illustrate important lessons for today. First, humans have profoundly influenced Hawaiian ecosystems for centuries or even longer. Any attempt to understand Hawaiian ecosystems must take



this into account. Recent environmental patterns in Hawai'i are very different from those in deeper time, reflected in an archaeological record ripe with examples of extinction and landscape alteration.

Another lesson comes from the perils of unchecked population growth that resulted in famine, environmental degradation, and concomitant social and political changes—difficult issues that are relevant but rarely addressed in today's densely populated world (Kirch 2004).

### **Roman Land Degradation: Southeastern France**

If you travel to the Rhône Valley located in French wine country, you will find an area that has sustained human occupation for millennia. Not surprisingly, you also will find an important archaeological record of human interactions with local ecosystems. This record has illuminated long-term patterns of landscape degradation analyzed by Sander van der Leeuw and his colleagues in the ARCHAEOMEDES project (van der Leeuw 2000; van der Leeuw et al. 2004).

One of the most dynamic and complicated periods of Rhône Valley history was the Roman period. Spanning some six centuries—from 50 B.C. to the sixth century A.D.—the Rhône Valley was brought into the broader globalized economies of Europe, Asia, and Africa that transformed the landscape in new and unique ways (van der Leeuw et al. 2004: 115).

To evaluate the effects of Roman settlement and agrarian systems in the Rhône Valley, van der Leeuw and his colleagues evaluated scores of archaeological sites, soil profiles, Roman maps and other historical documents, along with climate records over a roughly 10,000-year period. The team focused in part on the lessons ancient soils can tell us about the environmental productivity of certain landscapes, their suitability for agriculture, the history of erosion and other causes of landscape degradation, and ultimately how such factors affected human settlement and abandonment.

Initial Roman settlement in the Rhône Valley was rapid. It involved expansion into some of the most desirable settings, followed by a contraction that appeared to

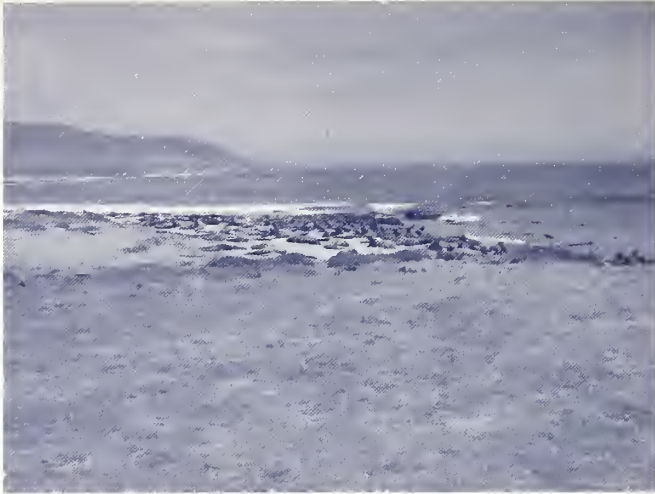
have balanced out the number of people in the valley (van der Leeuw et al. 2004). The Romans brought with them an economy and agricultural system focused on grapes, olives, and wheat. They relied on crops that would be economically lucrative, investing heavily in the clearing, draining, and irrigation of areas that had thus far been viewed as marginal. Wine production was particularly intense, comparable to the agribusiness of the 19th and 20th centuries (van der Leeuw et al. 2004:122).

A period of contraction and famine during the second and third centuries A.D. resulted in a social crisis, largely because the Roman system of agriculture was fragile and only viable during periods when climatic conditions were favorable (van der Leeuw et al. 2004). Heavier rainfall than expected caused widespread erosion and system disruption, part of a complex interplay of human-induced degradation, climate change, and political factors in an increasingly globalized market system. Roman activities and land use pushed the environmental and social system close to its limits of productivity. In the Roman agricultural system, the landscape was dependent on human intervention to function properly. This undermined the system's resiliency and its ability to adapt in the face of widespread change (van der Leeuw 2000; van der Leeuw et al. 2004).

Like the Hawaiian case study, the ARCHAEOMEDES project demonstrates that environmental variables cannot be viewed separately from social and political developments since these and other factors are intricately intertwined. Moreover, these analyses suggest that today's Rhône Valley ecosystems are the result of long-term human settlement and climatic characteristics. To effectively understand these ecosystems, they must be viewed on millennial as well as shorter time scales of a few decades or less.

### **California's Oceans**

Devastated by overfishing, nutrient enrichment, pollution, climate change, and other factors, our oceans are in a state of crisis with many ecosystems and fisheries at or near collapse. The impending threats to earth's oceans and an increasing awareness of the antiquity of human exploitation of coastal areas have prompted archaeologists to explore long-term human exploitation of marine ecosystems



Elephant seals on the beach adjacent to a badly eroding site on San Miguel Island, California. Sites in the area have produced few to no elephant seal bones over the last 10,000 years. However, they are the most abundant animal on the island today. Photo courtesy Torben Rick

and the ways in which these studies can help inform present day issues.

In California, I have worked with an interdisciplinary team investigating a continuous archaeological record of human exploitation of marine ecosystems on the Channel Islands spanning some 10,000 years (Braje 2009; Erlandson and Rick 2010; Rick and Erlandson 2008). Our research demonstrates that the Channel Islands' land and seascapes have been actively shaped by the islands' ancient hunter-gatherers. These men and women harvested a variety of marine and terrestrial resources and engaged in a sophisticated exchange system with the coastal mainland.

One of the hallmarks of California's Channel Islands today is the presence of over 150,000 seals and sea lions from six different species. These sea mammals breed and haul out (rest on the shore) in one of the largest colonies south of Alaska. Today, northern elephant seals and California sea lions, followed by northern fur seals, are the most abundant and conspicuous seals and sea lions on the islands with smaller numbers of harbor seals. Guadalupe fur seals are rarely seen. In contrast, the archaeological record suggests that seal and sea lion populations were comparatively limited for much of the last 10,000 years while

Guadalupe fur seals were the most common species with elephant seal remains rarely identified (Erlandson and Rick 2010; Rick and Erlandson 2008).

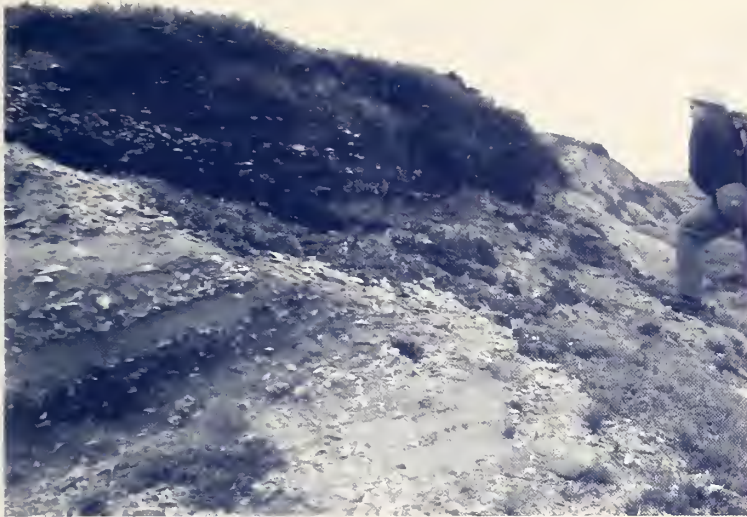
These differences are clearly apparent at Point Bennett on San Miguel Island. In this area tens of thousands of California sea lions, elephant seals, and northern fur seals come to breed every year. Some 400 years ago, however, there was a large Native American village site in the middle of these contemporary breeding grounds. This site contains visible house features, abundant artifacts, and faunal remains dominated by marine fishes with smaller amounts of seals and sea lions. The presence of this village and other nearby sites of even greater antiquity suggests that the current breeding grounds at Point Bennett did not exist just a few centuries ago (Erlandson and Rick 2010).

The disconnect between the ancient and modern abundance and distribution of seals and sea lions shows that ancient peoples strongly influenced prehistoric seal and sea lion biogeography and abundance. The modern sys-



Channel Islands artifacts: beads and microdrills (top); shell and bone fishhooks (middle); projectile points (bottom). Photo courtesy Torben Rick.





Archaeological shell midden on Santa Rosa Island, California. Photo courtesy Torben Rick.

tem simply has no historical baseline and appears to be the result of contemporary conservation and protection efforts. This case also demonstrates the incredible resilience of the system, as these animals recovered from the verge of extinction (caused by the 19th century's global fur and oil trade) in just about a century.

Ancient Channel Island peoples also reduced shellfish size, abundance, and probably age profiles through intensive predation that began over 10,000 years ago. Similar to the case of the Hawaiian rats, the human introduction of dogs, and possibly the island fox, also severely altered sea bird breeding habitats. Conversely, ancient human hunting of sea otters may have enhanced and improved the productivity of abalones, urchins, and other shellfish species.

These examples demonstrate that ancient Channel Island seascapes (and landscapes) were shaped by human activities for millennia and, like Hawai'i and the Rhône Valley, are riddled with the ancient ecological footprints of past peoples. Perhaps most importantly, and surprising to some, these data illustrate that hunter-gatherers, not just large agricultural societies, had a strong influence (both positive and negative) on the ecosystems they inhabited, including the oceans.

### Using the Past to Improve the Future

Archaeologists around the world are carrying out sophisticated interdisciplinary studies on the ways ancient peoples, from hunter-gatherers to imperial agriculturalists—and everything in between—have influenced the environments where they lived. Increasingly, archaeologists are rising to the challenges of contemporary environmental crises by providing information on long-term human environmental interactions and the ways such knowledge can inform contemporary issues. While archaeology's contribution to contemporary environmental issues continues to unfold, a few trends are emerging.

As we move into a new era when urgent environmental issues like climate change, extinction and biodiversity loss, and air and water quality seem to be taking a backseat to healthcare reform, terrorism, and the global economic downturn, it is important to remember that environmental issues cut across virtually all other political and social matters. This lesson is often pushed aside, glossed over, or championed only by a minority. The archaeological record illustrates all too well the instability that unchecked environmental degradation can have on human society.

Archaeology, however, can provide much more than just cautionary tales. The three case studies demonstrate that we cannot understand present day environments, ecosystems, or biological organisms without documenting their long-term histories and relationships with the people who lived and thrived in those environments for millennia.

While biologists and others work to restore degraded ecosystems to their "natural" state, archaeology illustrates that this natural state has been heavily influenced by ancient human activities. In fact, ecological baselines and benchmarks used to guide contemporary restoration and management have changed dramatically over time. As the Hawai'i, Rhône Valley, and California cases demonstrate, knowledge of how ecosystems change in light of human activities and climatic events over centuries, millennia, or more can help us better understand, predict, and prepare for the future's environmental uncertainty.

Archaeological studies also demonstrate that there has been no singular trend in the past towards human over-consumption and environmental degradation or ancient harmony and management. Long-term archaeological perspectives erase any notion that nature, especially during the last 10,000 years, can be separated from human actions and impact.

We must show the next generation of archaeologists, anthropologists, and the public that archaeology has much to tell us about the present and future state of the Earth's environments. Our greatest challenge is to continue to make archaeology relevant and meaningful to the modern world. Critical to this endeavor's success are university undergraduate and secondary school curricula, as well as museum exhibits and outreach programs that focus on the archaeology of long-term human environmental interactions. We must move beyond academia to engage teachers, students, and the general public on the importance of understanding the human past to promote a greener future.

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## MEET ARCHAEOLOGIST TORBEN RICK



Torben Rick. Photo courtesy Marcia Bakry

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