

Notes from Abroad

Restoring biodiversity in Ireland's national parks

By Daniel Sarr, Cameron Clotworthy, and Robbie Millar

ALTHOUGH NATIONAL PARK conservation arose in the wilderness landscapes of the American West, it is rooted in a strong preservation ethos and its worldwide adoption has since brought it into many long-settled lands. Such human-dominated landscapes often contain novel albeit anthropic ecosystems, distinctive biodiversity, and compelling questions for conservation science (Palmer et al. 2004). Of particular interest are historically degraded landscapes that have lost essential elements of biodiversity in the past, but through changes in land use and ecological restoration may be recovering their natural and cultural heritage. Ireland, an ancient cultural landscape, provides fascinating examples of the roles that national parks can play in biodiversity conservation and restoration, particularly in highly modified landscapes (fig. 1).

Ice, wind, and famine: The rise and fall of Irish biodiversity

After its evolutionary stage was swept largely clean by Pleistocene glaciers, Ireland was colonized by a spare and mobile suite of species and peoples during a relatively brief time when the nation was connected to Great Britain at the tip of the British peninsula (Yalden 1999). With the rise of Holocene seas around 10,000 years ago, it assumed its current island form, and flight, wind, and water became the only routes for species to arrive. The patterns of biological colonization and persistence in Ireland suggest a story of postglacial founders and subsequent invaders that occasionally attained dominance and

Abstract

Ireland, settled since late Stone Age times, has experienced a long history of environmental change and biodiversity loss. With the establishment of its national parks, Ireland began the relatively recent process of restoring its natural heritage. These ongoing efforts, which have involved restoration of focal communities or habitats, such as oak forest and, most prominently, the restoration of focal species populations such as the golden eagle, have provided potent symbols of renewal in an ancient cultural landscape. The restoration work also has yielded insights into the challenges and opportunities that can come from applying the national park idea in long-settled lands.

Key words

anthropic, biodiversity, Ireland, national parks, restoration

pushed ancient elements to marginal refugia (Searle et al. 2009). Ireland's insular setting ensured that native species would be inherently vulnerable to extinction and to the needs of a growing human population. However, the Burren and Killarney National Parks in western and southwestern Ireland contain a number of such relict species.

The environmental history of the British Isles has been well chronicled, especially since the late Middle Ages (Lovegrove 2007). Habitat losses began early. In both Britain and Ireland, largely forested in the early Holocene, major shifts in the fossil forest beetle fauna suggest abrupt habitat changes, most likely deforestation, around 3,000–5,000 years ago (Whitehouse 2006). This parallels the flowering of advanced megalithic cultures on both islands, suggesting that while they built such timeless structures as Stonehenge and Newgrange, late Stone Age cultures started a long trajectory of landscape change. Compounding habitat losses, persecution of many species in both Britain and Ireland accelerated until the beginning of the 20th century and still occurs in some regions (Lovegrove 2007). Losses of most large



Figure 1. The national parks of the Republic of Ireland are marked with red stars; black triangles are major cities.

carnivores, such as wolves, eagles, and hawks, were complete, or nearly so, by the middle of the 20th century (Hickey 2000; O'Toole et al. 2002). In Ireland these abuses were compounded by the human tragedy of the Great Famine of the mid-19th century, such that a ravaged fauna became a food source of last resort.

(A) NPS/DANIEL SARR, (B) CON MORIARTY, (C) LORCAN O'TOOLE, (D): PAM BROPHY



Figure 2. Focal habitat and species restoration issues in the Irish national parks. (A) One of the last native stands of Scots pine (*Pinus sylvestris*) woodland in Ireland and Lough Veagh at Glenveagh National Park. (B) Red deer (*Cervus elaphus*) stag, one of the first and most prominent and successful species restorations in Ireland. (C) Pontic rhododendron (*Rhododendron ponticum*, flowering evergreen shrub on right bank) invades a riparian forest, displacing native species at Killarney National Park. Pontic rhododendron is possibly the greatest threat to native biodiversity in the Irish national parks, because it competitively excludes most native plant species. (D) A golden eagle (*Aquila chrysaetos*) chick at Glenveagh National Park. Golden eagle introductions are the highest-profile species restoration in the last two decades in Ireland.

Restoring biodiversity in the national parks of Ireland

The culmination of Ireland's environmental history was severe biological impoverishment. By the 20th century, only 0.5% of the nation's land remained in forest, and the last vestiges of wild forests and their inhabitants were often to be found on private estates and hunting lodges. Without a wealth of public lands, the republic was forced to purchase lands incrementally for its parks or to accept land as gifts to the state. Nonetheless, progress has been impressive. In 1970, Ireland had only one national park and no other state-owned conservation areas (Craig 2001). However, by 2000, Ireland had established its current array of six national parks (fig. 1) and other designated conservation areas, constituting approximately 14% of its terrestrial and near-marine areas and putting it in the top half of European Union nations for lands conserved.

In the management of its national parks, Ireland follows the standards set forth by the International Union for the Conservation of Nature (IUCN) in 1969, which recommends that all governments agree to reserve the term "national park" to areas sharing the following characteristics:

- Where one or several ecosystems are not materially altered by human exploitation and occupation; where plant and animal species, geomorphological sites, and habitats are of special scientific, educational, and recreational interest or contain a natural landscape of great beauty.
- Where the highest competent authority of the country has taken steps to prevent or eliminate as soon as possible exploitation or occupation in the whole area and to effectively enforce the respect of ecological, geomorphological, or aesthetic features that have led to its establishment.
- Where visitors are allowed to enter, under special conditions, for inspirational, educational, cultural, and recreational purposes.

The application of this ideal is obviously problematic in a long-settled land, and although they occupy some of the most pristine areas of the country, none of the Irish parks have escaped human impact. Consequently, Ireland's national parks have become anchors for active and passive restoration (e.g., removal of impacts such as turf cutting and allowing natural recovery, respectively) of native biodiversity. In

some cases, this is because they contained remnant forests, for example the birch, oak, and pine woodlands at Glenveagh National Park (fig. 2A). In other cases, national parks have been determined to be places of stable land tenure, where hunting, grazing, and other impacts can be controlled. Nonetheless, major challenges to biodiversity restoration in the Irish parks, as elsewhere, include extirpation of foundational species, habitat change and loss, effects of native and domestic grazers, and invasive plant species.

Because many of Ireland's native predators were extirpated by the 19th century, species restorations have become a major conservation goal. National parks have been focal areas for the direct introductions of native wildlife, including the iconic red deer (*Cervus elaphus*, a close relative to the North American elk; fig. 2B). This species was restored to Glenveagh National Park in the late 19th century from populations in Britain and Ireland (GNP 2008). Raptor restoration has been a major focus in recent years, including the golden eagle (*Aquila chrysaetos*) at Glenveagh in 2001 (O'Toole et al. 2002), the white-tailed sea eagle (*Haliaeetus albicilla*) at Killarney National Park in 2007, and the red kite (*Milvus milvus*) in Wicklow Mountains National Park in 2007. To date, population

recovery rates of most raptors are low. Major sources of mortality include poisoning, vehicle accidents, and illegal hunting. However, the first golden eagle chicks in more than a century fledged in 2007 at Glenveagh (fig. 2C, previous page), and scientists are hopeful that these native-born birds will fare better than introduced juveniles. Only time will tell.

Other restoration needs in the Irish national parks include active and passive approaches to wetland and riparian restoration, forest restoration, and control of invasive plant species. The introduced Pontic rhododendron (*Rhododendron ponticum*), which competitively excludes native plants, is perhaps the greatest threat to biodiversity in the Irish national parks, and it has proven to be a strong invader of forests, moorlands, and riparian environments (fig. 2D, previous page). In contrast, some introduced species and communities are yielding beneficial ecological surprises. Plantations of introduced conifers, such as Sitka spruce (*Picea sitchensis*), which are rightly viewed as ill-conceived by many because they are not native to the British Isles, apparently provide important surrogate habitat for some forest-dependent species, including the pine martin (*Martes martes*) and the hen harrier (*Circus cyaneus*). Such observations reinforce a need for precaution, but also provide hopeful signs that native biodiversity can be resilient.

In other cases, the restoration of native species has had substantial negative effects on some habitats. Restoration research at both Glenveagh and Ballycroy using grazing exclosures of varied sizes has demonstrated that red deer and livestock tend to decrease the abundance of ling heather (*Calluna vulgaris*) and expand the dominance of purple moor grass (*Molinia caerulea*), and that heather can recover with short-term exclusion of native grazers and introduced livestock (fig. 3). However, long-term exclusion of



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Figure 3. A research grazing exclosure at Ballycroy National Park enabled scientists to understand the effects of grazing on vegetation by red deer. The dark vegetation in the exclosure is ling heather (*Calluna vulgaris*) and the pale tufted grass around the exclosure is purple moor grass (*Molinia caerulea*). Ling heather is critical habitat for the native red grouse (*Lagopus lagopus scoticus*), and research into the effects of both native (red deer) and non-native grazers (sheep) on habitat availability helps the park balance rural livelihoods and native species conservation.

red deer has also been observed to favor increases in the cover of grazing-resistant purple moor grass, which forms a heavy thatch that limits recruitment of native trees (Millar, unpublished data) and has less habitat value than heather. Some of these grazing impacts may be due to the current lack of large predators (wolves) in the Irish landscape, which is unlikely to change anytime soon. Restoration of a full diversity of habitats, therefore, will likely require long-term commitments to wildlife population management as well as innovative grazing management through the use of exclosures, movement of animals, or targeted grazing with other ungulates (e.g., sheep, goats, or cattle).

A marked decline in the populations of red grouse (*Lagopus lagopus scoticus*) across

Ireland and in the approximately 25,622 hectares (63,313 ac) Owenduff/Nephrin Complex Special Protection Area (CSPA) surrounding Ballycroy National Park is believed to have been caused by a combination of depredation and habitat loss. In particular, excessive grazing by domestic sheep has led to declines in ling heather height and cover, important dimensions of red grouse habitat (Murray et al. 2013). In 2006 the decision to remove sheep in winter for five months, split between late fall and early spring, allowed an improvement in habitat condition and a doubling in red grouse numbers (362–426 individuals in 2002 vs. 790–832 individuals in 2012) across the Owenduff/Nephrin CSPA (Murray et al. 2013). The success of this innovative approach may have broad implications for red grouse habitat management in Ireland.

Ireland, an ancient cultural landscape, provides fascinating examples of the roles that national parks can play in biodiversity conservation and restoration, particularly in highly modified landscapes.

Implications for biodiversity

These examples provide only a brief sketch of the challenges of restoring biodiversity in long-settled lands such as Ireland. These are rarely settings where absolutes and complete solutions can be implemented successfully in one effort. In Ireland, initial work ranged from largely successful (red deer restoration) to highly challenging (raptor restorations). Of course, there are also unintended consequences of restoration that can be both good and bad. A critical element in such a comprehensive restoration program is the strategic pursuit of an adaptive research and long-term monitoring capacity to help park managers and partners track the success of their efforts. Current monitoring and research have focused on a subset of species (red deer) through agency and collaborative public and nongovernmental efforts (raptors). The first author conducted the field research for this article in 2008 on a Fulbright Fellowship, just before the onset of the global economic crisis. Since that time, Ireland has endured great economic challenges, and is currently struggling to rebuild and expand its conservation research and monitoring capacity in a fiscally difficult time. Professional exchanges, in which scientists share ideas for inventory, monitoring, and research, are likely to be valuable for sharing insights and techniques in biodiversity restoration across differing environmental and cultural settings.

We conclude that national parks in long-settled lands like Ireland present interesting and compelling challenges for biodiversity conservation. They serve not only as important anchors of ecological restoration but also as windows on a vanished past and catalysts for human well-being today. Reestablished wildlife species and ecosystems provide potent and inspiring symbols of conservation for present and future generations. These examples from Ireland demonstrate the importance of park-based restoration programs to foster environmental awareness and conservation commitment in an ancient yet continuously evolving landscape. They also reinforce the importance of long-term commitment to inventory, monitoring, and adaptive research to ensure that such efforts succeed and biodiversity is restored.

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