

DEFINING AND EVALUATING EXOTIC SPECIES: ISSUES FOR YELLOWSTONE PARK POLICY

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ABSTRACT.—Exotics are species that are foreign to an ecological assemblage in the sense that they have not significantly adapted to resident biota or to local abiotic conditions, and resident species have not significantly adapted to them. Although they need not be human introduced nor damaging, when they are, a negative appraisal of such exotic species can be justified. Human introduction of exotics into natural systems typically increases human influence over those systems, thus diminishing their wildness. Valuing nature for its wildness is a rationale for the national parks' policy of letting nature take its course. Thus, Yellowstone Park has a strong reason for removing human-introduced exotics and for welcoming naturally migrating exotics. Disvaluing exotics that are neither human introduced nor damaging simply because they are foreign smacks of xenophobia. But given that wanton human mixing of species threatens to homogenize the earth's biological communities, biological nativism is justified as a way to preserve the diversity between such communities.

Key words: exotics, exotic species, native, nativism, Yellowstone, wild, natural, biodiversity.

There is considerable debate about how we should characterize exotic species (Scherer 1994, Woods and Moriarty 2001). Controversy concerning the negative evaluation of exotics is also significant (Pollan 1994, Throop 2000). In Yellowstone National Park these conceptual and valuational issues make a difference for policy and management. This paper provides suggestions for how we should define and evaluate exotic species, with particular reference to exotics in the greater Yellowstone region.

DEFINING EXOTICS

Exotic species are defined in many different—even contradictory—ways. The definition I propose aims to separate the distinct strands typically woven into this concept while still capturing most of our fundamental intuitions about exotics. I suggest that we define an exotic species as one that is foreign to an ecological assemblage. In contrast to a native species, an exotic species is one that has not significantly adapted to resident biota or to local abiotic conditions, and—perhaps more importantly—resident species have not significantly adapted to it. When an exotic first arrives, it will not yet have exerted selective pressure on local species, nor will it have responded to selective pressure from the resident

species or local abiotic conditions. Once this process of “evolutionary accommodation between newcomer and residents” (Westman 1990) has begun, the exotic species starts the process of naturalizing. At some point the mutual adaptation between immigrant and natives will be significant enough for the one-time exotic to have naturalized and become native (Hettinger 2001).

For example, the protozoan parasite (*Myxobolus cerebralis*) that causes whirling disease (an affliction that cripples some fish species) is a recent immigrant to Yellowstone's ecosystems. A European import arriving in this country about 45 years ago and first detected in park waters in 1998, the whirling disease parasite is exotic to the extent that it has not significantly adapted to species present in the park and to the extent that park natives have not significantly adapted to it. Although the microbe has successfully parasitized some Yellowstone cutthroat trout (*Oncorhynchus clarki bowieri*), there has been little time for cutthroat trout to adapt to the parasite or to exert selective pressure on it.

Whether a species is exotic to an assemblage is a matter of degree. The greater the differences between the species, the biota, and their interrelationships in the old and new habitats, the more exotic the immigrant will be.

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For example, mountain goats (*Oreamnos americanus*) that are moving into the park from the north are likely to be much less exotic to the Yellowstone assemblages they join than Japanese snow monkeys (*Macaca fuscata*) would be in the thermal areas of the park. Mountain goats have likely adapted with a number of species in the park, whereas little if anything in the park has ever adapted with any species of monkey.

Exotic arrival should be distinguished from range expansion where the traveling species does not move into ecological assemblages to which it has not already adapted. Thus, as bison (*Bison bison*) expand their range north and west out of Yellowstone Park into the surrounding grasslands, they enter a habitat in which they are native, because these assemblages and bison have significantly adapted to each other. When the U.S. Fish and Wildlife Service moved gray wolves (*Canis lupus*) from Canada into the park, this was not exotic introduction because gray wolves have evolved with elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*), and moose (*Alces alces*), among other species present in the park.

Contrary to a frequently adopted definition, including one used by the National Park Service (National Park Service undated), exotics need not be human-introduced species. This is true both because some human-introduced species are native (e.g., the restored Yellowstone wolves) and because some species move to foreign ecological assemblages on their own. Examples of the latter include Cattle Egrets (*Bubulcus ibis*) blown from Africa to South America and the first finches on the Galapagos Islands.

Exotics also should not be identified with damaging species, as some suggest (Scherer 1994), for some natives are damaging and some exotics are not. For example, the Asian long-horned beetle (*Anoplophora glabripennis*), recently discovered in trees in Chicago, is an important threat to trees in its native range as well (Corn et al. 1999). The National Park Service has management policies to deal with such native pests (National Park Service 1988).

It is true that exotics have caused massive amounts of damage, both ecologically and economically (Office of Technology Assessment 1993). Approximately 40% of threatened or endangered species on the U.S. Endangered Species lists are at risk primarily because of exotic species (Pimentel et al. 1999). Never-

theless, exotics need not be harmful. Many, perhaps most, immigrant species in foreign assemblages die out before they become established (Westman 1990, Williamson and Fitter 1996). One estimate is that about 10% of such immigrants succeed in establishing themselves (Bright 1998). Even those that become established need not be invasive or weedy (Mack 1996). Approximately 15% of foreign species that have established themselves in the U.S. have become serious problems (Simberloff 1997). The National Park Service's division of exotics into innocuous species and disruptive species reinforces the point that exotics need not be harmful (National Park Service undated). Making such a distinction is not without risk, for exotics that establish themselves in benign ways may eventually experience explosive growth that damages local assemblages (Simberloff 1997). Still, some exotic species are benign and some are even beneficial. Invasion biologists talk about the crucial role invaders have played in stimulating evolution (Vermeij 1996). In Yellowstone Park, grizzly bears (*Ursus arctos*) and other wildlife consume substantial amounts of nonnative clover (*Trifolium* spp.; Reinhart et al. 1999). A species of eucalyptus tree introduced into California from Australia over 120 years ago benefits monarch butterflies (*Danaus plexippus*) that rely on them during annual migrations (Woods and Moriarty 2001). Eucalyptus also benefits native birds and salamanders (Westman 1990). The common apple tree (*Malus sylvestris*) is an import from Europe and west Asia. It is hard to imagine that this tree has not benefited the North American landscape.

EVALUATING EXOTICS

Justifying a Negative Appraisal of Exotics

Although I do not think we should define exotic species in these ways, the exotic species typically of concern to the park (and others) are both human introduced and damaging. Each of these features provides a strong reason for a negative evaluation of such exotics and perhaps for a policy of control or eradication of them.

A negative evaluation is fairly straightforward when exotics significantly damage human interests or when they impoverish ecosystems, for example, by turning diverse native communities into single-species areas unable to support

other life forms. I say fairly straightforward because human interests are not the only ones at stake and because criteria are needed to distinguish changing ecosystems from damaging them (Throop 2000).

A negative evaluation is also called for when an exotic is human introduced. Although controversial, such a value judgment is justified by the following considerations: (1) the fact of ongoing massive human influence on the planet (Vitousek 1997) and the radical diminishment of the sphere of wild nature; (2) a positive evaluation of natural systems to the extent that they have not been influenced by humans, that is, to the extent that they are wild (Hettinger and Throop 1999); and (3) a judgment that the presence of human-introduced aliens lessens the wildness of natural systems and thus provides a reason for disvaluing such exotics.

For example, Yellowstone Lake has been humanized by the introduction of lake trout (*Salvelinus namaycush*), and the park is less wild as a result. Even though lake trout have been present in other park lakes for about a century (Schullery and Varley 1999), their recent introduction into Yellowstone Lake significantly increases human influence over park processes as their presence in that lake threatens Yellowstone cutthroat trout and other species that feed on cutthroat trout, including grizzly bears and Bald Eagles (*Haliaeetus leucocephalus*). Rather than feeling in touch with wild natural processes, a knowledgeable angler who catches a 10-pound lake trout while fishing for cutthroat trout in Yellowstone Lake will be reminded of humans and their ill-advised acts. Removing these lake trout will make Yellowstone a wilder, less human-influenced place, as did closing the garbage dumps to grizzly bears.

Letting Nature Take Its Course

Valuing nature for its wildness is a rationale for the park's policy of letting nature take its course. One implication of seeing the park as a natural area where human influences should be minimized is that just as the park has a reason to eradicate or control human-introduced exotics, so too it has a reason to welcome naturally dispersing aliens. Removing such exotics would seem to increase, not decrease, the human control and manipulation of natural systems in the park.

Those who believe that the purpose of national parks is to "preserve vignettes of primitive America" (Leopold et al. 1963) may argue that the park should eradicate even naturally arriving exotics, for they will alter the character of the native ecosystems the park should preserve. But national parks ought not to be in the business of trying to prevent nature from changing on its own. Yellowstone Park should preserve natural processes, not some particular status quo in nature. The national parks' management guidelines count naturally arriving exotics as "natives" and thus presumably sanction their arrival (National Park Service undated).

Although Yellowstone Park has a strong reason to welcome naturally dispersing exotics, the policy of letting nature take its course is not absolute. Such a policy could be overridden if an exotic—or native, for that matter—were to cause sufficient damage. If the whirling disease parasite somehow traveled from Europe into Yellowstone Park without the aid of humans, the park would be hard pressed to justify welcoming such a naturally dispersing exotic. If the parasite threatened to destroy the entire Yellowstone cutthroat population, the park would have strong reasons not to let nature take its course.

Disvaluing Exotics As Such

Are there reasons for disvaluing exotics per se, simply because they are foreign? If so, the park would have a reason not to welcome naturally dispersing exotics, even when they did not cause damage. But negatively evaluating a species simply because it is foreign smacks of xenophobia and a nativist desire to keep locals pure from "foreign biological pollution." In human affairs, such an attitude is morally repugnant. Nativist fear of foreigners and prejudice against immigrant peoples are morally troubling attitudes. Critics of biological nativism (i.e., the preference for native flora and fauna) point out that the Nazis had a native plant movement and attempted to purify the flora and fauna of their country as they purified their culture of Jews (Pollan 1994). One writer warns that "nativist trends in Conservation Biology have made environmentalists biased against alien species" and thinks it important to "protect modern environmentalists from reproducing the xenophobic and racist attitudes that have plagued nativist biology in the past" (Peretti 1998).

But biological nativists do not dislike foreign flora and fauna, and the charge of purism ignores their commitment to biodiversity. Biological nativists want to preserve the spectacular diversity between biotic communities. The wanton human mixing of species from around the globe creates mongrel ecologies and threatens to homogenize the earth's biotic communities (Hettinger 2001). The logical end point of the massive, human-induced spread of exotics is that ecological assemblages in similar climatic and abiotic regions around the world will be composed of the same species. This biotic impoverishment is much like the impoverishment of cultural diversity resulting from economic globalization and the cosmopolitanization of humans. Keeping a dandelion (*Taraxacum officinale*) out of Yellowstone is much like keeping Wal-Mart out of a small New England town or McDonalds out of India. Kudzu (*Pueraria lobata*) in the American South is like TV in Nepal, a threat to the diversity of the planet's communities and ways of life. Because humans have introduced so many alien species into so many of the earth's biotic communities, the park may well have a reason to oppose even naturally dispersing and nondamage-causing exotics.

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