

Response to Garibaldi and Turner. 2004. "Cultural Keystone Species: Implications for Ecological Conservation and Restoration"

## Invasive Species and the Cultural Keystone Species Concept

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**Key Words:** *biological invasions ; cultural keystone species; conservation; exotic species; invasive species; keystone species*

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The concept of the keystone species (Paine 1966, 1969, Power et al. 1996) has been a transformative notion in ecology. Keystone species were originally narrowly defined to be those whose importance to community and ecosystem structure, composition, and function is disproportionate to their abundance. Even this narrow definition fostered great insight into the nature of particular ecosystems and of threats to them (Power et al. 1996). However, in ecological circles the term came to be more casually used to mean any species that has a very large impact on the ecosystem, no matter how abundant it is (Simberloff 2003), and this casual usage has led to attacks on the concept on the grounds that it is so vague that it is meaningless (e.g., Mills et al. 1993). The phrase has even been freely and loosely borrowed outside ecology; for example, it has migrated into business and economics (Iansiti and Levien 2004).

In a recent issue of *Ecology and Society*, Garibaldi and Turner (2004) tried to demonstrate the importance of another loose adaptation of Paine's concept of the keystone species, namely the cultural keystone species (hereafter CKS), for ecological conservation and restoration. They define CKS as species that are culturally outstanding and that characterize the identity of a cultural group. We believe that the CKS concept could hinder biological conservation if we consider how exotic species can influence human cultures.

It is not rare to see exotic species, even invasive species that constitute severe threats to biodiversity

(Mooney and Hobbs 2000, Simberloff 2000), serving as cultural icons in different areas of the world. Examples of this include *Eucalyptus* in California, tomatoes (*Lycopersicon esculentum*) in Italy, bluegrass (*Poa pratensis*) in Kentucky, *Cannabis sativa* in Jamaica, bananas (*Musa paradisiaca*) in Ecuador, horses (*Equus caballus*) in the western United States, coffee (*Coffea spp*) in Colombia, and kudzu (*Pueraria montana*) in the southeastern United States.

More than 100 species of Australian *Eucalyptus* trees have been brought to California since the late 19th century. Many formed massive groves, and they quickly became a characteristic feature in the state. In the early 20th century, the species even gave rise to a major school of art, the Eucalyptus School, with many landscapes dominated by *Eucalyptus* (Moure 1982). Examples are "Eucalyptus Trees" by Marion Wachtel

([http://artroots.com/art/art06\\_index.html](http://artroots.com/art/art06_index.html)) and "Eucalyptus Hills" by William Hannum

(<http://www.allposters.com>). *Eucalyptus* are extremely damaging ecologically to many native species, not least because they are fire-promoters and tolerate the fires that they propagate far better than native species do (Williams 2002). Nevertheless, many attempts at ecological restoration, beginning with the removal of *Eucalyptus*, have been hindered or even foiled by fierce opposition from passionate defenders. A group called POET (Preserve Our Eucalyptus Trees) greatly delayed the attempt to restore Angel Island, in the Golden Gate National Recreation Area, labeling National Park Service

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employees "plant Nazis" for planning *Eucalyptus* removal (Williams 2002). However, native plant, bird, and insect biodiversity plummets in California *Eucalyptus* forests and can be restored only if these trees are removed (Williams 2002).

The rockbound coast of Maine, also the subject of many painters and writers (e.g., see paintings at <http://downeastwatercolors.com>), is another recent artifact of an introduced species. The European periwinkle snail (*Littorina littorea*) was introduced to Nova Scotia in 1840 and has gradually spread, transforming the entire coastal landscape (Bertness 1984). Although much of the New England coast formerly consisted of mudflats, marshes, and rocks covered with algae, the periwinkle grazed the algae off the rocks and ate the shoots and rhizomes of marsh grasses. The entire ecosystem changed, to the detriment of many native species of animals as well as plants, and many native species are far rarer now. Nevertheless, most nonbiologists do not know this history and view the current Maine landscape with great affection, regarding it as intimately associated with the ambiance and even spirit of this coast.

Exotic species arrive for various reasons. First, immigrants introduce CKS from their own foreign cultures for aesthetic reasons and psychological support, as many Europeans did in their immigration to the Americas and as Asians, North Americans, and Europeans did in Hawaii and Tahiti (Dillingham 1936, Guild 1938, Lever 1992). Second, species are also deliberately introduced for economic reasons. Such species can adapt well to the new region and become an integral part of the local ecosystem and culture simply because of their abundance or their adoption by local people, e.g., as food. Third, unintentional introductions can produce the same phenomenon as with intentionally introduced species in native cultures, e.g., they can become invasive dominant plant species. Examples include bluegrass in the United States, potatoes in Europe, or apples for a group of native people of the Patagonia who call their area "the country of the apples" (Capella 1998).

Garibaldi and Turner aim to show that conservation and restoration efforts that follow the CKS approach, which implies the use of species with outstanding importance in human cultures as a starting point for conservation practices, will have greater chances of success than other approaches, mostly because of the increased participation and interest of local people. Despite the apparent appeal

of this idea, we can think of ways in which this approach might detrimentally affect conservation or restoration programs. Garibaldi and Turner suggest that the best way to assess if a species is or is not a CKS is just to ask the original people of an area if the species is essential for their survival and identity. However, the memory of a culture is not static; it changes through time, and it is influenced by many different factors (Olick and Robbins 1998). Consequently, the traditions, mythology, and history of a people cannot be trusted as accurate depictions of ancient or even recent ecology. An example of this problem can be seen in the effects of the Spanish conquest of the Americas, accompanied by the introduction of many exotic species, some of them currently rooted in a number of native cultures. This is the case with horses (*Equus caballus*), which are so integrated into native cultures that it sometimes seems inconceivable that they were not present before the culture arose (Musters 1964). Another clear example of inaccurate cultural knowledge is found in the Nuer tribe from east Africa. The tree under which the Nuer believe mankind came into being was still standing at the beginning of the last century (Evans-Pritchard 1940), which exemplifies how beliefs can be acquired in cultures without written documents. The European periwinkle is now probably the most recognizable gastropod in Maine (Norton 1993), and in Maine and Nova Scotia it supports a substantial fishery. Nevertheless, as noted above, it arrived only in the last two centuries and has completely changed many native ecosystems.

These accretions to cultural memory can be problematic. For example, what if a restoration program depends upon eradicating or controlling an exotic CKS? What if the community decides to restore an exotic species that forms part of its tradition? The acrimonious attempt to impede the removal of exotic *Eucalyptus* from Angel Island in California (Azevedo 1990, Williams 2002) is mirrored by similar efforts to prevent the restoration of native ecosystems by the removal of longstanding invasive plants that have come to be prized by local communities, e.g., Australian pine (*Casuarina equisetifolium*) in Florida (Gasco 1995) and European buckthorn (*Rhamnus cathartica*) in the Chicago region (Gobster 2000). Garibaldi and Turner suggest that cultures and ecosystems are tightly related, but it is clear that there are exceptions.

The co-evolutionary process between cultural and

ecological systems proposed by Garibaldi and Turner is, at first glance, an appealing idea. However, we must bear in mind that changes in technology, e.g., fire management or agriculture, produce changes in human cultures. For this reason, it is difficult to see the relation between cultural and ecological systems as a symmetrical interaction. We cannot see human cultures, even those closest to nature, as evolving at the same rates as ecosystems; culture changes, and as a result the interaction of people with their surrounding ecosystems changes. The evolution of human culture and the evolution of native ecosystems can easily be out of sync. Today we have clear evidence that primitive cultures caused species extinctions in prehistoric times (Barnosky et al. 2004). This shows that even the most primitive and natural ecosystem-dependent humans can wreak havoc on biodiversity.

We applaud the attempts of Garibaldi and Turner to incorporate local people into conservation and restoration practices and to halt cultural loss, a distressingly common phenomenon in recent decades. However, even though conservation must obviously entail interaction with local populations, it is not necessarily true that human culture and natural ecosystems will both be preserved by the same activities. Each case must be examined critically. Otherwise, both goals, conserving ecosystems and cultures, could be negatively affected by a well-meaning proposal. Educating people about the problems that exotic species generate is essential for the success of any conservation program that includes the active participation of local people. With a deep understanding of the risks that exotic species entail for native habitats, the cultural keystone species approach for conservation could be a useful tool in the conservation arsenal.

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