Human perceptions of nonindigenous species will ultimately drive public policy, and given the large role these species play in our conservation strategies, those perceptions should be taken seriously. Associated with the experience of nonindigenous species are perceptions of place and ecological history. Lodge and Shrader-Frechette (2003) clear up some recent confusion regarding invasive species, and they conclude that “Despite apparent disagreements among scholars, little real disagreement exists about the occurrence, effects, or public-policy implications of nonindigenous species.” Nevertheless, their essay is neither clear nor critical with regard to nonindigenous species and the ecological history of North America. This is not a moot point, but central to conservation and restoration strategies.

Lodge and Shrader-Frechette reaffirm that there is now widespread evidence implicating invasive species in the wholesale reduction of biodiversity (e.g., Groombridge et al. 1992; Wilcove et al. 1998; Roemer et al. 2002). Action against invasive species is justified given the changes they induce in ecosystem function, their link to biodiversity loss, and the high value placed on the uniqueness of regional biota. The authors maintain that “…one of the greatest public policy challenges is the development of accurate, precise, generally applicable, and widely accepted risk-analysis protocols that are capable of distinguishing invasive species from the larger pool of nonindigenous species.” To meet this challenge, a detailed understanding of ecological history is a requisite. The deep history of North America, the last 40,000 years (i.e., within the range of routine radiocarbon dating), and its role in invasive species management and policy has been largely ignored by the scientific community.

Lodge and Shrader-Frechette acknowledge that North America has experienced natural biotic exchanges before the recent past and offer three qualifications of the “naturalness of invasions.” We agree that invasions in deep history do not preclude management of contemporary invasions, but we disagree with two points. Our first disagreement entails extinctions. Lodge and Shrader-Frechette affirm that “The human-induced rate not only of species extinction but also of species invasion has increased exponentially, in concert with the exponential growth of the human population over the last few hundred years.” This is true for invasions, but not for extinctions. On tropical islands of Oceania, for example, humans and their commensals (e.g., rats and cats) continue to drive species to extinction today. However, their prehistoric impact between 1000 and 3000 years ago is unparalleled: the extinction of over 8000 populations of birds and as many as 2000 species of birds (Steadman 1995; Worthy & Holdaway 2002; Steadman & Martin 2003). Given the mounting evidence favoring cultural models of Pleistocene extinctions (e.g., MacPhee 1999; Miller et al. 1999; Alroy 2001), this insular scenario likely illustrates the norm instead of an exception. These extinctions are no more or less “natural” than contemporary extinctions; rather, getting the ecological history right is central.

The deep history of North America is commonly ignored in conservation strategies. For tens of millions of years, a rich assemblage of large herbivores and carnivores evolved in the Americas. This diversity was largely extinguished about 13,000 years ago, coincidental with the arrival of the Clovis Culture. Whatever the cause—cultural, climatic, or both—25 of 39 genera of North American large mammals disappeared. Carnivores and large herbivores often play pivotal roles in ecosystems (Owen-Smith 1988; Estes et al. 1998; Terborgh et al. 1999), as likely did the Pleistocene megafauna of North America (Janzen & Martin 1982). The magnitude of that ecological loss warrants bold new thinking about restoration in the Americas.
In the process of returning the California Condor (Gymnogyps californianus) to the Grand Canyon, should we also return the kinds of animals the birds once fed on: equids, camelids, mountain goats, and proboscideans? Radiocarbon dates indicate that condors last soared over Grand Canyon more than 10,000 years ago, bringing the teeth of mammoths (Mammutus sp., for phosphorus) and bones of horses (Equus sp.), camels (Camelops sp.), and Harrington’s extinct goats (Oreamnos harringtoni) to their nestlings (Emslie 1987). Surrogates for some of our lost megafauna are available for restoration (Martin 1999; Martin & Burney 1999; Flannery 2001). Two potential surrogates are already present: horses and mountain goats (Oreamnos americanus). Both wild horses and burros range the Hualapai and Havasupai Reservations of Arizona, and mountain goats were recently introduced into southwestern Colorado. Given that North America is both the evolutionary home and the diversification center of Equidae (MacFadden 1992), should horses be managed as invasive or native species? Regardless of the answer, acknowledging and communicating to the public the deep history of North America and its ecological significance should inform management and policy decisions and will ultimately enhance appreciation of biodiversity.

Our second disagreement with Lodge and Shrader-Frechette (2003) involves conservation benchmarks. They note that “The arrival of Europeans on North America marked an ecologically significant time of rapid increase in human population, travel, and commerce.” During that same time, introduced Eurasian diseases depleted Native American populations by as much as 90%, perhaps releasing our late-Holocene fauna from human hunting pressure (Diamond 1997; Martin 1999; Kay & Simmons 2002). Ignoring deep history, planners and management agencies typically turn to Columbus and the year 1492 for a restoration baseline, thereby discounting the significant, earlier ecological impacts of Native Americans (Wagner & Kay 1993; Martin & Szuter 1999; Kay & Simmons 2002). The arrival from Asia of human hunters, known as the Clovis Culture, at least by 13,000 years ago also marked a major ecological event. At this time the last un hunted landscape in the Americas disappeared (Martin 1999). The arrival of the Clovis, recognizable by the distinctive points found with remains of mammoth, constitute a benchmark for managers no less monumental than the arrival of Columbus. From a management perspective, our benchmarks dictate who is native and who is not.

Horses illustrate our point of conservation benchmarks dictating natives and non-natives. From a genetic, evolutionary, and ecological perspective, horses are native to North America (Berger 1986; MacFadden 1992). They have been present for at least the last 50 million years and were abundant and speciose until they disappeared around 13,000 years ago. Should we remove feral horses as invasive species from our wildlands in accordance with U.S. Executive Order 13112 (U.S. Executive Office 1999)? Or should we view the passage of the Wild Free-Roaming Horses and Burros Act of 1971 (16 U.S. Code §§ 1331–1340) as an inadvertent attempt by the U.S. Congress to protect our neglected Pleistocene fauna? Such views, both of the public and land managers, hinge on both ecological and historical insight.

The ecological impacts of nonindigenous invasive species are realized and widespread. Such wholesale impacts are a call for action. Perhaps not realized, by either the public or the scientific community, are the techniques and actions available to curtail the effects of invasive species (Veitch & Clout 2002; Donlan et al. 2003). Also unrealized is the ecological history of North America. Nativeness, place, and history are central to the science, strategies, and aesthetics of biodiversity. Currently, a post- Columbian bias blinds us from a paleoecological view of North America, a vista with widespread policy implications. The attention of the public, long enchanted with dinosaurs, needs to shift to our indigenous Pleistocene patrimony. We lost and cannot replace the Ornithiscia. We can resurrect and along the way help save the Proboscidea.

Literature Cited