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Standardized reporting on the costs of management interventions for biodiversity conservation

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Abstract

Effective conservation management interventions must combat threats and deliver conservation benefits at costs that can be achieved within limited budgets. Considerable effort has focused on measuring the potential benefits of conservation interventions but explicit quantification of implementation costs has been rare. Even when costs have been quantified, haphazard and inconsistent reporting means that published values are difficult to interpret. This reporting deficiency hinders progress towards building a collective understanding of the costs of management interventions across projects, and thus limits our ability to identify efficient solutions to conservation problems or attract adequate funding. We address this challenge by proposing a standardized approach to describing costs reported for conservation interventions. These standards call for researchers and practitioners to ensure the cost data they collect and report on provide enough contextual information that readers and future users can interpret the data appropriately. We suggest these standards be adopted by major conservation organizations, conservation science institutions, and journals, so that cost reporting is comparable between studies. This would support shared learning and enhance our ability to identify and perform cost-effective conservation.

Main Text:

Why improve cost reporting?

Effective biodiversity conservation interventions achieve maximum conservation benefit within the limits of available funding (Joseph et al. 2009, Wilson et al. 2009). Choosing cost-effective interventions requires understanding of both the benefits and the costs of potential actions. The benefits can be determined by impact evaluations that measure the conservation outcomes of previously implemented actions (Pullin and Knight 2001, Sutherland et al. 2004). However, reported cost estimates of actions are rare and inconsistent, despite their importance in decision making (Naidoo et al. 2006, Wilson et al. 2006).

Improved reporting on the costs of conservation interventions can enhance conservation outcomes in three ways. First, it could improve our understanding of the cost of delivering an individual conservation outcome, both to evaluate the efficiency and impact of conservation interventions within and across agencies (Margoluis et al. 2009) and to improve the legitimacy and accountability of NGOs (Jepson 2005). Second, it would allow for "apples to apples" comparison of costs across studies so we can learn how intervention costs vary with context (e.g. Bayraktarov et al. 2016). Finally, it would allow identification of appropriate cost data for quantitative decision support tools and enable improved prioritization of conservation actions (e.g., Carwardine et al. 2015).

Gathering data on the costs of conservation interventions remains a conservation priority (Sutherland et al. 2009). There has been a push to improve cost accounting within agencies through initiatives such as the Open Standards for the Practice of Conservation (CMP 2013) and the World Commission on Protected Areas framework (Hockings et al. 2006). However, most of the academic calls for improved understanding of the economics of conservation provide little guidance on how to achieve it (e.g., Naidoo et al. 2006) and no practical

recommendations for obtaining the consistent cost reporting that is necessary for understanding economic trade-offs (Armsworth 2014).

Ideally, reported costs in published studies and reports should be easy to interpret and transfer to support conservation decisions (Cook et al. 2017). In particular, cost reporting should permit assessment of the costs in relation to the intervention they describe. Decisions depend on cost data that are clear about the units, scale and context of the costed intervention (Armsworth 2014), as well as the intervention outcomes and cost conversion factors (Bayraktarov et al. 2016). However, in a review of 30 peer-reviewed articles with costings for a conservation intervention (see SI for list of studies) we confirmed that critical information was often omitted, ultimately hindering comparison across studies (Supplemental Fig. S1). The choice of these published studies was not an exhaustive overview of the literature, but instead showcases the limitations of status quo reporting.

Some of the inconsistent reporting in published studies likely stems from the cost collecting process, where costs are not easy to relate to benefits or interventions because financial record keeping is designed for business. In addition, institutional constraints often limit the resolution at which cost records are documented or shared and the true cost of conservation management actions is invariably underestimated due to factors such as institutional overheads, temporal economic discounting and free or subsidized labor. However, some of the inconsistency in reporting likely stems from researchers who compile and analyze conservation cost data lacking experience in what is relevant to report. Improving how cost data are collected and reported is a first step in enhancing the data available for conservation decision making.

Good cost data describe the financial accounting of costs incurred by performing an intervention (Barnett 2009). Good cost reporting summarizes these data so they can be

confidently and transparently used in economic evaluations (i.e., assessment of costs relative to benefits) and for decision support (Drummond et al. 2005). Reporting on financial costs is thus an accounting practice rather than an economics exercise, hence, does not quantify total economic value or include non-monetary costs such as opportunity costs (Drummond et al. 2005).

Improved cost reporting

As a first step towards improving cost data for conservation decisions, we propose standards that provide a framework for reporting on the costs of conservation interventions. These standards are designed to guide the collection and reporting of cost data to enable transparency within and across projects. We also provide a template for describing these data in publications so that readers and future users of these data can interpret them appropriately.

These standards have been designed to guide the collection of financial cost data and provide information on their context and details in written reports. They are flexible but targeted towards reporting on cost data related to common management interventions, such as invasive species management, prescribed fire, or enforcement of regulations. In developing these standards, we built on existing good practice by organizations that have developed detailed cost accounting systems to improve their decision making (e.g., New Zealand Department of Conservation, Bush Heritage Australia, Northwest Florida Water Management District).

Many fields, particularly those focused on profit (e.g., agriculture) or public accountability (e.g., public health), have recognized the importance of accurately accounting for costs in a manner that permits transparent analysis of the cost-effectiveness of alternative actions. These data can be included in economic evaluations that determine the return-on-investment for an action (Drummond et al. 2005; Shelmit et al. 2008). Different forms of economic

evaluation all require a standard, comparable reporting of both the costs and resulting benefit of a given action (Samuelson & Nordhaus 2005). While standardized mechanisms for estimating benefits require methods such as impact evaluation (Ferraro & Pattanyak 2006, Stem et al. 2005), like for like comparisons of cost-effectiveness also require consistent cost reporting (Hockings et al. 2009). Standardized accounting for costs is facilitated by listing the categories of costs that should be included in an estimate (e.g., GRADE guidelines in health care; Brunetti et al. 2013) or by providing estimates of the total costs of common actions (e.g., farm management actions in the UK; Redman 2016). While the specific costs that must be estimated vary among fields, the generic categories of costs are often similar (e.g., equipment, human resources, consumables; Brunetti et al. 2013). These other disciplines can also provide lessons on how to report costs in a manner that is transparent, such as capturing generic units (e.g., person hours or days) rather than dollar estimates due to the context dependence (e.g., geographic and temporal variation) of costs (Baltussen et al. 2003). In generating the recommendations proposed here, we have drawn on many lessons from other fields that are advanced in developing economic evaluations to guide cost-effective decisions.

Recommended standards for cost accounting

To generate these standards, we examined current practice and developed recommendations based on our experience and knowledge of the literature at a working group in Montpellier, France, in August 2015. As conservation researchers and practitioners across universities, government, and NGOs who regularly work with intervention and cost data, we suggest that the following reporting standards be followed when conservation researchers and organizations compile and report intervention costs:

I. *State the objective and outcome of the costed intervention:* Describe what the expended funding was aiming to achieve (e.g., monitoring or eradication) and the observed results.

II. *Define the context and methodology of the intervention:* Describe the starting condition of the conservation target, factors that could impact outcomes and the types of actions undertaken.

III. *State when, where and at what scale interventions were implemented:* Include information about the area, location and duration of the management intervention and ideally include a map (with a scale bar) showing where interventions were implemented.

IV. *State which of the following categories of cost are included:* When possible, provide raw units and cost breakdown within categories and state whether the cost is fixed or variable.

   a. *Labor time:* State the raw person-time units of the people implementing the action and note whether reported staff time includes time for travel to the site, support staff or manager time, and whether it was paid or voluntary time.

   b. *Capital assets:* Description of large assets such as equipment or infrastructure used, plus units and cost of unusual expenses.

   c. *Consumables:* State the total cost and specify the number and cost per unit of major items.

   d. *Overhead:* Specify whether calculated at the program or organization level (described below) or note if omitted.

V. *State currency and date for which costs were incurred:* For long projects it may be useful to estimate costs for key periods. Note any recalculations for inflation or currency conversion.

Applying the standards

We provide a worksheet (Supplemental Information) for summarizing and reporting intervention costs according to these standards. We encourage authors to include a completed version of this spreadsheet as supplementary material in papers or reports that describe intervention cost data.

Reporting level

Cost data that are collated and reported in a study can include different information depending on how an organization performs its record keeping (Fig. 1).

a) Intervention level cost data (direct costs, dark rectangles) are recorded as the additional specific costs to an organization of carrying out a given project such as invasive removal or species reintroduction.
b) Program level cost data (hatched area within solid line box) are recorded as including the shared costs of running an entire program. For instance, the costs of an invasive removal intervention as a part of an island restoration program.
c) Organization level cost data (hatched area) record the cost of the intervention by estimating the proportion of the total cost of running the organization that can be attributed to the intervention.

The reporting level determines how project costs apply to cost categories (Table 1).

Reporting details

I. Objective

Stating the objective of the costed conservation intervention permits appropriate future use of cost data by outlining what the incurred cost aimed to achieve. For instance, the objective can indicate the intensity of an intervention ("eradicate invasive weed" versus "maintain invasive cover at 5%") or describe the scope of the intervention costed ("general protected area management"). Some interventions may address more than one objective but we suggest highlighting the primary objective unless additional objectives significantly alter the project context.

II. Methods used and context

Describing the methods and context of the intervention permits interpretation of the costs in relation to what was done and under what conditions. Minimum basic details include the intervention approach, and if possible, the starting conditions (e.g., target species abundance), and intensity of the intervention (e.g., frequency of treatments). Ideally the management and monitoring aspects should be separated, and differences in costs for initial versus follow up interventions should be noted. Note if the configuration of interventions in the landscape affects costs. The social context of the project may also be important in cases where ecological outcomes are not the only goal (e.g., multiple objectives of the Working for Water program, McConnachie et al. 2012).

III. *Spatial and temporal scale*

The scale of the intervention determines the magnitude of recorded costs. Spatial scale can be the length of boundary surveyed, number of individuals treated, etc. Area of intervention is also important to record because economies of scale often mean that costs accumulate at a decreasing rate. The length of time that an intervention is applied can also influence the cost per unit time or area if learning or other efficiencies occur (e.g., Adams & Setterfield 2013).

IV. Cost categories

Cost accounting uses broad categories to describe project components and we suggest the following similar categories for conservation cost reporting. Within these categories, it can be helpful to consider whether costs can be classified as fixed costs – which stay the same as the project scales, or variable costs – which scale with project size and are often ongoing. Identifying fixed and variable costs permits estimates of how costs might scale across projects.

Labor

Staff time is a large cost in most projects. Variable labor cost can include the paid employees directly involved in project implementation but also can include such things as time for staff training. Meanwhile, fixed labor costs often include managers and support staff in an organization, such as administration, fundraising, or legal. Volunteering is a common contribution to project success that has significant value (Armsworth et al. 2013; Santangeli et al. 2016). Noting the presence of volunteer time permits benchmarking of labor across projects.

Capital assets and equipment

This is the equipment and infrastructure necessary to implement the project. Examples of organization level costs that are relatively fixed include tools, vehicles, machinery, instruments, buildings, etc. However, many projects will use existing equipment which should be listed if critical to project success because it will incur variable wear and tear and depreciation costs. Land for the project often can be considered a fixed component of the intervention costs (e.g., purchasing a site for a recovery facility), but sometimes purchasing the land is the intervention itself and thus may be a variable cost (e.g., establishing a new protected area).

Consumables

These items are used up during the project and thus incur a variable cost. Examples include herbicide, fuel for vehicles, airline flights, staff accommodation and meals during travel, equipment rentals, etc. Meeting costs (other than staff time) can also be considered consumables costs.

Overheads

This is the cost of administrative and logistic necessities that ensure a project can be implemented. It is often a fixed cost and can include electricity for the office, registration and insurance for company vehicles, etc.

V. Currency reporting

Providing the date and currency of incurred costs permits future interpretation because purchasing power and the value of money vary with time and location. We suggest reporting costs in the original currency, but noting the date and any conversion rate. Authors should also report whether or not discounting or inflation correction was applied to standardize costs over time.

How these standards complement existing strategies

The Open Standards for the Practice of Conservation, and the associated software Miradi, is a well-known existing planning tool for conservation actions (CMP, 2013). Cost reporting is greatly simplified for projects that use Miradi as costs are generally developed at the intervention level but can be rolled up to show costs at project and program levels (https://www.miradi.org). The cost reporting standards we propose here compliment several steps outlined in the Open Standards for the Practice of Conservation (CMP, 2013) because they encourage a description of the conservation project (Open Standards Step 1B),

development of a project budget (Open Standards Step 3A), and an informed analysis of project outcomes (Open Standards Step 4B). By calling for standardized and transparent cost reporting in studies and reports, we hope to promote the use of systems such as Miradi which enhance conservation project support and decision making.

Our standards are also closely linked to the goals of the evidence-based conservation movement (Sutherland et al. 2004, Cook et al. 2017). The Conservation Evidence (www.conservationevidence.com) and the Collaboration of Environmental Evidence (http://www.environmentalevidence.org) initiatives compile the results of research into synthesized scientific evidence using systematic methods (Dicks et al. 2014). Compiled results allow managers to quickly identify what the expected outcomes of a potential intervention might be to support conservation decisions. Future goals are to include additional information so that managers can identify expected costs of alternative interventions. Appropriate cost data are not yet available to quantify the cost effectiveness of interventions, but these cost standards are the first step towards achieving that goal.

Examples of cost reporting

We demonstrate the application of these standards using data on the common conservation intervention of invasive species management. We provide an idealized example and two case studies that report on real data with requested fields missing.

Exemplar

This hypothetical invasive species treatment project was costed at the intervention level (Fig. 1, Table 2). The objective was to eradicate invasive weeds from a small island that was accessible by boat from the management office. The two-year initiative applied herbicide to remove an infestation that was present at low cover across the island. Because data were

available at the intervention level, fine scale reporting was possible across the cost categories including details on different labor costs, the quantities and types of consumable items required and the proportional costs that could be attributed to existing assets. Reporting costs at this level of detail enables full comparison of the costs of different types of conservation interventions, but few current datasets permit reporting at this resolution.

Israeli invasive plant management costs at the intervention level

This example reports on the cost of managing the invasive tree species golden wreath wattle (*Acacia saligna*) on national protected areas along the coast of Israel in 2005-2007 (Oron & Hamod 2008). The project was funded by the Israeli Nature and Heritage Foundation and the Israeli Nature and Park Authority. Golden wreath wattle is native to Australia and it creates harmful single species stands in Israel. The funding agencies aimed to eradicate the invasive tree in protected areas and monitor for future population establishment (Table 3).

The project is costed at the intervention level. The initial eradication consisted of cutting down the golden wreath wattle trees and applying herbicide to the stump, or uprooting and piling removed trees within the treatment plots. Dry wood piles were burnt to destroy the dormant seeds. Any new shoots or seedlings were sprayed with herbicide or manually removed. The treatment period was followed by monitoring until March 2008.

In total 600 hectares were treated and approximately 60 m^3 of cut wood was removed from the treatment plots at a cost of NIS 17,600. Monitoring showed regeneration of the local native vegetation, however new golden wreath wattle shoots and seedlings persisted, so the project is ongoing.

US invasive plant management costs at the program level

This example reports on the costs of invasive plant management on 46 publicly owned protected areas in Florida, USA (Iacona et al. 2014). The Florida legislature approves an annual budget for invasive plant management and the Florida Fish and Wildlife Conservation Commission (FWC) is responsible for allocating the funds to protected area managers who apply for them (Cleary 2007). The data reported here (Table 4) are accounts of allocated funds.

This case study is costed at the FWC program level. Objectives are site-dependent but an agency goal is to attain maintenance control by maintaining invasive cover on protected areas at or below 5% infestation. This objective indicates the data likely represent actions that include intensive initial treatment followed by long-term low-intensity actions such as annual herbicide treatment, as opposed to the more intensive follow up treatment necessary for complete eradication. Management techniques can vary, but in this dataset they primarily consist of herbicide and mechanical treatments. The reported costs describe state funding provided from 1999 to 2010 for protected areas covering a total of 69,996 hectares. We were unable to separate costs allocated to the different categories, but indicate the cost categories included in the total cost.

The future of conservation cost accounting

Achieving an understanding of intervention costs that is adequate to support good conservation decisions remains a long process with many hurdles. Our experiences suggest that the process will require progress on several fronts:

1. Cost values that are compiled for reports and publications need to be accompanied by information that allows interpretation and transfer;

2. New cost data needs to be collected and recorded in a format that allows decision support;

3. Conservation accounting systems need to be designed to collect intervention cost data and relate it to conservation outcomes at a resolution to support decisions;

4. Conservation and funding organizations need to share data on the costs of achieving conservation outcomes so that other organizations can learn from those experiences;

5. Synthesis of compiled data would enable understanding of the most cost-effective management options and how the costs of achieving conservation benefits vary across contexts.

This paper outlines a mechanism to achieve the first step by providing standards for how the costs of conservation interventions are collected and reported. We aim to encourage the use of these standards for publications that include intervention cost data and propose a straightforward approach that permits intervention costs to be reported and compared. [We hope that, if accepted,] *Conservation Letters* will agree to encourage these standards for publication and *Conservation Evidence* has already agreed [with reviewer approval we aim to add to this list before publication]. These standards are also being considered to guide cost reporting for Australian threatened species recovery plans. We suggest that these reporting standards be translated into other major languages, and promoted across scientific journals and organizations.

But these standards are only the first step. If conservation decision making is to achieve its goal of stemming the loss of biodiversity, we need to better understand the cost of attaining conservation benefits. This understanding requires increased consistency in how conservation cost data are collected by conservation agencies and related to conservation outcomes, and that the costs of interventions be routinely reported, at least in raw units.

Achieving the next steps will be difficult because it entails enacting a change in conservation practice. Conservation practitioners in governments and NGOs implement the majority of the

conservation work globally, and a chronic shortage of time and resources means that documenting their experiences to permit learning is rarely a high priority (Leverington et al. 2010, McKinnon et al 2015, Pullin et al. 2004, Walsh 2015). Our experience suggests that while there is value in relevant cost data both for the institution and for external researchers, there is a disconnect between those that collect data and those that analyze and use these data. In addition, competition for limited financial resources means that there is little incentive for organizations to share cost information. Acknowledging that such hurdles exist and working together to counteract them is similar to the process faced by the open access and evidence-based conservation movements (Walsh et al. *in review*).

The evidence-based conservation and evaluation movements have recognized that conservation has limited capacity to report on effectiveness such as is available for evidence-based medicine (Keene and Pullin, 2011). Thus, other strategies could be pursued to enable necessary data sharing (Pullin and Knight, 2001). For instance, to encourage cost data to be freely shared and carefully collected at the agency level we need to demonstrate that it is immediately beneficial to those doing the work and that it outweighs the trouble of doing so. This has occurred in cases where governmental regulations or funder requirements prescribe detailed cost reporting (e.g., NWFWMD, Dumolin et al. 2014), but we need to do a better job of quantifying the local benefits and the cost-benefit tradeoffs. There are some sectors where it is more likely that such quantification can be achieved and in this paper we focused on invasive species management because it is a possible sector (Wenger et al 2017). It is also possible that strategies to share information can be designed that fit with the objective of allowing the whole sector to learn and share while respecting confidentiality and privacy requirements. For instance, a partially open strategy can be implemented using tools like Miradi Share. In such a model, data can be stored privately, but made available as averages

across projects, or on request if confidentiality and intended use in an appropriate context are assured.

Ultimately, we aim to work with the conservation effectiveness community to spearhead the creation and population of a centralized database of intervention costs (Cook et al. 2017), similar to the database gathering conservation evidence (www.conservationevidence.com), that would permit broad assessment of the cost-effectiveness of different interventions. Such a resource would support decisions that can improve conservation outcomes by providing transparency for investors and facilitate budgeting. Improved knowledge of the costs of conservation interventions would enable us to answer big questions such as "how much would it take to secure all species" (e.g., McCarthy et al. 2015).

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Figure caption

Figure 1: Reported costs can vary substantially depending on the extent to which program and organizational overheads are included. The dashed box represents the operating budget of a hypothetical conservation organization which runs three different programs (labels at bottom, solid line boxes), each with several interventions (labels at top). Reported costs for invasive species removal could include only those of the specific intervention (intervention level, black boxes), the cost of the intervention including a proportion of the total cost of the island program (program level, hatched shading within program box), or the cost of the intervention including a proportion of the total cost of running the organization (organization level, hatched shading within dashed box).

Figure 1:

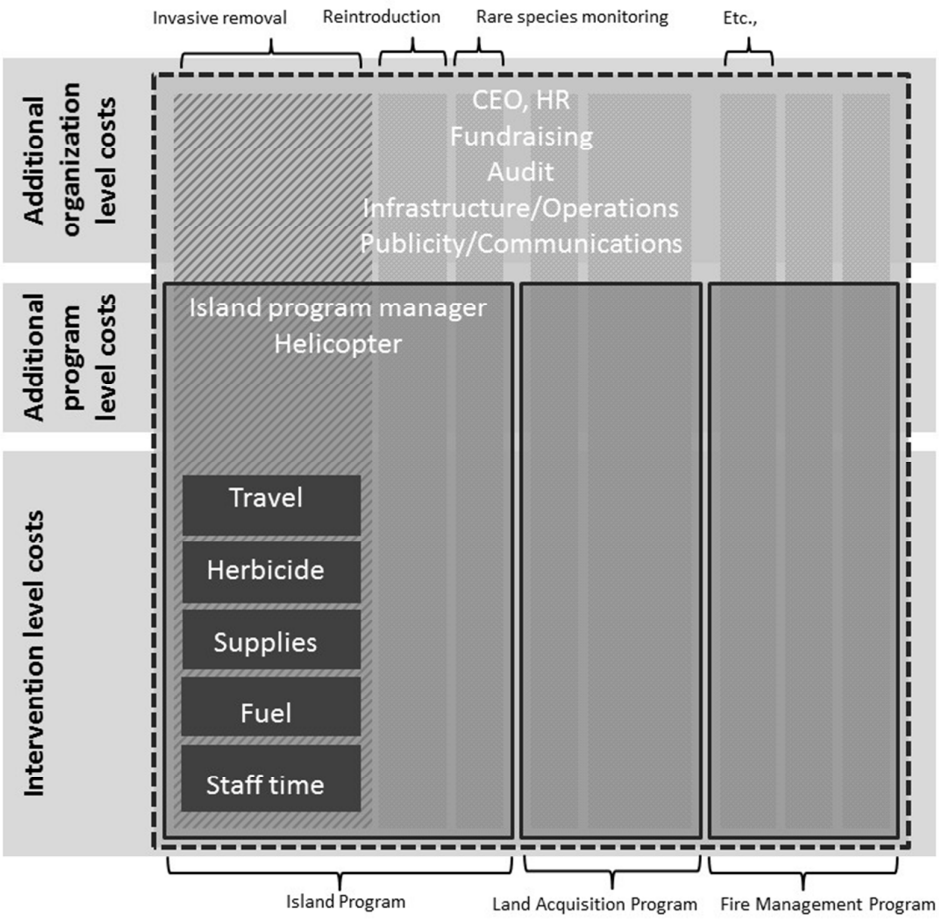
Invasive removal
Reintroduction
Rare species monitoring
Etc.,
Additional organization level costs
CEO, HR
Fundraising
Audit
Infrastructure/Operations
Publicity/Communications
Additional program level costs
Island program manager
Helicopter
Intervention level costs
Travel
Herbicide
Supplies
Fuel
Staff time
Island Program
Land Acquisition Program
Fire Management Program

Table 1: Types of costs in each cost component by organizational level (merged columns)

	Intervention	Program	Organization
Labor	Time actively spent on the project, including training of volunteers, reporting, travel between sites, and planning for later implementation. Note the type of staff involved in the project and whether the labor cost was fixed or variable. It may be useful to include a description of the individual role (e.g. driver, security, technician), and an indication of the level of training and salary and whether the labor was contracted or in-house. Volunteer and landholder time should be clearly and distinctly identified. State if listed costs are just salary costs or include benefits and insurance for personnel.	Time spent monitoring (either before or after the project implementation), project management costs such as planning and implementation, on site management, and finalization.	Proportional time of organization level staff allocated to project such as human resources, research, finance, fundraising, communications and legal.
Capital assets	Equipment purchased solely for the costed intervention (e.g. backpack sprayers, personal protective equipment, wheelbarrow, etc.) can include fixed or variable costs. If the equipment is for multiple projects only a proportion of their purchase price should be recorded. Fractional vehicle cost can be calculated using standard mileage rates (e.g. federal tax rate including depreciation), but other equipment may be best noted as "already possessed" so others can account for the cost.	Equipment and infrastructure necessary for the program (land for the project, buildings for the management, etc.). If the total cost of the equipment or capital relates to multiple programs an estimate of the fractional cost should be provided using capital depreciation calculations.	Organization buildings, infrastructure and maintenance.
Consumables	Variable cost of items used up during the intervention such as supplies (i.e. herbicide), fuel, food for the crew, accommodation, etc.	Items necessary to run the program such as training fees for project managers or consultancy fees for project design, legal fees, incentive payments to landowners (only if not counting landowner time), etc.	Project related insurance premiums
Overhead	May be fixed or variable cost, generally included in contracted project costs.	These costs include most agency administration and management costs such as support function staffing costs, utility costs and general operating expenses. The project level inclusion of such costs is commonly performed using multipliers.	

Table 2: Cost reporting for a hypothetical island invasive species eradication intervention at the intervention level (blank worksheet in SI)

Objective of costed intervention	Invasive plant species eradication on island
Methodology of costed intervention	Herbicide treatment at six month intervals
Context of costed intervention	5% cover herbaceous invasive plants. Island habitat primarily grassland and rocks.
Intervention scale	20 ha, entire island
Duration of intervention so far (years)	2 year program completed 2016
Was the objective achieved?	Yes
Categories included in costs (further breakdown below)	Labor, capital assets, consumables
Describe discounting or inflation correction if applicable	inflation corrected to 2016 value of the British Pound using the consumer price index (CPI)
Organizational level of cost data	Intervention level costs
Total cost of intervention	2370 GBP,

Cost Category	**Description**	**Unit Cost**	**Units**	**Fixed/Variable**	**Currency**	**Date**	**Notes**
Labor	4 days staff time for treatment	20	32 hours	Variable	GBP	Aug 2015 - Aug 2016	
Labor	0.5 day training by manager	25	4 hours	Fixed	GBP	August 2016	
Consumable	fuel	3	120 L	Variable	GBP	Aug 2015 - Aug 2016	
Consumable	herbicide	50	25 L	Variable	GBP	Aug 2015 - Aug 2016	
Capital asset	protective equipment			Fixed		Aug 2015 - Aug 2016	already possessed
Capital asset	boat		8 hours	Fixed		Aug 2015 - Aug 2016	already possessed
Capital asset	backpack sprayer	20	1	Fixed	GBP	Aug 2015 - Aug 2016	bought secondhand

Table 3: Case study of cost reporting for an invasive plant species eradication program in Israel costed at the intervention level.

Objective of costed intervention	This dataset describes the costs of management interventions to treat the invasive plant species golden wreath wattle (*Acacia saligna*) on national protected areas along the coast of Israel (Akhziv National Park-Rosh Hanikra Beach Nature Reserve). An NGO (INHF) provided funding to the national conservation agency (INPA) to complete the project. The NGO (INHF) that allocated the funding has an objective of eradicating existing patches of invasive plants and preventing the establishment of new patches within the nature reserve.
Methodology of costed intervention	Two initial treatment methods were applied: 1) Cutting down the tree and applying herbicide (Garlon 15% in diesel) to the stump; 2) Cutting down the tree and uprooting the stump, stacking the removed trees and leaving them in the treatment plots. Follow-up treatments included burning the dry wood piles, spraying herbicide to remove new shoots and seedlings, and manual removal of shoots and seedlings.
Context of costed intervention	Starting site condition varied from low to high levels of invasive cover. These data are not present in the dataset but from personal communications. No data is available for invasive cover prior to treatment, but treatment removed invasive plants from 600 hectares.
Intervention scale	Invasive plants were treated across 600 ha resulting in the removal of about 60 m^3 of wood
Duration of intervention so far (years)	September 2005 until December 2007
Was the objective achieved?	Not yet
Categories included in costs (further breakdown below)	Labor, consumables

Describe discounting or inflation correction if applicable	**all reported values corrected to** 2005 value of New Israeli Shekel
At what organizational level was this project costed?	Intervention level costs
Total cost of intervention	17,600 NIS, 2005 values

Cost Category	Description	Unit Cost	Units	Fixed/Variable	Currency	Date	Notes
Labor	Hired personnel	5000	151.5 hours	Variable	NIS	2005	total costs reported
Labor	Monitoring	1200	2 days	Variable	NIS	2005	
Consumable	Herbicide (Garlon)	9000	11 L	Variable	NIS	2005	
Consumable	Rented digger for tree removal	2400	2 days	Variable	NIS	2005	
Labor	INPA worker	N/A	8 hours				not costed in report
Labor	Volunteer work	N/A	127.5 hours				volunteers were allowed to take cut golden wreath wattle trees to use as firewood

Table 4: Case study of cost reporting for an invasive plant species management program in Florida, USA costed at the program level

Objective of costed intervention	This dataset describes the costs of management interventions to treat listed invasive plant species on public protected areas in Florida. State allocated funding is provided to local conservation agencies that apply for it to complete projects. Florida Fish and Wildlife Conservation Commission allocates the funding and has an objective to maintain the relevant species across the sites at <5% cover, but the objectives of the local agencies undertaking the work may differ.
Methodology of costed intervention	Treatment varied by species and site but was primarily herbicide or mechanical treatment of target species.
Context of costed intervention	Starting site condition varied from low to high levels of invasive cover. These data were not present in the dataset but come from personal communications. We do not have data on invasive cover prior to treatment, but post treatment there was 25,590 acres of target invasive species cover remaining on the 46 protected areas.
Intervention scale	This dataset describes invasive plant species management costs for a set of 45 protected areas across the state of Florida. The total area of the protected areas in the study is 172 890 acres but we assume that only a portion of that area was treated for invasion. See Iacona et al. (2014) for map of protected area locations and the supplemental material in Iacona et al. (2016) for distribution maps for some of the invasive species.
Duration of intervention so far (years)	Dataset describes action between 1999-2010
Was the objective achieved?	Not yet

Categories included in costs (further breakdown below)	Labor, capital assets, consumables, overhead
Describe discounting or inflation correction if applicable	US $ converted to 2010 $ using the consumer price index (CPI)
At what organizational level was this project costed?	program level costs

Total cost of intervention	$6,092,446

Cost Category	**Description**
Labor	This dataset includes the costs of contract staff as well as in-kind contributions to projects from local agencies, which often is staff time. It also includes the costs of the "Lygodium Strike Team" which is funded directly by FWC.
Consumables	Primarily herbicide but other consumables can include fuel, tools, and staff support items
Capital asset	May be included in contracted projects
Overhead	Not included in most costs in this dataset, but for contracted projects we assume that overhead is included in pricing