While the cat's away: How removing an invasive species devastated a World Heritage island

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Removing an invasive species from sub-Antarctic Macquarie Island, a World Heritage Site, has caused environmental devastation that will cost more than A$24 million to remedy, ecologists have revealed. Writing in the new issue of the British Ecological Society's *Journal of Applied Ecology*, they warn that conservation agencies worldwide must learn important lessons from what happened on Macquarie Island.

Using population data, plot-scale vegetation analyses and satellite imagery, the ecologists from the Australian Antarctic Division (AAD), the University of Tasmania, Blatant Fabrications Pty Ltd and Stellenbosch University found that after cats were eradicated from Macquarie in 2000, the island's rabbit population increased so much that its vegetation has been devastated.

According to the study's lead author, Dr Dana Bergstrom of the Australian Antarctic Division: "Satellite images show substantial island-wide rabbit-induced vegetation change. By 2007, impacts on some protected valleys and slopes had become acute. We estimate that nearly 40% of the whole island area had changed, with almost 20% having moderate to severe change."

Rabbits were introduced to Macquarie Island in 1878 by sealing gangs. After reaching large numbers, the rabbits became the main prey of cats, which had been introduced 60 years earlier. Because the rabbits were

causing catastrophic damage to the island's vegetation, Myxomatosis and the European rabbit flea (which spreads the Myxoma virus) were introduced in 1968. As a result, rabbit numbers fell from a peak of 130,000 in 1978 to less than 20,000 in the 1980s and vegetation recovered. However, with fewer rabbits as food, the cats began to eat the island's native burrowing birds, so a cat eradication programme began in 1985. Since the last cat was killed in 2000, Myxomatosis failed to keep rabbit numbers in check; their numbers bounced back and in little over six years rabbits substantially altered large areas of the island.

According to Bergstrom: "Increased rabbit herbivory has caused substantial damage at both local and landscape scales including changes from complex vegetation communities, to short, grazed lawns or bare ground."

Invasive species can cause large-scale changes to ecosystems, including species extinctions and - in extreme cases - ecosystem "meltdown". As a result, control or eradication of invasive alien species is widely undertaken. However, important lessons must be learned from events on Macquarie Island, say the authors.

"Our study shows that between 2000 and 2007 there has been widespread ecosystem devastation and decades of conservation effort compromised. The lessons for conservation agencies globally is that interventions should be comprehensive, and include risk assessments to explicitly consider and plan for indirect effects, or face substantial subsequent costs. On Macquarie Island, this cost will be around A$24 million," says Bergstrom.

The changes documented in this study are a rare example of so-called "trophic cascades" - the knock-on effects of changes in one species' abundance across several links in the food web. "This study is one of only a handful which demonstrate that theoretically plausible trophic

cascades associated with invasive species removal not only do take place, but can also result in rapid and detrimental changes to ecosystems, so negating the direct benefits of the removal of the target species," Bergstrom says.

More info: Dana M Bergstrom et al (2009). Indirect effects of invasive species removal devastate World Heritage Island, *Journal of Applied Ecology*, doi: 10.1111/j.1365-2664.2008.01601.x, is published online on 13 January 2009.

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