

Building capacity to eradicate invasive species from islands

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Introduction

Eradicating invasive species from islands presents some of the most exciting opportunities, and daunting challenges, in biodiversity conservation today. Just 50 years ago few would have believed that removing pest populations from islands for conservation outcomes was achievable, or even worth doing. In recent decades the number and size of islands from which invasive vertebrates have been eradicated has increased significantly (Keitt et al., 2011). As a result extinctions have been averted, species recovered and ecological processes revitalised (e.g. Bellingham et al., 2010). These successes have led to growing confidence amongst island restoration practitioners, and to further support from stakeholders, donors and administering agencies (Genovesi, 2011).

Advances continue to be made. The current attempt to eradicate ship rats, house mice and European rabbits from sub-Antarctic Macquarie Island is at the “cutting edge” in skills, technology and project management (Springer, 2011). A proposal to eradicate ship rats and house mice from Lord Howe Island is another example of important progress being made; in this case eradicating rodents from an inhabited island where gaining local stakeholder support is a crucial component of the operation (Wilkinson & Priddel, 2011).

Eradication has emerged as a key tool in species recovery and island restoration programmes in a growing number of countries with islands. Often, techniques, technology and skills have been developed through undertaking increasingly complex projects. These projects have also increased the capacity of agencies to manage invasive species and to maintain conservation outcomes.

Regional initiatives have involved multiple countries applying coordinated and cooperative actions against island pests. The Pacific Invasives Initiative was the first regional programme of the global Cooperative Initiative on Invasive Alien Species that was launched through the Convention on Biological Diversity in 2002. The Pacific Invasives Learning Network was subsequently created to promote the transfer of information and skills in support of invasive species management activities in the region. In 2009 these programmes were united as the Pacific Invasives Partnership (www.sprep.org/pacific-invasives-partnership), and merged with the Invasive Species Working Group of the Pacific Islands Roundtable for Nature Conservation. The Pacific Invasives Partnership now involves more than 20 government and non-government organisations. Its focus on coordinating activities, sharing information, developing skills and facilitating cooperation reflects increasing interest in building invasive species management capacity in the region.

The recent endorsement by national leaders of a Micronesia Biosecurity Plan is another example of a regional programme focused on collective capacity building alongside other objectives. Initiatives have also been taken in other island regions including the Indian Ocean, Caribbean and south Atlantic. International conservation organisations have embarked on regional programmes, including BirdLife International's Pacific Invasive Species Programme and the 'Small Islands, Big Difference' initiative launched by Island Conservation in association with the Global Islands Partnership and other organisations.

A focus on building further capacity

Despite the progress that has been made invasive plants and animals are impacting island biotas virtually everywhere. We are witnessing a global island extinction crisis due largely to their impacts.

There is an urgent need to build on our achievements, and to increase the pace and scale of eradication and associated biosecurity activities to prevent re-invasions. A focus on building our collective capacity will be the key to achieving and sustaining island restoration goals.

The word 'capacity' can be used to cover a wide range of attributes and the term 'capacity building' may refer to a variety of objectives and activities involving individuals, organisations and communities. With reference to eradication projects 'capacity' is here defined as the collective ability of practitioners, management agencies and stakeholders to manage successful eradication projects. However, the capacity requirements of participants may differ. Capacity building for eradication practitioners typically involves education and training aimed at improving their knowledge, skills and confidence. Capacity building within agencies generally involves developing policies, structures and procedures to support decision making, and providing for leadership and accountability. Institutional capacity building may also include securing funds to undertake eradications. Capacity building within communities and other groups has usually focused on supporting communication and enhancing access to information. A greater focus on engaging and empowering stakeholders is likely to be an important element in future eradication projects on inhabited islands. A more focused approach to identifying the capacity needs of all participants and key stakeholders is likely to lead to significant benefits.

Six components of capacity can be identified which, in combination, reflect the range of requirements for eradications to be successfully undertaken; knowledge, technology, skills, project management, stakeholder support and funding.

1. Knowledge

An ability to predict outcomes is central to the continued development and wider application of eradication as an island restoration tool. Over the last few decades considerable experience has been gained by a small, but growing number of practitioners undertaking eradications. The information gained by management agencies has allowed for standard operating procedures to be developed and applied to reduce the risks of operational failure, and of unexpected outcomes (eg Department of Conservation, 2011). Knowledge based on a sound understanding of the ecology of the species of interest, and of ecological interactions, will be critical to informing decisions and predicting eradication outcomes. For example, research on New Zealand islands has shown important changes in the composition and functioning of island ecosystems when seabirds are replaced by rats. Invasive predators can act as major drivers of island ecosystems through their indirect impacts on above and below-ground biotas (Fukami et al. 2006, Towns et al. 2009). This sort of research underpins our ability to predict ecological responses to rodent eradications, including recognition of complex relationships and the considerable time which might be involved for ecosystems to recover.

Research focused on key questions and the establishment of baseline monitoring programmes prior to eradication being initiated are important ways to improve knowledge. Analysis of collated information can allow outcome predictions to be made, and priorities for further research identified. In some cases eradication plans may involve an adaptive management approach through which further knowledge is gained, and uncertainty reduced, as management proceeds.

Experience of eradication techniques and knowledge of ecological responses has been shared through a variety of technical reports, scientific publications and databases (eg. the database of island invasive species eradications, Keitt et al 2011). Several international conferences have focused on eradications, and on sharing information and perspectives, including the 'Island invasives: eradication and management' conference held in Auckland, New Zealand, February 2010. Many of the papers referred to here are published in the proceedings of this conference (Veitch et. al, 2011). While

information dissemination to date has been creditable, a more focused and coordinated focus on strategic research needs such as understanding rodent feeding behaviour on tropical islands, detecting pests at low densities and confirming eradication success, would lead to further progress.

2. Technology

Successful ecological management typically involves a mix of “high-tech” and “low-tech”. New technology such as infra-red cameras, satellite-based navigation systems and increasingly sophisticated aerial bait spreading buckets have been important in underpinning operational successes and improving the effectiveness and efficiency of eradication operations. The absence of effective control tools underpins the relatively small range of pests that have been eradicated to date. Close relationships with technology companies can be very productive in promoting the development and refinement of eradication tools and devices. Several New Zealand helicopter operators, for example, have invested considerable time and effort to improve bait spreading buckets for aerial eradication operations. A coordinated, collective approach to making further improvements to eradication technology, such as the development of rodent baits that are unattractive to crabs, automatic re-setting traps and remote sensing surveillance devices are likely to underpin further important advances.



Figure 1: Helicopter and bait-spreading bucket undertaking the first aerial eradication operation in the south Pacific, on the Aleipata Islands, Samoa (Photo; Stuart Chape, SPREP).

3. Skills

The attributes of operators in the field, including a commitment to achieve eradication goals, are crucial to the success of eradication operations. Experienced eradication practitioners have specialised skills in using technology and in collecting, collating and analysing data, as well as a wide range of field skills necessary to operate safely and effectively in small teams, often in remote areas, for extended periods. People with this set of attributes are rare. In many cases the employment contracts of field practitioners are terminated at the end of eradication operations. Because they are typically highly motivated and resourceful most quickly take up employment in some other business area and their skills and experience are lost to the eradication sector. This represents a major loss of capacity nationally and internationally.

Skilled field staff have sometimes contributed to several eradication projects. There is a pressing need to share among projects the skills and experience of these people. In addition to providing a way through which skilled operators could contribute to multiple projects, a coordinated international skills-sharing mechanism would also improve the continuity of employment for experienced people who frequently rely on short, fixed-term contracts. Longer-term engagement in a sequence of projects would mean not only benefits to the individuals, but also to the various projects in which they are involved.



Figure 2: USDA APHIS dog handler and dog, Nutria eradication project, Maryland, USA. Highly-trained dog-handler teams have been key “low-tech” tools in many eradication operations to locate the last few remaining individuals of the targeted pest.

The need to develop mechanisms to retain capacity – in this case, skills and experience, and to share them, is evident. Simply building capacity is not enough if it is only applied to one or two projects and

then is allowed to dissipate. Expenditure by management agencies in educating and training eradication practitioners, and by the practitioners themselves, in effort and commitment, should be seen as strategic investments for further application and wider benefit. If “pipelines” of projects were to be developed across regions – and perhaps more widely, it is possible that practitioners would be able to move from one project to the next, providing their skills and experience seamlessly between them. This would lead not only to significant benefits for the projects, but would also be beneficial to these itinerant eradication specialists, allowing them to maintain their commitment and to further-hone their skills with further experience. The unavailability of suitably skilled people is likely to be an important constraint to further eradications internationally.

A multi-country, multi-partner project undertaken in 2011 to eradicate rats from islands in three countries across the Pacific constituted another important advance. Project managers recognised the potential benefits in combining their projects in a single operation. A vessel was chartered which carried a small team of eradication specialists, two helicopters, rat baits and support equipment to each project in turn as part of a single expedition (Figure 3). While the financial benefits are still being evaluated it is clear that significant savings can be anticipated from sharing costs and resources across a suite of projects. Benefits in improved effectiveness and efficiency can also be expected from engaging a small team of specialists to undertake similar tasks in a sequence of projects within a single operation. Important economies of scale can also be anticipated in planning and managing projects as part of a coordinated programme, rather than as discrete “one-off” projects as is still typically the case (Saunders et al. 2011). These and other initiatives have led to conservation achievements few could have anticipated even 20 years ago.

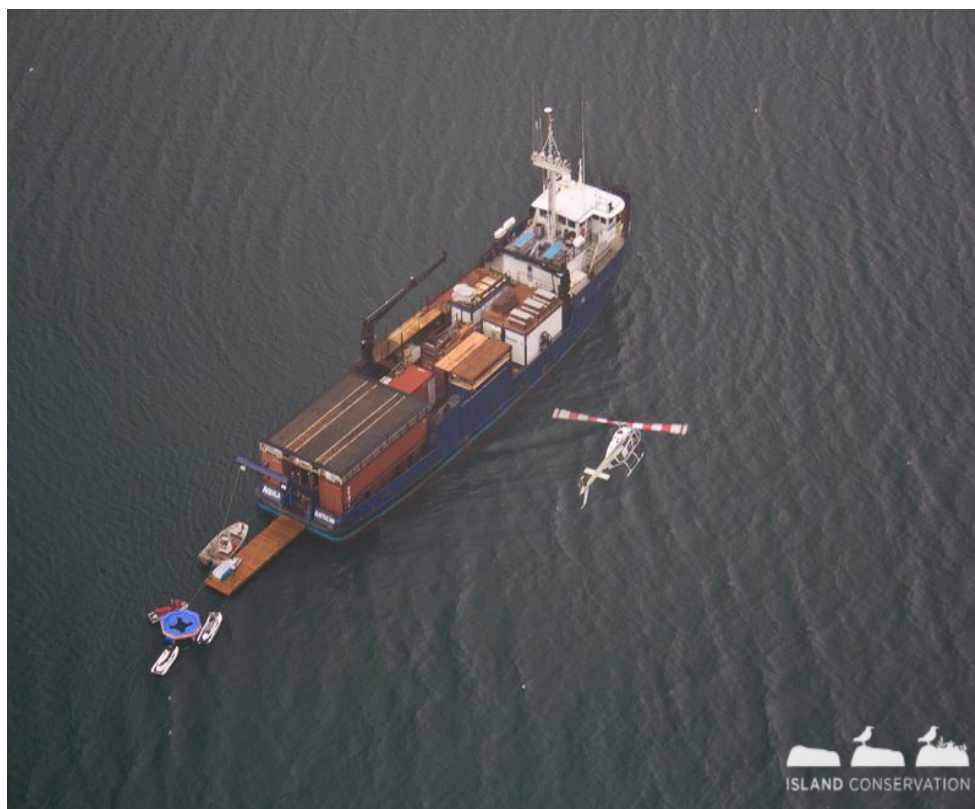


Figure 3: A multi-country, multi-project ship-based eradication expedition in the Pacific in 2011 represented a new era in collaboration and capacity sharing (Photo provided by Alex Wegmann, Island Conservation).

4. Project management

Appropriate project management procedures applied by the institutions implementing eradications have been an important success factor. Good project management ensures consistency, transparency and accountability in decision making and facilitates effective and efficient management actions. The establishment of an appropriate project management structure and clear decision making processes at the outset allows participating organisations, including donors, to identify their required inputs. Robust project management also provides participating organisations, practitioners and others with interests in the project to influence the direction of the project during planning stages, and to contribute to decisions as the project proceeds. Most eradication projects have been undertaken by government agencies or international non-government organisations, either alone or in partnership. Robust project management is a standard requirement in most businesses and most of these organisations have been able to successfully adapt established policies and procedures to eradication projects.

Where implementing agencies have little experience with eradication operations, an early focus on building institutional capacity, including the development of project management structures and procedures may be needed. Once developed this capacity could have benefits across a spectrum of activities. Alternatively, where implementing agencies are too small, or lack the resources to manage an eradication project alone, support might be provided by a partner organisation with the appropriate capacity. Identifying the capacity needs of agencies to effectively manage an eradication project, and determining how this capacity could be developed are important early tasks in the planning process. Project management, and wider governance, may be influenced by political imperatives and institutional cultures. What is appropriate for one agency may not be appropriate for another. To this extent project management structures and procedures may not be transferable between eradication projects although the principles underpinning successful eradication projects are well understood.

5. Funding

Even relatively small eradication operations can involve significant financial investments. Multi-species eradications on large, remote islands can cost millions of dollars. A lack of funds is often given as a reason for eradications not being undertaken. Insufficient funds may also be given as a reason for eradication operations being initiated, but not completed, and consequently failing. Typically funding is secured for an “initial knock-down” of the target population, but is withdrawn at some stage during the subsequent “mop-up” or surveillance stages as the effort and cost per pest removed increases. In the eradication of feral goats from Santiago Island, Galapagos, the cost of removing the last 1,000 goats (of the more than 79,000 removed), and subsequent monitoring to confirm eradication, were 40% of the project costs overall (Cruz et al., 2009). Reducing the costs of removing the last few individuals of a targeted population, and confirming eradication remain as key challenges. Significant reductions in cost and risk can be anticipated if these issues, in particular, can be addressed.

Despite the high initial investment required eradications can be remarkably cost-effective in relation to the outcomes achieved. As part of Project Isabela in the Galapagos Archipelago feral goats were eradicated from Isla Isabela for a little over US\$9 per hectare and a range of ecological responses have subsequently been reported (Carrion et al. 2011). As with other elements of institutional capacity, a collective approach to reducing the anticipated costs of eradications is likely to be more productive than *ad hoc*, opportunistic efforts.

6. Stakeholder support

The support of people with an interest in the proposed eradication, and a stake in its outcomes, is another important component of eradication capacity. Stakeholders including landowners, resource users, local communities, conservation groups and perhaps a host of others are likely to have views on how a project should be implemented – or whether it should be undertaken at all. Identifying key stakeholders in the early stages of a project and facilitating their engagement so that their views may be taken into account in decision making will be important. Local residents, in particular, are likely to have invaluable local knowledge and insights which could have a strong influence on the success of the project. Local people are likely to be the only ones able to advise on cultural, religious and other social dimensions which may need to be recognised.

The need to engage stakeholders and to facilitate their support will be increasingly important when inhabited islands are identified as potential eradication sites. In many cases multiple landowners and land uses will be involved, requiring sophisticated policies and adaptive strategies to ensure peoples' views and needs are properly acknowledged. Maintaining biosecurity programmes to ensure islands remain pest free will also require appropriate social and institutional policies. For many agencies responsible for undertaking eradications on inhabited islands this may require accessing a set of new perspectives and skills, including sociologists and economists, as well as adopting outward-looking policies and procedures to enable organisations to engage with a wider set of stakeholders and to incorporate different perspectives and requirements into management plans. The need to develop this kind of institutional capacity has been largely overlooked to date.

A more strategic approach to capacity building

Over the last 20 years, eradications have emerged as an important island restoration tool. Progress has been made in improving our knowledge and ability to predict eradication outcomes, in developing skills and technology, refining institutional policies and procedures and generating stakeholder and donor support. As the number, scale and complexity of eradications increases, costs and risks are also increasing. For individual practitioners the high level of commitment required can mean that an operational failure can constitute a major blow, and lead to a reluctance to be involved in further eradications. The political and institutional risks of an eradication failing may be so high that even one failure may prevent management agencies and donors contemplating supporting another for a very long time. Financial risks are compounded by the all-or-nothing nature of eradication goals. Political risks may also be elevated if the expectations of local communities and other stakeholders are not met.

Improving our collective capacity to manage risks and to improve the efficiency and effectiveness of management actions will be important if the pace and scale of eradication is to increase. A collective approach would recognise that most agencies – and even most countries – are unlikely to be able to justify developing or retaining the full range of capacity needed to successfully undertake eradications. Cooperative international capacity building programmes will be required which are focused on addressing identified needs, and on sharing this capacity for maximum effectiveness and efficiency. Such an approach will require agreement on collective capacity needs, and on collegial actions to address them. This would probably require agreement that eradication projects should include capacity building goals. Recent cooperative international projects involving the sharing of skilled staff, specialised equipment and other resources between management agencies and donors may be forerunners of further exciting developments.

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References

- Carrion, V., Donlan, C.J., Campbell, K.J., Lavoie, C. and Cruz, F. (2011). Archipelago-wide island restoration in the Gala'pagos Islands: reducing costs of invasive mammal eradication programs and reinvasion risk. *PLoS ONE* 6(5): e18835. doi:10.1371/journal.pone.0018835
- Cruz, F., Carrion, V., Campbell, K.J., Lavoie, C., Donlan, C.J. (2009). Bioeconomics of large-scale eradication of feral goats from Santiago Island, Galapagos. *Journal of Wildlife Management* 73(2): 191-200
- Department of Conservation. (2011). Current agreed best practice for rodent eradication—aerial broadcasting poison bait. Version 2.2. October 2011
- Fukami, T., Wardle, D.A., Bellingham, P.J., Mulder, C. P. H., Towns, D.R., Yeates, G. W., Bonner, K. I., Durrett, M. S., Grant-Hoffman, M. N. and Williamson, W. M. (2006). Above- and below-ground impacts of introduced predators in seabird-dominated island ecosystems. *Ecology Letters* 9: 1299–1307
- Genovesi, P. (2011). Are we turning the tide? Eradications in times of crisis: how the global community is responding to biological invasions. Pages 5-8 In: Veitch, C.R., Clout, M.N. and Towns, D.R. (eds.). *Island invasives: eradication and management*. IUCN, Gland, Switzerland.
- Keitt, B., Campbell, K.I. Saunders, A., Clout, M., Wang, Y., Heinz, R., Newton, K and Tershy, B. (2011). The Global Islands Invasive Vertebrate Eradication Database: A tool to improve and facilitate restoration of island ecosystems. Pages 74-77 In: Veitch, C.R., Clout, M.N. and Towns, D.R. (eds.). *Island invasives: eradication and management*. IUCN, Gland, Switzerland.
- Saunders, A., Parkes, J.P., Aguirre-Munoz, Morrison, S.A. (2011). Increasing the return on investments in island restoration. Pages 492-495 In: Veitch, C.R., Clout, M.N. and Towns, D.R. (eds.). *Island invasives: eradication and management*. IUCN, Gland, Switzerland.
- Springer, K. (2011). Planning processes for eradication of multiple pest species on Macquarie Island – an Australian case study. Pages 228-232 In: Veitch, C.R., Clout, M.N. and Towns, D.R. (eds.). *Island invasives: eradication and management*. IUCN, Gland, Switzerland.
- Towns, D. R., Wardle, D.A., Mulder, C. P. H., Yeates, G.W., Fitzgerald, B.M., Parrish, R., Bellingham P. J. and Bonner K. I. (2009). Predation of seabirds by invasive rats: multiple indirect consequences for invertebrate communities. *Oikos* 118: 420-430, 2009
- Veitch, C.R., Clout, M.N. & Towns, D.R. (eds). (2011). *Island invasives: eradication and management*. IUCN, Gland, Switzerland
- Wilkinson, I.S. and Priddel, D. (2011). Rodent eradication on Lord Howe Island: challenges posed by people, livestock and threatened endemics. Pages 508-514 In: Veitch, C.R., Clout, M.N. and Towns, D.R. (eds.). *Island invasives: eradication and management*. IUCN, Gland, Switzerland.