An inventory of natural resources harvested from national parks in South Africa

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Resource harvesting is permissible within South African protected areas under certain conditions as part of benefit sharing that seeks to strengthen relationships with communities living adjacent to parks. However, not all resource use is authorised and little is currently known about what is harvested, or the extent and impacts of harvesting in parks. This limits capacity to monitor and set the boundaries for such use. This paper provides a checklist of resources harvested within each of 19 national parks managed by South African National Parks. Data were gathered by means of a question-based survey of park staff. A database detailing the parks from which each resource was harvested and its purpose(s) was compiled, representing the most comprehensive list of resources harvested from parks to date. A total of 382 harvested biological and abiotic resources (284 terrestrial and 98 aquatic), used for a wide range of purposes, were identified across parks. Many of the resources, especially animals (96%), were harvested destructively. The strongest motivation for harvest was subsistence, although most resources were also used for financial gain through informal business. Although current data are not sufficient to determine harvest sustainability for most resources, better data and increased awareness of resource use activities will enable future research to this end.

Conservation implications: The checklist of harvested resources provides critical baseline data for parks, which will facilitate assessment of park-specific priorities for research, monitoring and management action.

Introduction

To be effective, protected areas need to succeed in conserving biodiversity whilst providing livelihood opportunities that safeguard continued socio-economic benefits (McNeely 1993; Salomon *et al*. 2011). The overharvesting of resources was identified through the Millennium Ecosystem Assessment (Millennium Ecosystem Assessment 2005) as a driver of global environmental change, which poses a threat to biodiversity and the people dependent on it. Overharvesting is not limited to areas outside of formal protection, but can also happen within protected areas, especially when resources become scarce outside of such areas (Agardy *et al.* 2003; Castley & Kerley 1996; Naughton-Treves *et al.* 2006; Waite 2007). Increasing pressures on both local and global natural resources, stakeholder rights and the need for development in many countries have led to people's needs becoming a core consideration in conservation, with the recognition that without the support of local people, conservation efforts are likely to fail (Naughton-Treves, Buck Holland & Brandon 2005; Zaccagnini *et al.* 2001). This is true also in South Africa, where many people rely directly on natural resources for their livelihoods and even survival (Dovie, Shackleton & Witkowski 2007; Shackleton & Shackleton 2004; Shackleton *et al.* 2007). However, how best to ensure the balance between sustainable resource use and conservation of biodiversity remains uncertain (McShane *et al.* 2011; Robinson 2011; Salafsky 2011).

South African National Parks (SANParks) have a resource use policy aimed at ensuring sustainable use of biological resources for the benefit of local communities (SANParks CSD Policy Unit 2010). The policy is guided by both South African national legislation (*The National Environmental Management: Protected Areas Act* [Republic of South Africa 2003] and its accompanying regulations) and international best practice (Secretariat of the Convention on Biological Diversity 2004). However, managing resource use and determining (or even defining) whether or not use is sustainable is not straightforward in practice (Callicott & Mumford 1997; Chapman, De Lacey & Whitmore 2006; Hardin 1968). Although challenges range from the development of sustainable harvest systems (e.g. Hall & Bawa 1993; Seydack 1995; Vermeulen 2009) to unrealistic expectations

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with regard to benefits (especially commercial, as discussed by Belcher and Schreckenberg [2007]) or unrealistic promotion of access to resources by policy makers, one of the most prevalent problems is the lack of, or insufficient, data to estimate factors necessary for determining sustainable use thresholds. These factors include the species harvested, their distribution and life histories, harvest practices and quantities extracted (Ndanyalasi, Bitariho & Dovie 2007; Ticktin 2004; Williams & Kepe 2008). To begin to overcome this challenge, several sets of baseline data are required. In this paper, we detail a checklist of resources that are harvested from each of the 19 South African national parks managed by SANParks as one of the first steps towards addressing these knowledge gaps.

This first checklist of harvested species will provide (1) a basis for identifying those resources that may be threatened and that should not be harvested, or that require stricter control or alternative harvest practices, (2) a list from which to prioritise species for further study and (3) an important baseline for monitoring resource use in national parks (McGeoch *et al.* 2011).

Methods

Data were collected using a questionnaire that was completed by park management personnel and SANParks scientists in each park. The questionnaire was developed by scientists and policy makers in the Conservation Services Division of SANParks, with the aim of gathering information on natural resources currently harvested from the SANParks estate. The questionnaire covered only harvestable resources, or consumptive resource use; that is, all activities where a tangible benefit (economic, social, cultural or ecological) is gained from a resource, with all or part of the resource removed. Non-consumptive use, which includes a range of tourism activities, was not considered. The questionnaire consisted of four sections, one each for terrestrial, aquatic and abiotic resources and one section for resources harvested and made available for use through management actions (Online Appendix 1). Within each section a number of potential resource use purposes (e.g. animals used for medicinal or ritual purposes, plants used for medicinal or ritual purposes, or animals used as a food source) were listed to ensure that those tasked with data compilation had a common understanding of the full range of resource uses of interest. An open-ended option ('Other') was included in each section to accommodate information not considered during the design of the questionnaire. For each resource listed, the respondents were further required to answer a series of questions pertaining to the purpose, authorisation, user group and quantity of the resource used. For the questions where data availability was likely to be limited, a range of possible answers were provided to allow comparable estimates of use (Online Appendix 1). Use of these categorical ranks to score quantities was reserved for when no other information was available and their use was not encouraged otherwise.

Blank questionnaires were sent to each of the 19 national parks and instructions for their completion were communicated telephonically and via email. Responses were collated and a follow-up questionnaire (re-survey) was sent to all parks one year later to allow for revision or addition of further information. Where possible ($n = 7$), this was followed up with face-to-face meetings with park managers and rangers where the listed resources and possible omissions were discussed. These meetings took the form of round-table discussions between park managers, section rangers and scientists, with data being displayed and updated during the meeting. The completed questionnaire for each park was therefore the outcome of collective rather than individual contributions.

Once all data had been cleaned and checked, a single database containing a full list of resources used in SANParks was compiled. The database included the parks from which each resource was reported as being harvested, the parts of the resource harvested, and the motivation(s) and purpose(s) for its harvest. Where relevant and possible, species names were assigned to the resource used. Scientific names were verified using relevant literature and official species databases such as The Plant List (The Plant List 2010), the World Register of Marine species (Costello *et al.* 2012) and the Encyclopedia of Life (Encyclopedia of Life 2008). Because multiple common names are often used for a single species, especially in different languages, the common names used by those contributing to questionnaire completion were retained. These common names are those likely to be most widely used in park-specific contexts. Purposes of resource use, as detailed in the responses from each park, were grouped into ten categories as follows:

- bait
- construction
- food
- fuel
- grazing
- handcrafts or decorations
- medicinal or ritual use
- ornamental plants (including cut flowers) or pets
- thatching or weaving material
- timber.

In addition, four motivations for harvesting resources were identified, namely financial gain, subsistence (including all personal use), park management (including alien species removal and population management through culling or live sale) and recreation (Muth & Bowe 1998).

Results and discussion

Results showed that a wide range of species and resources are harvested from parks for a variety of purposes. The final checklist of harvested resources comprised 382 resources, of which 289 were identified to species level, 46 to genus level and 40 to family level or higher (e.g. blood worms, a Polychaete species). The remainder were non-specific (six

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abiotic resources and grazing; see Online Appendix 2). Of the 382 resources used, 284 (74%) were terrestrial and 98 (26%) were aquatic (90 marine and 8 freshwater; see Online Appendix 2). The abiotic resources harvested included gravel, rocks, salt, soil or sand, water and diamonds, with the latter being from the Richtersveld National Park. The biological resources included 194 plants, 179 animals, mushrooms (not identified to species level) and two seaweed species. These species belonged to 152 families, of which 92 families had only one species harvested, whilst 27 families had more than two species harvested and six families had 10 or more species harvested. The family from which the most species were harvested (22 species) was the Bovidae (even-toed ruminant ungulates), followed by the Sparidae (a group of marine fish), with 19 species harvested. The most commonly used plant families were the Fabaceae (17 species) and the Asteraceae (16 species). In addition, 26 alien species were also noted as being harvested (6.8% of all resources). Products derived from alien species harvest are considered positive spin-offs, where, unlike other harvested species, the aim is not sustainable harvest but rather eradication the over medium to long term.

Although survey respondents did not always specify which parts of a resource were used, 95% of resources in the final list had at least one 'part' specified (Online Appendix 3). Based on the parts reported to be harvested, nearly all cases where animals were harvested would have resulted in the death or removal of the animal from the national park. For 95.5% of listed animal resources, the whole animal was harvested, whilst specific parts were listed for 7% of these resources. These parts, as well as the parts of the remaining 4.5% of animal resources, included body parts, bones, dung, eggs, fat, feathers, honey, horns, quills, shells, skin, talons and tusks. Harvesting of some of these parts (e.g. bones and horns) may require that the animal be killed, but they could be harvested from animals that are already dead, whilst other parts (such as dung, feathers or quills) would not require the death of the animal.

Only 24.2% of the listed plant species were harvested as whole plants or in a manner that could result in the death of the plant (e.g. timber harvest where the entire above-ground portion of the plant is cut down to obtain the useable parts, although for some species coppicing does allow for regeneration; see Kaschula, Twine & Scholes 2005). It was more difficult to determine whether the other uses of plants were destructive. Use of plants for medicinal purposes often included harvest of the roots, corms or bulbs of plants, which, depending on the method and extent of harvesting, could result in the death of the plants. Harvest of bark, branches, stems and leaves may also result in the death of plants, but in many instances stems and branches were harvested as fuel, which may have been from dead specimens and often included use of non-native species. Use of other plant parts, for example the use of flowers and seeds and even foliage, may not result in the death of plants, but could affect their reproductive output (Gaoue & Ticktin 2008; Peters 1999).

Recreation (a motivation for 19% of harvested resources) and park management (13%) were less frequent motivators than subsistence or harvest for financial gain. However, the way in which the survey was designed required that financial gain versus subsistence (or both) be specified as a motivation for all harvested resources. Therefore, resource harvest motivated by park management or recreation would also have been counted as having a subsistence or financial motivation, albeit secondary rather than primary. Most harvested resources (49%) were used for both subsistence and financial gain (usually in the form of small informal businesses, especially traditional medicines), whilst nearly a third (30%) were used only for subsistence (Online Appendix 2). Although 21% of resources were used solely for financial gain, large-scale commercial harvesting was limited to the marine sector and timber in two parks (Garden Route and Table Mountain), which included the harvest of non-native pines and blackwood. Commercial harvesting was mostly authorised, with the exception of abalone and rhino poaching. Unauthorised resource use was fairly common, with 42% of reported resources harvested without authorisation (across all 19 parks) and a further 36% of resources harvested (1) with authorisation only some of the time, (2) in some parks but not others, or (3) in contravention of authorised limits. Despite these figures, seven of the 19 parks reported that no unauthorised resource use took place within the park. Whilst this is likely to be true for the very isolated parks, the levels of unauthorised resource use reported from the other 12 parks (44.2% of all resources used in these parks) suggest that further investigation may reveal additional resource use activities.

Although the checklist presented here represents a valuable first step in documenting resource use across national parks, it is likely to be incomplete. The current list is based on knowledge supplied only by the management and scientists of protected areas. Caveats exist particularly for unauthorised cases of resource use, which are known to be substantial in some parks, particularly those with open access (Petersen *et al.* 2012; Van Wilgen & McGeoch in preparation). The level of effort associated with data collection varied across the country, with surveys of parks in the Cape provinces being more comprehensive than those in other provinces (due to the feasibility of re-visiting some parks for follow-up). Nonetheless, all parks (with the exception of Table Mountain and Tankwa Karoo) were surveyed twice, approximately one year apart. Very little information emerged on the harvest quantities of each resource (also see Van Wilgen & McGeoch [in preparation]) and additional information on life stage (for biological resources), quantity, frequency and extent of harvesting will be critical to the future assessment of sustainable yields (Botsford, Castilla & Peterson 1997; Goodland & Daly 1996; Waite 2007). In general there is

a paucity of published research on resource extraction from protected areas in South Africa (Petersen *et al*. 2012; Shackleton 2009) and the outcome of the current survey reveals that this is also true of national parks.

This checklist will contribute not only as a baseline for further work but also to increasing awareness within South African protected area agencies about the role that resource use plays and the information and actions required to sustainably manage resources. More comprehensive and detailed information will improve the effectiveness with which parks are able to manage authorised use and promote strategies to limit unauthorised activities.

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Competing interests

The authors declare that they have no financial or personal relationship(s) that may have inappropriately influenced them in writing this article.

Authors' contributions

N.J.v.W. (SANParks) was responsible for data collation, analysis and compilation of results. M.D. (SANParks), W.V. (SANParks), A.S. (SANParks) and M.A.M. (SANParks) were responsible for the design of the original survey and data collection. E.B. (SANParks) and K.S. (SANParks) contributed research results from the Garden Route National park. M.A.M. also made conceptual contributions to the manuscript.

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