

Bad Abstractions: Response to Sullivan

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Sullivan (2009 [this issue]) correctly observes that lay and environmentalist perceptions of cattle ranching in the western United States, and in the Southwest in particular, have changed dramatically in the past decade. Long considered a scourge, ranching is now widely viewed, at worst, as the lesser of two evils (the greater evil being subdivision), or, at best, as a means of realizing conservation objectives such as ecological restoration, habitat preservation, and open-space protection (Knight et al. 2002). The questions Sullivan poses, moreover, are important ones: Is this shift in perceptions justified? Does it rest on solid scientific evidence? As he puts it, “is it a defensible position for conservation biologists?” Sullivan is dubious, based both on his own observations and on peer-reviewed research.

Although one could cite other studies that complicate or confute his specific claims (of which more below), a prior issue should be addressed first: Are the categories Sullivan employs capable of yielding answers to the questions he raises? I argue they are not. As he uses them, *ranching*, *livestock grazing*, and *natural* are bad abstractions. “A bad abstraction arbitrarily divides the indivisible and/or lumps together the unrelated and the inessential, thereby ‘carving up’ the object of study with little or no regard for its structure and form” (Sayer 1992:138). In this case, Sullivan’s categories are too general to capture the processes that actually determine whether grazing on public lands in the southwestern United States impairs, enhances, or has no effect on biodiversity and other conservation values.

One can illustrate the point by analogy. Ask yourself, Is fire natural? Is it good for biodiversity or bad? The questions cannot be answered yes or no because too much depends on details and context. The effects of fire vary widely depending on timing, intensity, frequency, and the prior evolutionary history of a given site. Other factors, such as historical management effects or invasive plants, may interact with these variables to complicate the picture further. Some fires seem easily characterized as natural, but others are not—for example, those in-

duced, or made more damaging, by human activities or impacts such as fire suppression or global warming. In short, the category “fire” is the wrong level of abstraction at which to try to assess the effects of actual fires on biodiversity. And it is actual fires, not the abstraction “fire,” that matter on the ground.

The same holds for grazing, whether by wild, feral, or domesticated animals. All that can be said about it in general is that it is a disturbance whose effects depend on details and context (Sayre 2001). The details can vary a lot (e.g., stocking rates, precipitation, management), but the category “grazing” obscures this variability, as though one could reduce a complex interaction to a simple matter of presence or absence. This weakness is not unique to Sullivan; it has been an obstacle to clear understanding of these issues for a long time. The review article by Fleischner (1994), which Sullivan cites, is a prime example. McNaughton (1986:765) once criticized Belsky (whom Sullivan also cites) along similar lines, pointing out that she committed “the fallacy of many questions. . . [b]y posing a question in a fashion demanding a single answer when only a complex answer can be correct.”

Moreover, the context of public lands grazing is not static but has changed significantly in the last 150 years, and effective conservation requires an understanding of this history. In southeastern Arizona cattle grazing began in earnest under Spanish rule around 1700 (although some animals were probably present earlier, feral remnants of Coronado’s expedition of the 1540s). For nearly 2 centuries, its effects were apparently benign—at least we have no evidence of lasting negative impacts. Between 1880 and 1900, however, when U.S. settlers flooded the region with herds from elsewhere (underwritten by far-off investors and banks), widespread ecological degradation occurred due to the interacting effects of grazing and severe drought (Sayre 1999). Vast areas were denuded of grass, and subsequent flooding cut deep arroyos in all the major drainage systems. The roughly decadal fire regime collapsed for lack of

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continuous fine fuels, and woody species such as mesquite (*Prosopis* spp.) took advantage of altered competitive conditions to spread from drainages into the uplands (Turner et al. 2003). By the 1930s large areas of former grassland were well on their way to a shrub-dominated state. Ranchers, agencies, and publicly employed scientists responded with expensive investments—fencing, artificial water sources, bulldozers, chemicals, and grass seeding—but had very limited success restoring grasslands. Stocking rates declined over the 20th century to a small fraction of what they had been at the height of the 1880s boom, making aggressive shrub control less and less economical, especially when evaluated against rising land values for residential development (Sayre 2002).

In view of this history, recasting ranching as natural is not so much disingenuous—as Sullivan fears—as it is meaningless, unless one defines *natural* more specifically. Sullivan's arguments imply that for him, natural means something like "consistent with evolutionary patterns and processes," with a tacit baseline condition preceding European settlement. But this abstracts from the history both before and since that time, and the choice of any baseline is ultimately arbitrary. (A baseline of 13,000 years ago, for example, could make today's cattle surrogates for prior ungulates and therefore natural.) On Sullivan's definition, one might just as well assert that historic grazing, fire suppression, shrub encroachment, and arroyo formation have made today's Southwestern landscapes "unnatural," regardless of whether they are grazed by livestock.

Problems of abstraction aside, the specific arguments Sullivan makes against Southwestern ranching today are debatable on their own terms. First, the management practices alluded to by White (2008) do not rest on Clementsian successional theory or a presumed "balance of nature." The Clementsian paradigm informed the management prescriptions of mainstream 20th century public lands grazing, even as those prescriptions manifestly failed in the Southwest (Curtin et al. 2002). But "the new ranch" is a reaction against this paradigm. The targets and temporal scales of the two approaches are quite different: mainstream approaches sought to affect plant *communities* over periods of years to decades by adjusting stocking rates, erroneously believing that grazing pressure was the key independent variable. Intensive or planned grazing, by contrast, seeks to affect *productivity* on shorter timescales (annual or even intra-annual) by affecting *processes* of nutrient and water cycling. Grazing is conceived as a tool for this purpose and a dependent variable relative to others such as rainfall. There are separate reasons to question the efficacy of rotational grazing systems (Briske et al. 2008), and Sullivan is right to cast doubt on Clementsian theory, especially in arid and semiarid settings. But the new ranch does not entertain illusions of linear succession to "climax" (Sayre 2001).

There is no disputing the fact that native amphibians are in a perilous state in the Southwest and that radical alterations in riparian habitat conditions are a major contributing factor to their plight, as Sullivan avers. (One might add native fishes to this group, although Sullivan does not mention them.) Here again, though, referring to putative natural conditions does little to elucidate answers to the practical question: What should be done now? There is little or no reason to believe that removing livestock, by itself, will restore pre-cattle boom riparian conditions: it will not heal arroyos, raise water tables, or reverse shrub encroachment on any meaningful timescale, and it will not extirpate the non-native species Sullivan refers to, such as the Bullfrog (*Rana catesbeiana*). The perennial streams of circa 1850 are mostly gone, and nothing humans can do will bring them back quickly. Riparian habitat change has been complex and dynamic, with numerous contributing and interacting drivers; popular notions of uniform and continuous decline grossly oversimplify matters and fail to notice that, for example, cottonwood-willow riparian forests have in fact *increased* in the presence of livestock over the past century (Webb et al. 2007).

In the meantime, the question is whether and how we can sustain remaining populations of native species. It happens that artificial water sources installed for livestock have provided habitat for some of them and that the noncontinuous distribution of these sources (compared with streams) has insulated some populations from non-native predators, pathogens, and competitors. (Hence, the U.S. Fish and Wildlife Service's [2007] conclusion that stock tanks serve as critically important refugia for Chiricahua leopard frogs [*R. chiricahuensis*] and that routine maintenance of stock tanks is therefore categorically exempt from "take" under the Endangered Species Act, for example.) The fact is that ranchers, in their actions as "ecosystem engineers," have done some things—inadvertently or not—that have benefited imperiled native species. After all, any species that persists today has survived much greater grazing impacts than occur at present and may well have *adapted* to anthropogenic alterations to its habitat.

The issue is not whether grazing or ranching is natural, but how to achieve actual conservation of biodiversity—and this can best be determined on a case-by-case, species-by-species, and even a site-by-site basis. Clearly, livestock can degrade ecosystems under various (although determinate) circumstances. But in other contexts—also various but numerous—livestock can be internal to the ecologically significant processes that sustain biodiversity. This, I believe, is what White (2008) meant when he wrote: "The New Ranch operates on the principle that the natural processes that sustain wildlife habitat, biological diversity, and functioning watersheds are the same processes that make land productive for

livestock." Such a formulation speaks precisely to the concerns of Sullivan's students regarding ecosystem function and the impacts of development. These are different, and much more concrete, considerations than Sullivan himself voices. Perhaps his students have learned not to evaluate ranching in such abstract terms as *natural*, but instead to consider the details of history, geography, land use, and site-specific management practices. From this perspective, one judges livestock grazing based on its actual, current effects rather than its abstractly generalized impacts, and one does so while recognizing that alternative land uses may be more damaging ecologically than the current one.

The erosion of the Clementsian paradigm is far from complete, and it entails much more than modifying research questions or methodologies. To recognize the limits of successional and equilibrium models requires one to reevaluate the assumptions embedded into one's categories and concepts as well. Recognizing bad abstractions and replacing them with better ones are fundamental to learning and advancing our understanding of ecological systems and processes, especially in relation to human activities.

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