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Evidence-based practice

Zoo BAPs: biodiversity action plans for conserving native wildlife in and around zoological gardens

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Abstract

Failure by the international community to meet Convention on Biological Diversity targets has heaped added pressure on national and local biodiversity action plans (BAPs). Zoological gardens are playing an increasing role in practical conservation of wild habitats, but zoos have rarely developed formal BAPs. Here we introduce the concept of zoo BAPs, i.e. strategic plans for the conservation of biodiversity in and around zoological gardens. We use the first formal zoo BAP, developed at Flamingo Land Theme Park and Zoo in the UK, to introduce a framework for the establishment, monitoring and re-evaluation of a Zoo BAP. Throughout the framework we emphasise stakeholder participation, particularly involving zoo staff and local government biodiversity representatives. Species and habitats must be selected that are locally relevant, and are either threatened or have value as indicators or flagships for conservation. Each species or habitat must have targets that can be measured, monitored, and then evaluated for annual revision of conservation actions. This kind of "adaptive management" should allow a flexible, evidence-based approach to conservation. Use of national and international frameworks for biodiversity assessment should also help zoos to become increasingly aligned with the international conservation community.

Introduction

The term "biodiversity", the variety of life, was popularised by the Convention on Biological Diversity (CBD; United Nations 1992). Biodiversity measures can be used to estimate the value and health of ecosystems (Teder et al. 2007) and to identify priority conservation regions (Myers et al. 2000). Following the CBD, national and local Biodiversity action plans (BAPs) were established across the world to help conserve biodiversity. However, nearly 40,000 species remain threatened with extinction worldwide (IUCN 2012). The most biologically rich ecosystems are also declining, e.g. 70% of coral reefs are either threatened or destroyed (Wilkinson 2004), 35% of mangrove forests have been destroyed in just 20 years (Millennium Ecosystem Assessment 2005), and 13 Mha of forest are being lost annually (FAO 2010). In light of the abject failure of the CBD to halt biodiversity loss by 2010 (e.g. Pollard et al., 2010), BAPs are more crucial than ever for achieving success.

Biodiversity conservation by zoos

In its revised CBD targets, the United Nations (UN) Strategic Plan for Biodiversity 2011–2020 advocates an increasing role for zoological gardens (United Nations 2010). Accordingly, modern zoos have become centres for biodiversity conservation, through in situ and ex situ conservation, and through public engagement (WAZA 2005). Of the species held in World Association of Zoos and Aquariums (WAZA) zoos, one in seven is threatened in the wild (Conde et al. 2011a). Of 34 species listed by the IUCN as extinct in the wild, 29 are actively bred in captivity, and 22 have been reintroduced to the wild (Gusset 2011). At least 13 out of 68 downgradings on the IUCN Red List have resulted from conservation breeding and release into the wild by zoos (Conde et al. 2011b).

However, conservation breeding, fund-raising and environmental education can be thought of as peripheral to conservation success (Fig. 1). As a result of a need for direct conservation action to complement captive efforts, 92% of British and Irish Association of Zoos and Aquariums (BIAZA) zoos supported field conservation during 2010 (Marshall and Deere 2011). Furthermore, WAZA member expenditure on field conservation has risen to nearly US$350 million a year, and is now the third highest non-governmental contributor to biodiversity conservation globally (Gusset and Dick 2011). The World Zoo and Aquarium Conservation Strategy further states that zoos should try to focus their conservation activities using local, national or regional BAPs, and/or similar recovery plans (WAZA 2005).

Most zoological gardens are found in temperate regions, and typically hold a low representation of native wildlife from the surrounding area in their collections (Conde et al. 2011a).

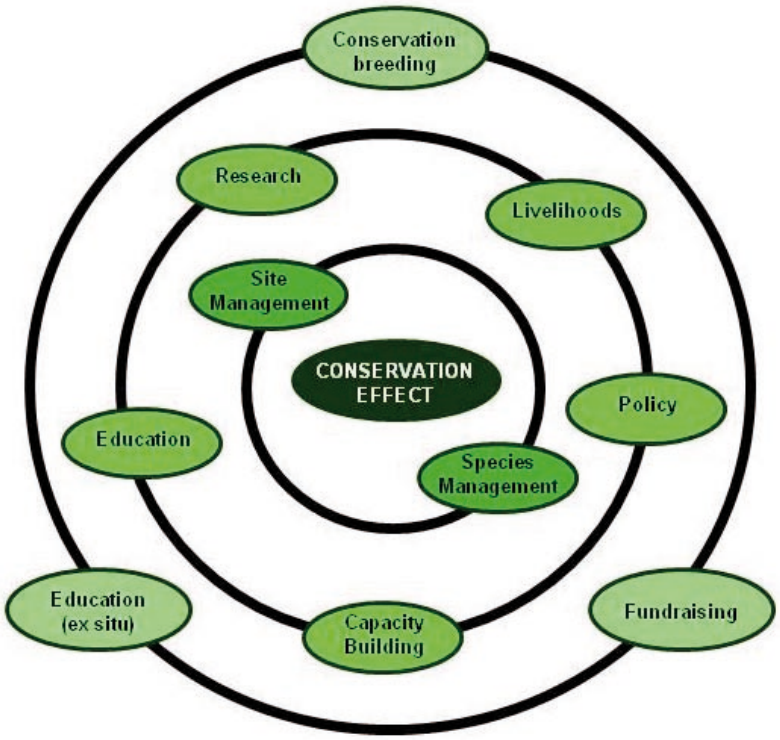

Figure 1. Schematic representation of the immediacy with which different types of conservation activity contribute towards conservation effect (adapted from Kapos et al. 2008). The ex situ activities of zoos contribute to conservation in a more indirect manner than other activities. Site and species management contribute directly as they deal with the actual conservation targets.

The UK is home to 100 zoos accredited by BIAZA (BIAZA 2012), which house hundreds of exotic species. However, the UK has also seen nearly 100 native species extinctions in just 100 years (UK Biodiversity Steering Group 1995). Accordingly, a growing number of zoos are contributing to native biodiversity conservation in their host countries (Marshall and Deere 2011). Activities include conservation breeding and reintroduction, community education programmes and habitat improvement. Quantitative data on the number of species found living wild in and around zoos are extremely limited, but the first in-depth survey of one Swiss city zoo found 3110 species in an area of only 13 hectares, including 31 species previously unknown from Switzerland, and 113 on the national Red List (Baur 2011). The potential for the broader zoo network as a metapopulation of biodiversity reserves may therefore be high.

Conservation planning

Structured and well-managed strategic plans are essential in order to achieve successful evidence-based conservation (Conservation Measures Partnership 2007). If measures of conservation success are not made, there is no evidence for the outcome of a management action. Furthermore, activities cannot then be fully explained to partners and stakeholders, and future management decisions become ill-informed. Accordingly, the United Nations has 97 operational indicators to monitor the progress of international biodiversity targets, within five strategic goals (UNEP 2012). However, conservation planning has traditionally suffered from a lack of indicators of success, with only anecdotal evidence as the major source of information for management actions (Pullin et al. 2004; Sutherland et al. 2004).

The aim of this paper is to give guidance for zoological gardens on the importance and procedures for the development of a "zoo BAP", a document used for planning the conservation of native wildlife in and around the grounds of individual zoological gardens. In achieving this aim we use the UK Biodiversity action plan (UKBAP; Maddock 2008) as an example of good practice for conservation planning, illustrating how this was used to develop the first zoo BAP.

Developing a BAP

BAPs and zoos

A biodiversity action plan (BAP) is a document that sets out targets for biodiversity conservation based on priority species and habitats. As a result of the CBD, over 170 countries have developed national biodiversity strategies and national BAPs (NBAPs; United Nations, http://www.cbd.int/2011-2020/). The UK was the first country to produce an NBAP in 1994 (Maddock 2008); however, conservation management actions can rarely operate at a national level, and hence at least 225 local biodiversity action plans (LBAPs) were then created in the UK to improve regional relevance. One of these, the Ryedale BAP, outlined a strategy for conservation for one North Yorkshire district (Ryedale Biodiversity Steering Group 2007), and was central to the implementation of the first zoo BAP.

There are few examples of zoo BAPs for planning the conservation of biodiversity in and around zoological gardens. The first formal zoo BAP was created for Flamingo Land Theme Park and Zoo (Hambly & Marshall 2011). The 150 ha acre site at Flamingo Land represented six habitats, including five of importance under the UKBAP (Maddock 2008), interspersed between a zoo, theme park and holiday village. In the year preceding publication of the first zoo BAP, the park attracted 1.3 million visitors (Mills 2011), and hence the aim was to conserve wildlife in full integration with human activities. In developing the first zoo BAP, a stepwise procedure was followed (Fig. 2), which we hope can form a blueprint for planning future zoo BAPs.

Consultations and assessment

The first stage of BAP development is an assessment of current knowledge regarding biodiversity and conservation management in the locality. In our experience, close collaboration with government LBAP representatives is particularly important for gaining advice on resources, contacts and priorities for BAP development and content. Involvement of local people increases the likelihood of success, and can be used as a form of environmental education (Elbroch et al. 2011). Accordingly, LBAP legislation emphasises that knowledge and opinions of both local

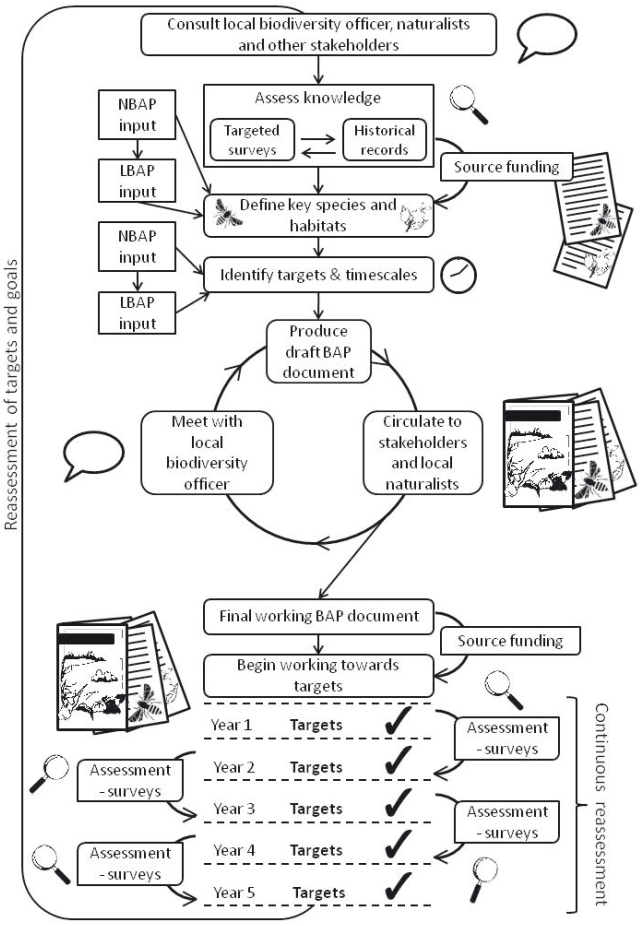

Figure 2. Recommended steps for creating and evaluating a five year Zoo Biodiversity Action Plan (Zoo BAP). NBAP = National BAP, LBAP = Local BAP.

people and conservation scientists should be included in BAPs (Harrison et al. 1998). Knowledge assessment would also therefore benefit from extensive stakeholder consultation, including zoo staff, local naturalists, conservation groups and land-owners. Discussion might include important features of biodiversity in the area, threats, timescales and identification of potential conflicts. In particular we found that long-standing members of staff were a valuable source for historical records of wildlife.

Alongside stakeholder consultation, pilot surveys are important to assess habitat types and the presence of LBAP species. Such surveys can benefit from partnerships with local communities, conservation/wildlife special interest groups, local naturalists and/or universities, thus providing high quality and yet low cost surveys (Harrison et al. 1998).

Defining key habitats and species

On completion of a full assessment of current knowledge, key habitats and species can be identified for priority conservation. These can be species and habitats currently on site, or species and habitats that may have existed in the past and could feasibly be restored. For instance, a water vole action plan may outline habitat improvements needed to encourage dispersal from surrounding waterways onto the Zoo BAP site (Hambly and Marshall 2011).

Species and habitats may be selected for a BAP based on a number of criteria. A good indicator species should be easily recognisable, easy to locate, occur in reasonable density, not highly mobile, and representative of ecosystem health (Caro and O'Doherty 1999; Hilty and Merenlender 2000). Selection of species and habitats based on an existing, locally relevant LBAP, is likely to provide the best linkage to national and international biodiversity targets. Using the Ryedale and UK BAPs, the first zoo BAP comprised species and habitats based on the following criteria (Hambly and Marshall 2011):

1. *National/local rarity:* Species/habitats that are nationally scarce, and/or species at risk of local extinction. This may also include species/habitats with localised distribution, e.g. common, but only in small areas due to specific habitat requirements.
2. *Nationally important populations, or populations in rapid decline:* Species that may be nationally common, but becoming rare elsewhere, and/or species that have suffered dramatic population reductions.
3. *Indicators of habitat quality:* Species that represent ecosystem health or threatened/regionally characteristic habitats. Indicator of habitat quality may even include relatively common species that represent ecological functions, e.g. restoring habitat connectivity, or providing microhabitats.
4. *Charismatic species:* Careful selection of attractive or well-known species may help the profile of biodiversity. These can be used in fund-raising or education, assuming their management will benefit ecosystem health.

Monitoring, verification and reporting

For successful conservation, measurements are needed to indicate progress towards targets (Sutherland et al. 2004). There have been a number of initiatives promoting the development of monitoring plans for gathering and using conservation data (e.g. Margoluis and Salafsky 1998; Salafsky and Margoluis 1999; Stolton et al. 2007). Management of the first zoo BAP has followed the "Open Standards for Conservation Practice", a now well-established procedure for planning conservation projects (Conservation Measures Partnership 2007). The CMP Open Standards uses a standardised terminology to help understanding of how project activities are intended to influence conservation targets. Zoo BAP managers might also benefit from determining targets for each species and habitat based on the relevant LBAP.

With measurement at the heart of conservation planning, the involvement of scientific expertise may be vital. The challenge here is to gather scientific information, but to report it in a way that is useful for practitioners. However, environmental scientists have a poor record of ensuring that their research has impact (Milner-Gulland et al. 2012) and conservation managers rarely read any scientific literature (Pullin et al. 2004). Consequently a BAP aims to bridge the research–implementation gap. The language used in a BAP is therefore intended to be neither simplistic nor specialist. A BAP also has a simple structure, for instance each habitat or species plan is typically written to stand alone.

A central database is also recommended for recording the progress towards conservation targets (Sutherland et al. 2004). One example is the UK Biodiversity Action Reporting System (BARS), a database of completed BAP conservation actions (BARS 2012). At the time of writing, the BARS database comprised records by 4339 conservation workers from 1311 organisations, hence providing a vital resource for assessing progress towards national targets. There is no zoo equivalent to BARS, but zoo native wildlife records can be sent to the BIAZA Native Species Working Group (http://www.biaza.org.uk/conservation/).

At the heart of all the various standards for conservation planning is the principle of "adaptive management", the cyclical process of assessment, reassessment and adaptation to experience and changing conditions (Conservation Measures Partnership

2007; Fig. 2). Stakeholder communication through workshops and circulation of documents remains crucial throughout the process to ensure expert input and partner satisfaction. Therefore, although the BAP document is fixed, the targets and strategies evolve according to monitoring outcomes. Finally, towards the end of any BAP term, plans must begin for a new document, starting with a repeat of the knowledge assessment process.

Conclusions

The emphasis here is the further progression of zoos from their original ex situ approach to biodiversity conservation, to ambassadors for field conservation. The concept of the zoo BAP aims to bring zoos another step further towards partnership with government, and the broader biodiversity conservation community. In contrast to larger scale BAPs, zoo BAPs are relatively easy to produce and provide targeted management guidelines. We see huge potential for the development of zoo BAPs for the promotion of zoos as miniature "biosphere reserves", where people and nature co-exist sustainably. With over 700 million annual visitors, the world's zoos provide an opportunity to conserve biodiversity in a human-dominated environment, while also promoting biodiversity conservation in a unique manner that is informal, educational and fun.

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