

### Species Reintroductions

Recent papers reporting the results of molecular studies of the Iberian lynx (Beltrán et al. 1995) and Sonoran topminnows (Quattro et al. 1996) have profound implications for conservation biology. Primarily, they emphasise how genetics can identify unique populations that are particularly worth preserving, so helping to optimize conservation efforts. But broader repercussions lie in the field of species reintroductions.

Reintroducing animals to bolster depleted populations or as a form of biodiversity restoration is a prominent component of many conservation strategies. Reintroductions are also popular at the grassroots level, often offering nonprofessionals hands-on involvement in projects with clearly defined, short-term goals. These projects may be fraught with problems, however, as is recognized in several draft sets of guidelines (e.g., Stubbs 1988; World Conservation Union 1993). Unfortunately, such guidelines are rarely incorporated into national legislation, so reintroduction programs cannot be regulated in law.

These problems are epitomized in the United Kingdom, a country with an apparently well-researched fauna and comprehensive species-protection legislation. Here the release of exotic species is prohibited by the Wildlife & Countryside Act of 1981, but legal constraint upon the release of "native" forms is rare regardless of the status of native population(s) or the origin(s) of introducees. Despite this, the U.K. government is committed to support reintroduction programs through its obligations under the Berne Convention.

Reintroduction has been moot now for almost every bird or mammal species that has disappeared from Britain within the historical period. Many other species that are rare rather than extirpated have be-

come the focus of reintroduction programs, and not always to the benefit of surviving populations. A well-known example is the catastrophic result of a popular campaign to increase Barn Owl (*Tyto alba*) numbers by releasing captive-bred individuals; this eventually led to deliberate release becoming a criminal offense (Reid 1994).

Two species recently to attract the attention of the reintroduction movement are the polecat (*Mustela putorius*) and the pine marten (*Martes martes*). Both were widespread formerly but now are highly restricted, with populations estimated at 15,000 and 3650 respectively (Harris et al. 1995).

Genetic data on British polecats are preliminary and unpublished (A. Davison, unpublished data), but most populations outside of the refugia in the Welsh and English Borders appear to be composed of feral ferret-polecat hybrids. The pine marten's situation is more complex and less well-understood. Genetic studies have only recently commenced, but increasing field evidence suggests that its range is not as restricted as once believed, with probable isolates in the more remote parts of Wales and northern England (Jefferies & Critchley 1994).

The "precautionary principle" (Myers 1993) counsels us that conservation or other action should not be taken unless it can be shown not to be damaging. Until native populations can be genetically sampled and profiled and their inter-relationships resolved, any reintroduction runs the risk of becoming a form of genetic genocide. For example, it is well known that many of Europe's beaver (*Castor* sp.) populations consist either of Canadian animals or of European animals derived from the interbreeding of different subspecies during the reintroduction process. If the reintroduction of lynx to Iberia

or of Sonoran topminnows to the catchments of the Rio Yaqui had been carried out, these animals might already be extinct, at least as genetically distinct forms.

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#### Are the Naturalists Dying Off?

In a recent editorial, Reed Noss (1996) laments that the great natu-

ralists are dying off, an observation inspired in part by the writings of Dr. Archie Carr and the personal experiences of Dr. Noss under the tutelage of Dr. Carr. Reed Noss is concerned that the naturalists are being replaced by a generation of keyboard biologists who lack the intimacy with nature necessary to guide conservation efforts.

Indeed, there seems to be a generation of great naturalists retiring from academia in the United States. As the wilderness retreats farther from our doorsteps, fewer naturalists are born in the backyard environments so eloquently described by Carr and E. O. Wilson. But is this really the end of an era? Three points bear consideration:

First, perhaps great naturalists are dying off because great naturalists tend to be old. It takes a lifetime to master the natural history of an ecosystem or taxon. Like the leaders in other fields, great naturalists are usually recognized late in life.

Second, the majority of great naturalists exist outside the fields of academia and professional wildlife management and hence are not likely to be encountered in first-world conservation programs or the Society for Conservation Biology. Great naturalists are often found among the ranks of farmers, hunters, and rural inhabitants. Most field biologists know indigenous people who understand principles of zoology, botany, ecology, and conservation at a level reserved for graduate education in the industrial world. These self-educated people are the pool of great naturalists, with origins not unlike those of Archie Carr and E. O. Wilson. It is a happy coincidence when one of these naturalists has the opportunity and inclination to become a professional biologist. Naturalists are perhaps becoming rarer in the academic programs of industrialized nations, but the universities in developing countries contain many such persons.

Third, it is a dire mistake to assign second-rate status to keyboard biolo-

gists and practitioners of biotechnology. Yes we need great naturalists. They are our teachers and often our leaders. But we also need theoretical ecologists, virologists, and biochemists. Their contributions to conservation have been immense (Dhondt 1996), and it is not appropriate to appoint these specialists as scapegoats for the loss of naturalists from academic institutions in the industrial world.

The Biotechnology Center at University of Florida includes a program—BEECS—dedicated to conservation studies. In these conservation initiatives we welcome assistance from all manner of folks, including immunologists, computer scientists, endocrinologists, protein chemists, and statisticians. With few exceptions these people are nature lovers who are willing to labor in cement boxes to further the cause of conservation. They deserve the respect and support of a unified conservation community, not the derision that their specialities are “less central to our discipline than ecological and organismic courses” (Noss 1996). These caste assignments serve no discernable purpose other than to divide and damage the cause of conservation.

Finally, it seems relevant to consult the source of Dr. Noss's inspiration, Dr. Archie Carr. What did Dr. Carr think of these keyboard biologists? In one of his last public interviews, given to the student newspaper of the University of Florida on March 9, 1987, Carr discusses his 1936 thesis work, a description of the herpetofauna of Florida: “I wouldn't accept a graduate student today who wanted to do a paper like that. In those days they had to be done because we lived in a different time. We didn't even know what we had here. You can't get a job in zoology being the kind of biologist I was anymore. You've got to be highly quantitative, highly statistically oriented—lab work preferably. To get in your basic zoology department, you ought to be interested in mitochondrial DNA.” Ar-

chie Carr was highly supportive of “indoor” approaches to conservation, a role that the leadership of *Conservation Biology* would be prudent to consider.

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I've read the recent editorial by Reed Noss (1996) on the death of field biology; if some of what I read was frustration, then I share it with him. Far too few of my college courses had any outdoors action, much less my graduate classes—either the “lab” involves labwork (blades and flasks and splay-pinned worms), or “field exercises” are just a sideline, a necessity for collecting data to be whisked away indoors and onto disk for numerical analysis. The life itself has no intrinsic worth; organisms only supply the numbers to fuel the statistical engines.

The experience of nature, the living world—separate from rough asphalt and smooth metal—is what drew me to biology before I knew it was a science. Like E. O. Wilson I grew up in the South, but a later South: California and Florida of the development boom, as nature drew back, but a determined boy could still find ponds and woods, seas and jungles, beckoning, a soft tug that drew me and sustained me and convinced me I had a career as something exotic, a marine biologist, or maybe a rainforest taxonomist. Conservation, then, came easy as breathing; came *of* breathing, and all that implies. I have this unbearable drive

to "be a part of the solution," if conservation biology *is*, to channel the love of these great, fading worlds into a lever and a fulcrum, to lift away the weight of swelling humanity. But I'm not learning what I need to know—what other people need to know, the ones making the deadly decisions, who live by charts and squiggles and are immune to any shock *we* might feel, we who have glimpsed the substance behind all the declining percentages.

I've asked other people about schools for conservation biology, but after reading Noss's essay I wanted to ask him where, in this blossoming field, can I find a teacher who hasn't traded animals for ANOVAs? Where among the slew of offerings is a school, a program, a professor with the wood lore and the life ken, the memory of the living ages to balance the fears of nearest future? If Type II curves and GIS overlays are pivotal in the efforts of conservation, so be it—necessary armor, perhaps, against the slings and arrows of outrageous politicians. But I need more than that if I'm to remember why all of our wonders should be fought for—not words, like biodiversity and ecosystem integrity, but those things that can move any human, and should move them all.

Simply being "in the field" is delightful and inspiring but not enough. One learns more than nomenclature and breeding ranges; one learns how to learn what classrooms never teach. Are there still any like this out there?

John M. Aguiar

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The editorial by Reed Noss (1996) entitled "The Naturalists Are Dying Off" struck a responsive chord. As a

naturalist and an educator I am at times appalled at the generally low level of awareness of nature possessed by some of the students who arrive at my college. No longer a matter of common knowledge, words such as *conifer*, *invertebrate*, and even *ecology* can elicit blank stares or require lengthy explanations before their meanings sink in. Because those students demonstrate an ability to learn such terms and apply them once they have been exposed to them, I can only conclude that their social and educational environments prior to coming to college have been ecologically depauperate. Although it may be true that general vocabulary has declined since the ascendancy of television and video games, the lack of an ecological vocabulary is particularly distressing, given the urgency of biodiversity threats and sustainability issues.

When I attended graduate school and for years thereafter, the term *naturalist* was often used as a perjorative, yet I have always worn that title comfortably ("If it was good enough for Darwin. . ."). Now no less a scientist than E. O. Wilson entitles his autobiography *Naturalist*. David Cavagnaro in his foreword to my book (Anderson 1983) wrote that "A naturalist, I think, is first a person of the Earth, a shaman really, one who feels as well as sees, one who simply **knows** with greater breadth and depth than intellect alone can muster. Second, a naturalist is an interpreter, one who can translate the complex language of nature into the vocabulary of the common man, who can reach out to us from the heart of the natural world and lead us in."

The Noss editorial decries "the death of natural history" and calls for educators and professionals to take action to reverse the "trend toward indoor ecology." He outlines some excellent points which, if followed, would no doubt make a difference. I would like to reinforce his message by mentioning some of the educational approaches of Prescott Col-

lege which demonstrate the truth of his words.

Located in the central uplands of Arizona, Prescott College is dedicated to "the liberal arts and the environment." Incoming students participate in a 3-week wilderness orientation before they take any academic subjects. The school year consists of alternating blocks (3.5 weeks of immersion in a subject) and quarters (10 weeks devoted to three classes or equivalent units). The blocks lend themselves well to extended field courses, and the quarter courses usually involve some combination of classroom and field time. Interdisciplinary links and experiential education, in which students are active, self-directed learners, are the norm. Often the emphasis of a course is project-based, resulting in a concrete achievement such as a literary journal, a set of proceedings, publishable research, an exhibition, or some other significant demonstration of real-world competence. Field work is considered so central to the educational mission that, unlike at most schools where field trips are the first to go when budget cuts are necessary, field trips are sacrosanct.

Students in the environmental studies program build upon a foundational course called "Ecology and Natural History of the Southwest," which helps develop naturalist skills, an understanding of ecological concepts (reinforced through field experiences), and—equally important—a sense of place. Many go on to gain theoretical and practical skills in environmental education, natural history, field ecology, conservation biology, human ecology, or agroecology; all gain a better understanding of themselves as ecologically literate citizens. Even students concentrating in the social sciences, humanities, human development, and adventure education programs gain an appreciation of and commitment to "the environment" as part of this culture. Our students and graduates are gaining an impressive reputation for their maturity, self-direction, compassion for others and the Earth, and the

ability to work comfortably and competently in the field, which comes from that emphasis on field experience that Noss so correctly values. We are fond of saying that "education is a journey, not a destination," and we stubbornly resist the idea that time in college is just a preparatory period for the real world (Strauss 1995).

The naturalist's approach, the integration of humans with the rest of nature in a passionate and ecologically sensitive way, is not yet dead in all parts of this country. Here, and in a few other like-minded institutions, the study of natural history is alive and growing. A cadre of naturalists is spreading out, potential "field-wise mentors for another generation of ecologists and conservation biologists" (Noss 1996). The editorial's suggestions and the wisdom from columns such as "Conservation Education" show that the Society of Conservation Biology is dedicated to genuine ecological literacy, and I hope that such messages are heard and acted upon throughout the educational systems of this planet.

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I take this opportunity to endorse Reed Noss's (1996) editorial, hoping that I don't sound redundant. I grew up in a family of amateur naturalists, and like Noss I was exposed to some nationally renowned professional conservationists and wildlife biologists during my formative years. In 1937 my father took me to the Alvord

Desert region of southeastern Oregon; among other features, he showed me the fish in Borax Lake, now listed under the Endangered Species Act. He informed me that Borax Lake was the only place in the world this fish was found, and that it was unnamed. For a reason I cannot explain, an unnamed endemic of a small hot lake intrigued me as an 11-year old (over 40 more years passed before this fish was formally described [Williams & Bond 1980]). William L. Finley's lectures and outstanding hand-tinted lantern slides that illustrated the plight of the California condor (*Gymnogyps californianus*) also captivated me. In 1938 I took a week-long tour led by Stanley G. Jewett, Regional Biologist for the U.S. Biological Survey, of what was then called the Malheur Migratory Waterfowl Refuge. Jewett became my mentor. By the time I was 12, I had decided to go into the field now called conservation biology.

My first two years at Oregon State College were anything but enjoyable. I failed to connect basic courses such as chemistry, genetics, anatomy, general zoology, and general botany with being a field biologist. But once I was exposed to courses in taxonomy and ecology and was encouraged to make field collections and investigations that tied into the courses, things changed. I question how I might have made it through school under today's curricula.

As it turned out, I look with considerable satisfaction at numerous conservation accomplishments that have occurred during a career that is nearing the half-century point. Yes, I too now spend most of my working hours in front of a computer, but not without drawing upon years of field experience, basic courses in taxonomy and ecology, and frequent trips to the field to renew my spirits and observation skills and remind me why I continue to work. It was the "naturalist's intuition" based on field experiences that told me which areas to recommend in the early 1960s for some now very successful na-

tional wildlife refuges. One such refuge in the Willamette Valley of Oregon, purchased for the Dusky Canada Goose (*Branta canadensis occidentalis*), had no prior history of goose use, but I knew through experience that, with some changes in land management, geese would readily use the area.

Professional judgment and little data brought us the first official federal list of endangered species compiled under the Endangered Species Preservation Act of 1966, a precursor to today's act. This list was "grandfathered" into subsequent acts. Today I cannot recall any species on this list that should have been omitted. I also have to ask myself where we would be if we had waited for today's data analysis approach before decisions were made on hunting and fishing regulations. In fact, I look at my career with some degree of guilt for having been too cautious when the opportunity was there to move. Early in 1973 I was the Washington D.C. staff person responsible for listing domestic birds and mammals under the Endangered Species Act. By then it was obvious that the Northern Spotted Owl (*Strix occidentalis caurina*) should be listed if changes in silvicultural practices were not made, yet I hesitated in preparing a listing proposal, hoping and waiting for more data. As listing procedures tightened, it became more difficult to list a species, and the bird did not make the list until 1990 through court action. Perhaps if we had listed the bird in 1973, when there was more flexibility, some of the subsequent trauma could have been avoided and a better habitat-distribution pattern would be preserved than is now possible.

Over the past several years I have served on viability panels for various birds in connection with ecosystem planning efforts for federal lands. Here again, we had to act in some instances on anecdotal evidence and the naturalist intuition that comes only from time spent in the field. In a most recent exercise of this na-

ture, I was surprised at how much I relied on observations and field notes made while working and camping out for three summers in national forests starting as a teenager on a brush-piling crew.

I fully support using population modeling and other new computerized and statistical tools and methods, but many young people fail to realize that the new technology has serious limitations and is only as good as the available field data and assumptions used.

I remain a naturalist first, and like Noss I regret that those of my kind are dying out. Following Noss's recommendations would help turn this around.

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I have received more letters and emails in response to my editorial on the death of naturalists than on any topic since I became editor of this journal—over 60 at this writing, all but one (Bowen & Bass, printed above) in agreement or sympathy. The favorable phone calls and discussions at meetings have been too numerous to count. Most of the written responses have been informal and personal. Those printed above offer a glimpse of our readers' reactions.

I do not accept Bowen and Bass's claim that great naturalists are dying off because they are old. Although this may be literally true, the bigger problem is lack of recruitment. I've

known many excellent field naturalists who obtained their skills early in life, but we are not providing enough opportunities for young people today to learn these kinds of skills. Biology students today, with few exceptions, will not be good naturalists when they are old because their education and careers forced them indoors. I agree, however, with the second point of Bowen and Bass, that great naturalists are often outside academia and professional wildlife management. I gave several examples of such naturalists in my editorial but I also provided reasons why it would be imprudent to leave field biology entirely to people without scientific training. Furthermore, my observation is that natural history as a hobby also has been in decline and that amateur naturalists become fewer and less knowledgeable every year.

The third point Bowen and Bass made is that it was unfair of me to deride keyboard biologists and practitioners of biotechnology. Derision was not my purpose, and I conceded in my editorial that skills in mathematics, statistics, and computer sciences are "almost essential" in conservation biology today. Perhaps that was an understatement. I would eagerly add that population and molecular geneticists are making enormous contributions to conservation. But why not strive for balance in our profession? There is no dearth of keyboard biologists. Bowen and Bass's final point, that Archie Carr was supportive of indoor approaches to conservation, I will not argue. But I find it strange they do not detect any sadness in the quote they offered. We are losing a lot with the decline of field biology, as Archie Carr knew better than anyone.

I meant to respond to the (edited) letter from John Aguiar personally. However, Aguiar's address was not on his letter, I mistakenly threw away the envelope, and he is not in the list of members of the Society for Conservation Biology. So, I offer a brief reply here. First, John, please join

SCB. Second, there are still schools that offer good training in field biology, especially at the undergraduate level. The letter from Walt Anderson provides the example of Prescott College. At the graduate level individual faculty at many institutions carry on the naturalists' tradition, but from what I am told they do so less effectively than before because of declining funds and less administrative enthusiasm for field trips. Faculty at several universities—the University of Nevada at Reno and the University of California at Davis come to mind—wrote me to say that their departments still have strong field-based programs. But the best advice I can offer is to take the time to get out in the field on your own with binoculars, hand lens, collecting vials, plant press, and a backpack full of keys and field guides. Good field naturalists are largely self-made, provided they are given some encouragement.

Finally, although I am gratified that so many people wrote and called me to commiserate about the problem, we still need to do something to correct the situation, and soon. As David Marshall points out in his letter, the loss of people with a naturalist's intuition from conservation professions can have dire consequences for biodiversity. A joint statement or "white paper" from several major scientific societies to the U.S. Secretary of Education, the National Science Foundation, and other entities here and abroad could be helpful, especially if accompanied by a press conference. Would anyone like to help organize such an effort?

#### Reed F. Noss

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#### Livestock Grazing: Replies to Brown and McDonald

Imagine for a moment that a strange new beast, say a bacterium, was in-

roduced into western North America and rapidly came to inhabit three-quarters of the region. The wily bacterium displaced native species, altered the structure of ecological communities, disrupted nutrient cycles, and affected the course of water flow; in short, it caused enormous upheaval of the native biodiversity. Without question, the conservation biology community would be up in arms, united against this ecological threat that endangers all we hold dear. Let us also imagine that a few people in the region were raising these bacteria on public lands and insisted upon their right to do so. Especially vocal supporters declared that "Bacteria farmers *must* be allowed to continue their lifestyle."

Now, if just for a moment you grant that domestic livestock have had and continue to have an impact analogous to that of our fictitious bacterium, you might think that conservation biologists would be concerned. You might even expect conservation biologists to protest—loudly and decisively—that our culture has a responsibility to biodiversity, not just to particular human lifestyles.

As a recent spate of letters in *Conservation Biology* demonstrates, conservation biologists are decidedly not united on such an issue when biology intersects with fondness for cultural icons like cowboys. Discord among conservation biologists in such a scenario has two possible causes: (1) scientific disagreement over the facts—in this case, is livestock really causing negative ecological effects? and (2) agreement that livestock damage exists but emotional differences of opinion on how we should respond to it. Brown and McDonald's (1995) critique of my review (Fleischer 1994) demonstrates how deeply emotional is the issue of livestock grazing in western North America. They bundle together a critique of my methods and a subjective sympathy for rural lifestyles; the latter I share but consider ultimately irrelevant in answering scientific questions about grazing ecology.

My article concluded that whether or not livestock grazing has a sustainable future in the American West "ultimately is a question of human values, not science." Do we or do we not want grazing to continue, even if at the expense of native biodiversity and important ecological processes? Brown and McDonald walk both sides of the fence: they want grazing to continue (clearly stated), and they don't think it diminishes biodiversity (implied, but not clearly stated).

I provided abundant evidence—largely culled from researchers sympathetic to grazing—that livestock grazing entails serious ecological costs. I did not say that all grazing is terrible, that ranchers are bad people, or that all grazing must be eliminated—Brown and McDonald inaccurately portrayed my words. I did, I hope, make clear that livestock cause numerous effects of precisely the sort that conservation biologists profess to be deeply concerned about.

Brown and McDonald offer several lists: "concerns" with my article, "facts," and "opinions," the latter two being liberally mixed. Brown and McDonald offer scant support for their assertion that my work overestimates the negative impact of livestock. They complain that a few cited works suffer from poor experimental design. Even if this were true, what about the other 160-plus references? Furthermore, enclosure studies, even though they're the best tool we have, probably *underestimate* grazing impact because they cannot judge the original, most severe impact.

Brown and McDonald's concern that I neglected to describe the ecological effects of removing native herbivores seems extraneous at best. I agree that removal of rabbits, prairie dogs, and probably any other herbivore has ecological consequences. Similarly, adding a large herbivore changes ecosystems. The studies they cite could, in many cases, be interpreted as support for my point: Because livestock alter species composition (Brown and McDonald agree), native herbivores can be excluded

(prairie dogs are an excellent example), with the effects that Brown and McDonald point out. Their statement that I "repeat the fiction" that pre-Columbian America represented "a natural and inherently desirable state" is irresponsible; I do not believe this and never wrote any such thing.

Brown and McDonald's critique is somewhat confusing because even as they toss out a smokescreen of irrelevant false dichotomies and busily nitpick at details, they agree with my major point that livestock are one of "the most important ecological conditions" (their words). Brown and McDonald bundle facts with opinions: statements such as "should be possible" are included as facts. This reflects a bias toward utilitarian land users and contradicts their claim of scientific objectivity; this is particularly ironic in light of the discomfort of Brown and McDonald with what they call advocacy (in only some cases accurately). Statements such as "livestock ranching *must* be both ecologically sustainable and economically viable" [emphasis added] indicate wishful thinking and do not deserve the mantle of "scientific objectivity and rigor."

Brown and McDonald's comments on the coevolution of grasslands and large herbivores are largely immaterial for two reasons. First, the majority of land used by livestock in the 11 Western states is not grassland. Second, natural selection works at the population level; ecological communities do not evolve as intact units. We simply do not know enough to invoke these sorts of evolutionary arguments and they should not be used to support or refute livestock grazing.

I still believe what I wrote before: Livestock impose serious costs on ecosystems of western North America, and society must grapple to make value judgments about the ecological and social consequences of our choices. This work requires good science and great humility. Let's keep talking. (I encourage conservation biologists to become familiar with

the position statement of the Society for Conservation Biology on livestock grazing on public lands in the United States of America, published in the SCB Newsletter 1(4):2-3. I would be happy to provide copies.)

### Thomas L. Fleischner

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Brown and McDonald (1995) claimed to "detect a dangerously one-sided presentation of data and opinions on livestock grazing in a recent issue of *Conservation Biology*." They criticized the writings of Fleischner (1994), Noss (1994), and Wuerthner (1994) and attempted to present contrasting viewpoints. Because their comments contain some glaring deceptions and invalid premises, they cannot go unchallenged.

We believe that the controversy relating to livestock grazing must be considered in perspective. Brown and McDonald express concerns about one-sidedness and balance, but we must remember that the principal adversaries in the dispute are a wealthy and politically powerful livestock industry whose economic interests are at stake and portions of the conservation community standing to gain not a penny from the outcome. Although it has obvious scientific ramifications, the grazing controversy is primarily a cultural, political, and social issue, especially as it relates to public lands.

It is a convenient ploy for Brown and McDonald to criticize the use of literature citations from popular and

environmental publications as opposed to scientific publications. Of course a great deal of scientific literature exists (e.g., Bureau of Land Management 1994; Fleischner 1994). But in this instance it is more relevant that a poll of people living in 100 counties in the interior Columbia Basin revealed that only 23% of them favored commodity production on public lands; they ranked grazing and ranching seventh behind such concerns as water and watershed protection, ecosystem protection, recreational uses, landscapes, scenery, and quality of life (Rudzitis et al. 1995). Obviously, more is involved here than a need for additional scientific research. The point is that an advanced degree is not essential to seeing the difference between abused land and healthy land.

Brown and McDonald chose language that injects a prograzing bias into their comments: public lands become "rangelands," grazed lands are "seminatural ecosystems," and "pastoralism" is synonymous with livestock production and the modern livestock industry. Ordinarily, pastoralism refers to shepherds tending flocks and implies rural innocence, simplicity, and attentive stewardship. But does it really apply to Dan Russell (California) grazing 5 million acres of public land in three western states, or the Ellison Ranching Company grazing 2.4 million acres of public land in Nevada, or J.R. Simplot grazing nearly 2 million acres of public land in four western states (U.S. House of Representatives 1994)? Does it apply to federal land management agencies and their policies?

Brown and McDonald seem to believe that the sole impact of livestock grazing is forage cropping. Soil compaction, destruction of the cryptobiotic crust, erosion, loss of fish and wildlife habitat, destruction of riparian zones, effects upon water quality and quantity, and many other matters discussed by Fleischner (1994) are ignored. Whereas predator and pest control (e.g., prairie dogs) and the invasion and control of alien

plants are attributed to human influences, they are not acknowledged as direct, subsidized costs of livestock production.

The criticism directed at Wuerthner for lumping farming and pastoralism (a word he didn't use) in contending that agriculture is a more serious threat to biodiversity than subdivisions is unwarranted. Wuerthner made a clear distinction between livestock production and other forms of agriculture. But all this becomes pointless when we realize that the public lands are not going to be subdivided, that most intensive agriculture in the western states is devoted to producing food for cows, and that the greatest use of irrigation water goes not to people or communities but to the production of cow fodder (Aldridge & Schulbach 1978; Klaper 1991; Wuerthner 1991).

We cannot address all our concerns and disagreements with Brown and McDonald's comments, but we mention a few of the most obvious:

- (1) In writing a paper dealing with the ecological costs of grazing, Fleischner is criticized for not reviewing papers that reflect the "average" impact. What is the "average" impact of smoking or of World War II?
- (2) Fleischner is accused of citing papers with poor design and replication. Yet, Brown and McDonald advocate continued grazing across the West, without controls, with a promise to do a better job, and with hopes that additional research will save the day.
- (3) Fleischner is charged with repeating a "fiction" that the West was in a more "natural and inherently desirable state" before settlement. Are they serious?
- (4) Brown and McDonald drag out the discredited notion that Herefords have merely replaced bison and other native herbivores; they ignore the facts that pristine populations of native ungulates have been reduced to

miniscule remnants of their original numbers and that modern domestic livestock consume an estimated 90% of the forage in the 11 western states (Wagner 1978; Jacobs 1991).

- (5) Brown and McDonald claim to represent the "rational voices" of the "radical center," yet they support the livestock industry in advocating the status quo.
- (6) Brown and McDonald contend that in some cases removal of livestock can lead to deleterious ecological events and cite the "extinction of a population of desert pupfish (*Cyprinodon nevadensis*) following fencing of a spring in Ash Meadows, Nevada" as an example. Our inquires with the current refuge manager at Ash Meadows National Wildlife Refuge reveal the following: (a) Pupfish are doing fine on the refuge in sites protected from abusive grazing. (b) The population that suffered extinction occurred in an artificial pool "never more than two feet around," never containing more than six pupfish, and the pool would have disappeared eventually anyway."
- (7) Brown and McDonald offer considerable discussion of prescription management of rangelands, of whether it's better to

share a campground with other humans or cows, of whether or not enormous government subsidies to the livestock industry are justified. They make arguments in favor of keeping ranchers on the land and suggestions that the grazing controversy must be settled by compromise, consensus, and more scientific research. None of this is reassuring.

Brown and McDonald miss the point. The public lands and all their treasures belong to all Americans, not to 22,000 permittees interested only in the bottom line. The livestock industry has had well over a century to clean up its act, and we see not the slightest indication of meaningful reform. In short, we found Brown and McDonald's defense of the western livestock industry unconvincing, but given the facts and realities of the situation, theirs was an impossible task from the start.

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