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Assessment of the Effectiveness of Protected Areas Management in Iran: Case Study in Khojir National Park

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Abstract The requirement to assess the management effectiveness (ME) in protected areas (PAs) is increasing around the world to help improve management and accountability. An evaluation of ME for Khojir National Park (KNP), one of the Iran's oldest PAs, was conducted using a multi-method approach that consisted of structured interviews, open interviews, and site visits. This was the first ME evaluation in Iran. The structured interview was based on the management effectiveness tracking tool methodology. KNP received an average score of 43 %, which is lower than the global average, illustrating that its general management was in the low-intermediate level. The indices of legal status, resource inventory, planning for land and water use, regulations, and objectives received the highest average scores, whereas education and awareness, community co-management, regular work plan, boundary demarcation, visitor facilities, budget sources, staff training, protection systems, and management plan received the lowest ones. The management system of KNP was generally established, but many problems of the management still need to be resolved. To improve ME, some countermeasures should be taken, such as increasing funding, strengthening capacity building, planning, and adaptive management, and implementing community participation.

Keywords Management effectiveness · Assessment · Khojir National Park · Iran

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Introduction

Protected areas (PAs) play critical roles in safeguarding biodiversity and maintaining the crucial services provided by the natural systems. They have an important role in the evolving challenge of maintaining a sustainable world (Borrie and others 1998; Groombridge 1992). Currently, more than 161,991 areas have been reported as PAs in the World Database of Protected Areas (WDPA; PPW 2011), and the number continues to increase. PAs have long been the only way to conserve ecological regions from the other forms of land use (EEA 2010). For example, they have significantly lower rates of clearing compared to locations outside their boundaries and to conditions before they were gazetted, although clearing is still significant, especially in the African and Asian regions (Leverington and others 2010; Nagendra 2008).

Conservation management specifically involves managing risk (Alexander 2008), and PAs can only deliver environmental and socioeconomic benefits if they are managed effectively (Hockings 2000). There is a growing evidence of critical biodiversity (species, ecosystems, and genes) breakdowns both inside and outside many PAs (Stolton and Dudley 1999; Hockings and others 2002; Dudley and others 2004; Fischer 2008; Butchart and others 2010). Accordingly, many PAs are presently being degraded and destroyed (Liu and others 2001; Hockings 2003; Dudley and others 2004). To improve the management systems of PAs, it is necessary to evaluate the management effectiveness (ME) of and the extent to which PAs actually protect the ecosystem value and deliver benefits to the communities (Hockings and Phillips 1999; Ervin 2003a; Southworth and others 2006; Timko and Innes 2009; Quan and others 2011).

ME evaluation has been recognized as an important mechanism to create proper accountability, good

management practices, and transparency for both reporting on and improving PA management (Hockings and others 2006, Hockings and others 2009). ME provides an assessment of how well a PA is being managed, and primarily considers the extent to which recent management is protecting values and achieving PA goals and objectives (Stolton 2008; Hockings and others 2006). It has become a prominent part of systematic preservation planning and is a key step in linking plan implementation with subsequent planning and budgeting (Saterson and others 2004; Sutherland and others 2004; Brooks and others 2006; Margules and Pressey 2000; Hockings and others 2004a; Hockings 1998). ME evaluations of PA systems also fall within a broader set of assessment concerns. Assessments of conservation, whether conducted to assess the status of a species or a continuum of threats, are receiving increasing attention from managers, policy makers, researchers, and stakeholders (Stem and others 2005). However, such studies often seek to find gaps between management objectives and management actions (Day and others 2002; Hockings and others 2004a; Dudley and others 2007). Other continuous actions, such as the publication of status reports on PAs, are likely to contribute to our understanding of ME results (Parr and others 2009; Chape and others 2005). Moreover, Parr and others (2009) proposed that biodiversity conservation outcomes were most likely to be related to the adequacy of dedicated resources and monitoring programs, the explicit identification of clear objectives with associated performance indicators, and the considered application of the management prescriptions.

Although PA managers are conscious of local designations, this does not guarantee that effective management will occur. Managers need to understand the strengths, weaknesses, threats, and results of their management activities. Therefore, ME evaluation has received a significant attention in the last decade (Hockings 2003; Hockings and others 2000, 2004a, 2006; Margoluis & Salafsky 1998; Leverington and others 2008; Nolte and others 2010). At the fourth International Union for Conservation of Nature (IUCN) World Parks Congress in Caracas in 1992, the PA community recommended that the IUCN develop a system for monitoring ME of PAs (Stolton 2008). Subsequently, the World Commission on Protected Areas (WCPA) of the IUCN developed guidance for the assessment systems through a series of frameworks and tools (Hockings and others 2000). Based on the WCPA framework for assessing ME of PAs and their systems (Hockings 2000; Hockings and others 2002, 2006), a number of ME assessment tools have been developed around the world to monitor PAs systems; most tools involve a similar "project-cycle-based framework" (Stem and others 2005). Detailed evaluation indices have been established and used to evaluate practices in various countries and organizations throughout the world (Courrau 1999; Ervin 2003a; Hockings and others 2004b; Xu and Melick 2007; Leverington and others 2008, 2010). More than 40 different methods have been applied in more than 100 countries (WDPA 2011). This development of methods represents a response to counter both the inabilities of managers and current threats (Hockings 2003). These tools will likely play an important role in helping signatory countries to the Programme of Work on Protected Areas, including Iran, which was adopted by the Convention on Biological Diversity (CBD), to fulfill their obligations. Obligations include improving the frameworks for monitoring, evaluating, and reporting ME for PAs, and assessing the ME for at least 30 % of PAs by 2010 so that the results of such assessments can be used to enhance management (CBD 2004; Coad and others 2008). In addition to these international conventions, it was agreed that all PAs might have effective management programs in place by 2012 (CBD 2010). Subsequently, in 2012, toward achieving Aichi Biodiversity Target 11, it is emphasized that all PAs should be effectively and equitably managed by 2020 (CBD 2012). These programs are to use participatory- and science-based site planning processes, to incorporate clear biodiversity objectives, targets, management strategies, and monitoring programs, and could draw upon existing methodologies and long-term management plans with an active stakeholder involvement (CBD 2010, 2012).

Iran has a long history of nature protection (Yakhkashi 2002). Currently, PAs are divided into four categories under the management of Iran's Department of the Environment (DoE). However, since the 1950s, following new definitions of PAs, the number of PAs in Iran has increased dramatically, especially during the last 10 years. In total, 253 PAs have been declared which cover 10.12 % of the country's area (Table 1; Fig. 1; DoE-GIS 2011; BHPAs 2011; Mirkarimi 2007; PPW 2011). Although this trend of increasing protection is welcome, there has been some debate about ME, and concern has arisen that Iran may be establishing "paper PAs" rather than achieving sustainable preservation outcomes (Kolahi and others 2011, 2012). Makhdoum (2008) and Kolahi and others (2012) reported that only 3 % and 2 %, respectively, of the country's PAs are effectively protected by nature experts and rangers (who are sometimes killed by poachers), local communities, and NGOs. During recent decades, the rich cultural and historical background seems to have been incorporated less in the establishment of new concepts for policy making and the implementation of environmental regulations for establishing and managing PAs in general, and national parks in particular. Therefore, the monitoring of ME for Iran's PAs is required and needs to involve well-established evaluation methods.

Unfortunately, there is no established process by which Iran's PA managers or interested people can find out if PAs are achieving their objectives. We conducted a survey to

Table 1 PAs Categories of Iran by November 2011

Categories	Number	Area (ha)	% To the whole PAs	% To the country
National Parks	26	1960537	11.76	1.19
National Natural Monument	35	38697	0.23	0.02
Wildlife Refuge	42	5567643	33.39	3.38
Protected Area	150	9109857	54.63	5.53
Total	253	16676734	100	10.12

([DoE-GIS] 2011)

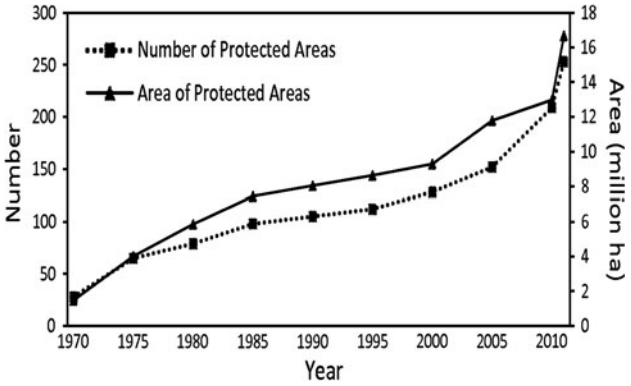

Fig. 1 Growth in the total number and area of PAs in Iran

assess ME for one of the oldest and most important PAs in Iran, where this type of evaluation has never been conducted. When evaluating PA management, the objectives are to determine ME for the PA, to identify problems facing the PA, and to extract the primary factors for that habitat. In addition, the strengths and weaknesses of the current management are determined, and recommendations may be presented for improving the existing management strategies. These recommendations are applicable for other Iranian PAs.

Method

Study Area

The study area for this research was the oldest PA in Iran, Khojir National Park (KNP; Fig. 2; 35° 41′ 32″ N, 51° 41′ 34″ E. It is situated inside the Jajrud Protected Area, east of Sorkhe-hesar National Park and Tehran city (the capital of Iran). Jajrud PA, KNP, and Sorkhe-hesar National Park, with a total area 72,626 ha, are managed by a common office with about 6 staff and 30 ecoguards. One-fifth of the ecoguards are employed by official (permanent) contracts, but the others are employed through temporary contracts for 1–5 years.

This study site was selected because it has a comparatively extensive PA system and a strong management body. This site is also experiencing the increasing pressures from human activities and climate changes, and management strategies have been created to address these changing stressors. This active management allowed us to assess the effectiveness of these strategies.

Starting in 1754, Khojir was controlled as a royal game reserve (Safaei and Mohammadi 2005). In 1979, it became part of the Jajrud protected area. It was later promoted to a national park in 1982, with an area of 9971 ha. A model management plan based on FAO guidelines was prepared for KNP and Sorkhe-hesar National Park in 1985 (Makhdoum and others 1987), although the plan is currently being updated.

The region is located on the southern slope of the Alborz Mountain range in Tehran Province; it is a mountainous rolling area ranging from 1300 to 2100 m in altitude. The Jajrud River flows through this region. Mean annual precipitation and temperature are 300 mm and 11 °C, respectively, producing a temperate semi-arid climate. Biodiversity is high, with 512 plant and 192 animal species identified in this region (ATM-Web 2011). Because of its proximity to the Tehran metropolitan area, numerous access roads, biodiversity, beautiful landscapes, and rivers and frequent springs, the park attracts tourists and scientific activities (Darvishsefat 2006).

Assessment Tool

In 1998, the World Bank (WB) and the World Wide Fund for Nature (WWF) formed an alliance for forest conservation and sustainable use. To evaluate ME of PAs, the alliance published the management effectiveness tracking tool (METT) in 2003 (Stolton and others 2007). METT is a simple site-based tool that relies largely on multiple-choice questions, and therefore on the opinion of whoever fills in the form (Dudley and others 2007). It is an independent rapid assessment method that provides a quick overview of ME (Stolton and others 2007). METT was revised in 2007 and is used to identify PA management problems, strengths and weaknesses, and threats and finally to assess ME (Stolton and others 2007). METT includes all the six components of management that are identified in the WCPA framework (context, planning, inputs, processes, outputs, and outcomes), but places emphasis on context, planning, inputs, and processes (Hockings and others 2006). METT is being used by the WB, WWF, and Global

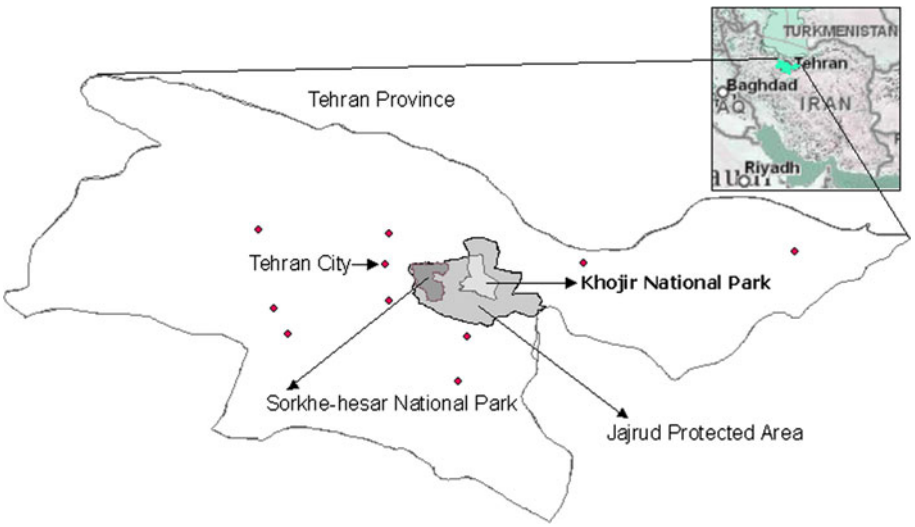

Fig. 2 Location of the study site (Khojir National Park: KNP)

Environment Facility (GEF) as a mandatory monitoring tool for areas in which they are involved and has been adapted for more specific uses around the world (Hockings and others 2006).

We used the revised version of METT (available at http://bit.ly/VEIewg). The METT questionnaire has two main sections: two datasheets and an assessment form. *Data Sheet 1* records details of the assessment and some basic information about the site, such as its name, PA class, size and location, date of establishment, and protection targets. *Data Sheet 2* provides a generic list of threats that PAs can face. Threats are defined as "any human activity or related process that has a negative impact on key biodiversity features, ecological processes or cultural assets within protected areas" (Ervin 2007). *Data Sheet 2* is to be filled in by PA staff. The assessees are asked to identify the threats, and rank their impacts on the PA using *Data Sheet 2* (Table 5 in Appendix). The *Assessment Form* consists of approximately 30 questions that are presented in a table format that includes three columns for recording the details of the assessment. A series of four alternative answers were provided for each question from 0 (poor) to 3 (excellent) to help the assessors choose an appropriate score (Table 6 in Appendix). In addition, 12 supplementary questions elaborated on key themes in the previous questions and provided additional information and points (0 or 1). The total score on the *Assessment Form*, including the 30 questions and 12 supplementary questions, ranged from 0 to 102. However, METT is conducted in a participatory process so that results are not the opinion of a single person.

Data Collection and Analysis

Management evaluations tend to have focused on the views of managers (Hockings 2003). These surveys of managers are important as they provide essential insights into the strategies that have been implemented and associated changes in the biophysical environment that may not be readily evident to visitors, local people, and NGOs (Moore and Walker 2008).

The evaluation of ME for KNP was based on a multi-method approach that consisted of structured interviews using METT, open interviews, and site visits. This approach is useful when some answers from structured interviews are not clearly identified, and can be used to gain insight that might be missed if only one method was used (Maneesai 2003).

We translated METT into Persian, implemented it, and carried out interviews with administration and management staff related to KNP. These interviews were conducted to identify KNP management problems, strengths and weaknesses, threats, ME, and management needs. Eight DoE staff were directly involved in park management and all of them completed questionnaires. They included six staff from the common office (for the Jajrud Protected Area, KNP, and Sorkhe-hesar National Park), one person from the Bureau of Habitats & Protected Areas, and one person who manages the ecoguards in KNP. Open interviews with 11 people (six staff members and five ecoguards) and site visits for first-hand observation of conditions in KNP were conducted to uncover the potential issues (both inside and outside KNP) and to verify the management problems identified during the interviews and from the questionnaires.

We further analyzed the survey data to assess the status and characteristics of ME in KNP. This survey results were analyzed using descriptive statistics, mainly percentages. Pearson correlation coefficients, *t*-tests, and principal component analysis (PCA) were conducted using the scores for each assessment index and for the overall ME that was obtained the from *Data Sheet 2* and the

Assessment Form. Pearson correlation coefficients were used to measure the associations between the assessment indices representing ME and biodiversity, ecological, and cultural values. *T*-tests were used to compare ME scores among respondents. PCA was conducted using METT scores from the questionnaires for all the respondents. All statistical analyses were conducted using SPSS 18.

Results

General Information

The answers in *Data Sheet 1* indicated that KNP has genetic resources, a high diversity of fauna and flora, is a biome representative of Central Alborz, and preserves ancient history. The area's role as a filter to reduce air pollution was mentioned because it is adjacent to Tehran city. It was also considered a place where the native species of the purest breed of rams and ewes are found and as a center for scientific studies. The two primary KNP management objectives were protection, and ecotourism and use of park potentials.

The ME assessment results for KNP were compared to a global analysis of ME for PAs (Leverington and others 2010) based on six management components (Fig. 3). KNP received an overall ME score of only 43 %, which was lower than the overall global mean ME score for PAs of 54 %.

Threats

The threats affecting ME in KNP were analyzed on the basis of *Data Sheet 2* results (Fig. 4; see also Table 5 in Appendix). These scores implied that the threat levels are serious. Major threats to KNP were housing and settlement (100 %; Q1.1); increased fragmentation within KNP (100 %; Q7.3a); dams, hydrological modifications, and water management/use (95.9 %; Q7.2); loss of keystone species (95.9 %; Q7.3d); and droughts (91.8 %; Q11.2).

The observations and discussions collected through open interviews and site visits showed that there were other major threats to KNP (Table 2): road construction through the park, interference in the park management by other organizations (Defense and Agriculture Ministries), local people-park conflicts, government policies, land encroachment for agricultural purposes, population growth, human habitation, and shifting cultivation. In other words, most of KNP's extent is facing intense pressures from human activities, especially military services, and the activities of other organizations. Major impacts from these threats include degraded park health and ecosystem services, illegal logging and hunting, land conversion, and a decrease in the functional size of the park, which result in wildlife and plant habitat degradation, species loss, erosion, and impacts to watersheds. The resistance of KNP to illegal hunting and other human activities is low, indicating the vulnerability of wildlife species and habitats.

Strengths and Weaknesses of Management and Solutions

The findings from the three methods showed identifiable patterns in the strengths and weaknesses of management. The most consistently successful aspects of management across KNP related to legal status and resource inventory (Q1 and Q9; Fig. 5; see also Table 6 in Appendix). KNP has been formally gazetted. It has a management body, some dedicated staff, and adequate information, but this information is based on an old resource inventory. Few direct benefits were derived by the local people that occasionally contribute to park conservation as ecoguards.

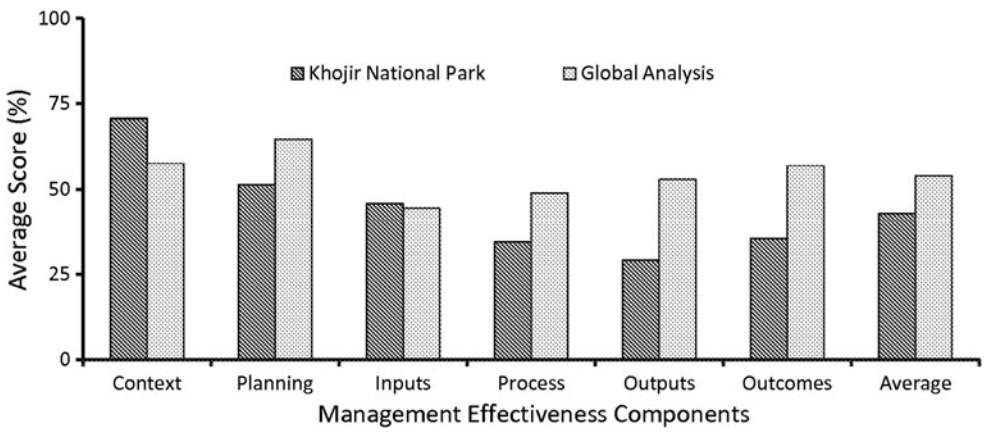

Fig. 3 Evaluation of the status of KNP by respondents based on the *Assessment Form* compared with a global analysis. The results were categorized based on the WCPA framework

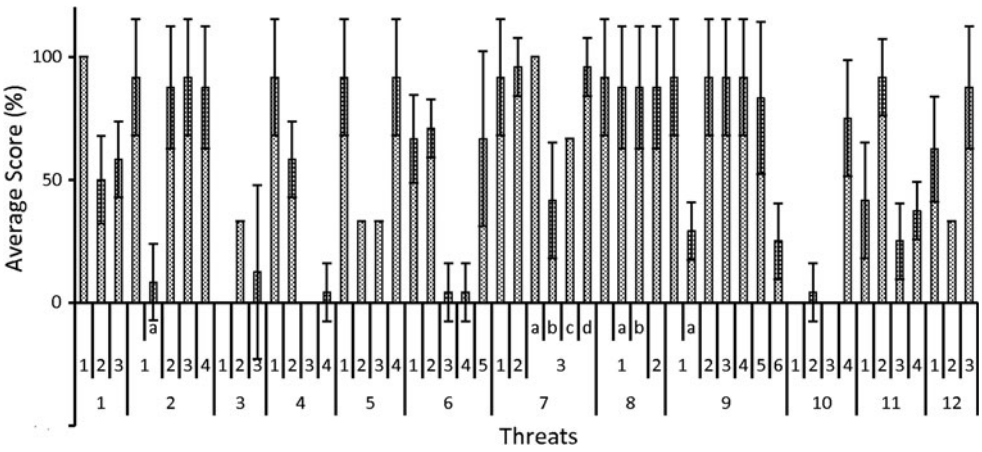

Fig. 4 Evaluation of the threat factors affecting the management of KNP identified by respondents as scores for threats in *Data Sheet 2*. The standard deviation of each factor is also shown. Scores were converted to percentages. Higher scores indicate that a factor poses a stronger threat to the management of KNP. *Numbers* on the *X-axis* indicate threat numbers in *Data Sheet 2*; the threats are described in Table 5 in Appendix

They had a low secured budget, but KNP maintained other strengths such as having an appropriate entry/exit gate and an adequate radio communication system. In addition, issues related to planning for land and water use, regulations, and the setting of objectives are generally well addressed, but other issues are less well addressed and also less effective.

The *Comment/Explanation* column in the *Assessment Form*, open interviews, and site visits revealed many other weaknesses and problems in KNP management (Table 2). To empower strengths and reduce weaknesses, some solutions were addressed based on responses in the *Next steps* column of the *Assessment Form*, open interviews, and site visits; these are also shown in Table 2.

The interviews and site visits confirmed that the values of KNP (biodiversity, habitat, and cultural/historical and archaeological resources) have been severely degraded (Figs. 5, 6; Table 2). This means that the present systems

Table 2 The issues of weaknesses and the possible solutions offered by interviewees and site visiting

	Issues of weaknesses	Next steps
Context Where are we now?	Inadequate funds, manpower, equipment and resources and poorly maintained; Lack of incentive systems; Un-demarcated boundary; No local community involvement; and Major conflict by other departments' acts	Mobilize and lobby donor and private sector support; Hire well-train staff and ecoguards; Implement education and awareness; Procure equipment; Clearly demarcate boundary; and Start partnership programme
Planning Where do we want to be?	Law weaknesses; Managed partly according to agreed objectives; Old management plan; Constraint of design; Mismanagement; Presence and involvement of other organizations such as military or agriculture ministry via their activities and road construction inside park; Lack of management assessment; and Instability in the management	Revise law, plans & guidelines; Redefine KNP & Sorkhe-hesar national park boundaries in a new design to make a unified national park; Use proper and sustainable management; Prohibit and transfer other organizations activities to outside; and Prepare management assessment system at the end of each year
Inputs What do we need?	Low skills for research, planning, resources, administration, information & financial management; Lack of staff training centres; Temporary contract with the majority of the employees; Inadequate support from high management levels; and Interests surpass laws enforcement and studies	Improve allowances; Ratify research policy; Increase personnel training centres; Assess staff training; Take fees and allocate them just for KNP; Introduce incentives; Start management-driven research; and Apply comanagement

Table 2 continued

	Issues of weaknesses	Next steps
Process	Inappropriate management of budget;	Start conservation awareness programme;
How do we go about it?	Partially protection systems and lack of necessary performance;	Update Management plans;
	No conservation awareness programme;	Identify and maintain degraded areas;
	Illiterate or uneducated local people;	Develop specific management plans;
	People-KNP conflict;	Develop law enforcement monitoring system;
	Limited collaboration with tourism operators;	Strengthen law enforcement capacity;
	No specific management plans;	Construct visitor centre;
	No conservation awareness programme;	Sensitize the community;
	Inadequate personnel management and financial management; and	Have one revenue collection point;
	No maintenance programme for degraded areas	Prepare appropriate management; and
		Improve human resource management at local communities
Outputs	No Information centre for visitors;	Determine fees based on the real amount of losses and damages (hunt, land use changes etc.);
What were the results?	Inappropriate tourism facilities and services;	Advocate revenues to use in KNP; and
	No entry fees; and	Prepare tourism management plan
	Very few of fines contribution to KNP conservation efforts	
Outcomes	Severely degraded values of KNP;	Make collaboration with environment universities on values surveys;
What did we achieve?	Inadequate protection and control system;	Develop resource protection programme;
	A few economic benefits to local communities; and	Develop habitat monitoring/management programme; and
	Non-performance integrated management	Completely implement the exiting plans

The results were categorized based on the six management components

are not effectively protecting natural resources. The criteria used to judge the ineffectiveness of the system were the increase in the rate of encroachment and fragmentation, the decrease in the rate of key resources, and the status of biodiversity compared to the past. On the other hand, inadequate funds, budget, equipment & resources; unstable politics and managers; inactive management; mismanagement; destructive activities by the Defense and Agriculture Ministries inside the park; lack of motivation; and lack of co-management in the KNP management system are major causes of the system's ineffectiveness at protecting its fauna, flora, and ecosystem.

The ineffective management of KNP is depleting wildlife and habitats. Female wild sheep, for instance, regularly produce two offspring in a year, but most females in KNP are barren or produce a single offspring. This decrease is caused by many factors, one of which is pollution from surrounding factories and industries. In addition, the passage of a highway through KNP has fragmented the park. On average, four wild animals are killed per month on that road through accidents with cars. These changes illustrate the conflict between biodiversity conservation objectives and management for human convenience.

All the respondents pointed out that a budgetary shortage was a major problem. They wrote that money is needed for aspects such as law enforcement, boundary demarcation, planning and plan implementation, monitoring, education and awareness, hiring and training staff, considering local people, and visitor facilities. They also felt that the management of KNP should apply all of the "next steps'' which are listed in Table 2 along with the major reason for their need. The reasons include: to preserve and increase biodiversity and other values in KNP; to support ecosystem health and wildlife species; to protect sensitive areas from encroachment and destruction; to increase representativeness and include other remnant key areas under the protection, and to provide recreational opportunities.

Assessment Index

There were significant differences ($p < 0.001$) in ME scores among the respondents. ME, as derived from responses on METT forms, was significantly correlated with most of the individual indicators (Table 3). These strong correlations proved that there is a need for the active management of critical ecosystems, species, and habitats.

The PCA results revealed that six respondents had very similar ideas about issues in KNP, but two others did not have the same opinion (Fig. 6; Table 4). These two people were from different offices or levels in the KNP

management body. This shows that staff in different levels had different and sometimes antithetic knowledge, at least about the park's outputs.

Discussion and Recommendations

ME has grown over the last two decades to become a prominent issue in relation to PAs (Hockings and others 2004a; Moore and Walker 2008). The WCPA framework provides a useful starting point for this evaluation, especially for the identification of evaluation elements and objectives (Hockings and others 2004a, b, 2005). Countries around the world are making considerable progress in undertaking ME studies of PAs in accordance with their obligations under the CBD Program of Work for Protected Areas (Leverington and others 2010).

Our survey results allowed us to formulate some generalizations. Among the assessment indices, issues related to budget, education, boundary demarcation, regular work plan, and community involvement received the lowest scores (Fig. 5; Table 2). Available budget, for instance, was inadequate for basic management needs and placed serious constraints on the capacity to manage. Major consequences of ineffective management include degraded ecosystem health and services, loss of key species, increased habitat degradation, increased vulnerability of KNP, and a decrease in the PA's effective size. This suggests that a focus on specific activities is needed for management and monitoring.

The interviews and site visits revealed that major factors that contribute to ineffective management in KNP stem from top managers. They suffered from problems such as a lack of enthusiasm for their work, and showed limited initiatives in developing essential projects, administrative failures, inadequacy of resource investment, policy conflicts among government sectors, and weak public relations (Table 2). In other words, most of the threats and pressures to KNP come from inability, mismanagement, and a lack of support from upper management levels. Motivations can be properly or improperly applied, and they influence productivity. The Government, Parliament, and Judicature should understand and use proper incentives for environmental managers to achieve desired results. Simply stated, if a proper motivational environment is in place, PA conditions will encourage productive associates.

The score for the outputs component in KNP was lower than for other components (Fig. 3). This shows that the achievement of identified activities or work program

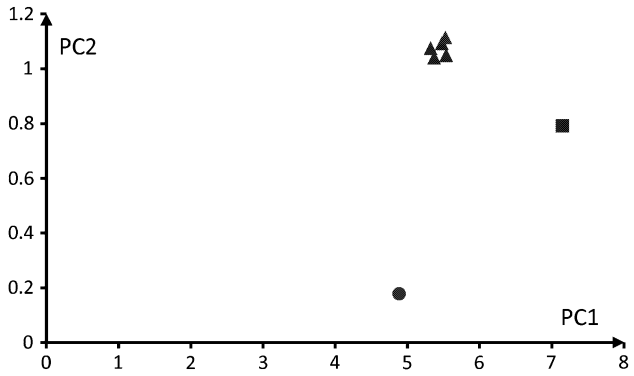

Fig. 6 Results of a principal component analysis (PCA) on correlations among the scores of six management effectiveness components by all respondents. The first two principal components, which are presented as the *x* and *y* axes, explained 88 % of the cumulative variance. Correlation structures (eigenvectors) for the principal components are shown in Table 4. *Triangles*, *circles*, and *squares* indicate respondents from the common office, the Bureau of Habitats and Protected Areas in the Department of the Environment, and ecoguards who were responsible for KNP, respectively. Different traits were identified by the respondents, especially in the outputs

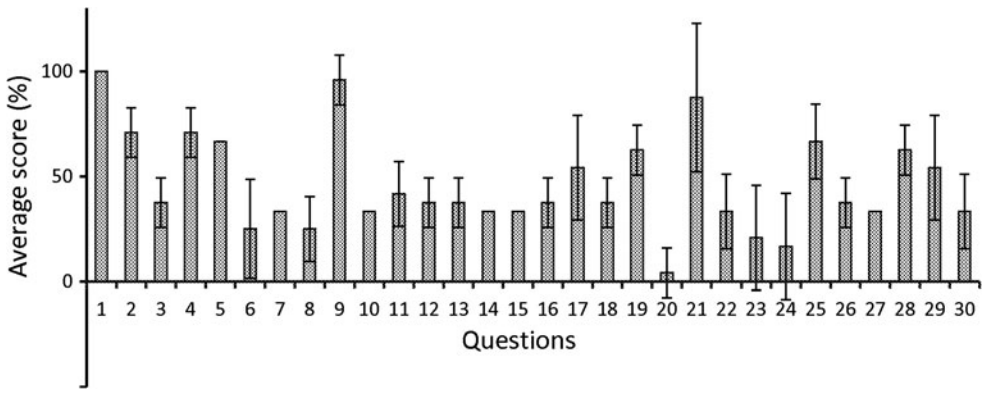

Fig. 5 Itemized evaluation of the status of KNP by respondents based on the *Assessment Form*. Average scores for each question in the *Assessment Form* that affected the management of KNP. The standard deviation of each question is also shown. Scores were converted to percentages. Higher scores indicate better status. *Numbers* on the *X-axis* indicate question numbers in the *Assessment Form*; the questions are described in Table 6 in Appendix

Table 3 Correlation coefficients between ME and the indices influencing KNP management effectiveness

Indicator	*r*
Legal status	–
KNP regulations	0.877**
Law enforcement	−0.563**
KNP objectives	0.877**
KNP design	–
KNP boundary demarcation	0.696**
Management plan	–
Regular work plan	−0.360**
Resource inventory	0.563**
Protection systems	–
Research	0.360**
Resource management	0.877**
Staff numbers	0.877**
Staff training	–
Current budget	–
Security of budget	0.877**
Management of budget	0.005
Equipment	0.877**
Maintenance of equipment	−0.877**
Education and awareness	0.877**
Planning for land and water use	0.563**
State and commercial neighbours	0.972**
Indigenous people	0.888**
Local communities	0.877**
Economic benefit	−0.598**
Monitoring and evaluation	−0.563**
Visitor facilities	–
Commercial tourism operators	0.563**
Fees	0.507**
Condition of biodiversity, ecological or cultural values	0.972**
Average of threats	−0.708**

See Table 6 in Appendix for the detailed explanation of each indicator

** $P < 0.01$, * $P < 0.05$

– The correlation coefficients for these questions cannot be computed because their variables were constant

Table 4 Correlation structures (eigenvectors) for principal components

	PC1	PC2
Context	0.798	−0.574
Planning	0.823	0.555
Input	0.905	0.234
Process	0.935	0.251
Outputs	−0.439	0.892
Outcomes	0.739	−0.074

targets (e.g., number of patrols run, paths built, or restoration activities) needs further consideration.

KNP suffers from having a low number of staff and from serious shortfalls in training (Fig. 5; Table 2). The correlation analyses among the indices indicated that the number of staff was strongly correlated with ME (Table 3). This means that the total scores were basically proportional to the number of staff, which clearly demonstrates the importance of adequate staffing. Success in maintaining biodiversity appears to be linked to a well-regulated and managed PA, where staff assess progress and make changes as necessary (Dudley and others 2007). In other words, adequate and well-trained staff members can perform their management duties more effectively, and they are a basic condition for the efficient management of PAs (Dudley and others 2004, 2007; Lacerda 2004).

According to IUCN guidelines for national parks, the primary objectives include equal ranking for the preservation of natural biodiversity and promotion education and recreation (Eagles and others 2002; Dudley 2008). Approximately, 8 % of the pages in Iranian case studies on management plans address the management of tourism (Mirkarimi 2007). Management plans seem to place greater emphasis on the protection of parks and less emphasis on recreation. On the other hand, good management of recreation requires advanced resourcing, staff training, facilities, policies and management planning, and processes to prevent issues such as waste management and track erosion from having serious impacts (Nolte and others, 2010). This may also explain why recreation was perceived as such a serious threat (Fig. 4). PA management in Iran does not appear to have the capacity to cope with rapid increases in the number of visitors. The visitor management headline indicator for the evaluation of ME scored quite low (33 %, Q27; Fig. 5). Unfortunately, a ranger at the entrance of KNP prevented visitors from entering the park because there are military factories inside and around the park. These activities plus actions by the Agriculture ministry frequently prevent KNP management activities. Rationally, these activities must be excluded from PAs.

The responses on *Data Sheet 2* showed that there were many threats to organisms, such as habitat fragmentation, losses of keystone species, and invasive species (Q7.3 and 8; Fig. 4; see also Table 5 in Appendix). Wildlife are endangered and threatened in every PA in Iran, and urgent conservation actions are needed (see IFNRCBD 2010; Makhdoum 2008; Farhadinia and Hemami 2010; Ahmadzadeha and others 2008) because mismanagement and human activities are the primary causes of death. In other hand, the DoE at the national, provincial and PAs levels are unable to engage on equal terms with other government sectors and remain weak actors (UNDP-GEF 2004). Therefore, conservation must be legally, politically, and

financially empowered. Activities that affect wildlife and habitats should be forbidden. For instance, highways cause fragmentation of animal habitats; despite this fact, highways have been constructed through PAs, such as KNP, Sorkhe-hesar National Park, and the Jajrud Protected Area. Road construction must be prohibited inside PAs (Kolahi and others 2012). In KNP, ecological habitat and wildlife corridors need to be created to allow species to move between the "islands of biodiversity." This was recognized as a potential method to reduce the fragmentation effects (Bennett 2003).

From the above discussion, we have made recommendations in four areas, namely, (1) funding, (2) building capacity and facility improvement, (3) participation of local and/or interested people, and (4) planning and adaptive management.

Funding

Underfunding of PAs appears to be a systemic problem in most countries (Ervin 2003b; Leverington and others 2010; Bruner and others 2001). In KNP, inadequate funding was identified as a serious weakness and additional funds would directly influence ME (Fig. 5, Table 2).

Investments from the government should be strengthened and different strategies for budgetary support should be implemented. There are a variety of new and innovative financing mechanisms, including funding at three levels, local (e.g., user fees, sponsorships, and donations), national (e.g., taxes and charges, endowment funds, and incentives), and international (bilateral and multilateral donors and lending agencies) (Phillips 2000). These funding options could be used to cover the costs (or a substantial part of them) of PAs, to reduce their dependence on the public purse, and to secure sustainable funding. However, any income from PAs fees and fines should not be sent Treasury, but should be spent within the PAs (Kolahi and others 2012).

In addition, budgetary management must be strengthened to make sure budgets are used effectively for ecosystem protection. The budgetary mechanisms of the government should guide the application of funds for hiring well-trained staff and promoting and training existing staff and managers, as well as controlling investments in infrastructure. The budget of KNP should not be used for tourism or economic development, or be disguised as equipment investments (Figs. 5, 6, Table 2).

Building Capacity and Facility Improvement

Hiring, supporting, and motivating well-trained managers with training and responsibilities related to environmental sciences are the key issues for PA success. In addition, well-trained staff and ecoguards should be hired and paid according to the national rules of the civil service. This would provide an effective solution for addressing the inadequacy and instability of the ranger program. For example, in essence, 7 of the 30 ecoguards in the common office (see Sect 2) protect KNP. They suggested that if the three additional ecoguards were hired (increasing the number of KNP's ecoguards to ten), and then the ecoguards could effectively protect the entire park. Furthermore, regular training should be organized to improve the knowledge and practical skills of staff, patrollers, and managers.

The number of ecoguards per 1,000 ha is dependent on local threats, the density of the population, and the distributions of species at risk (Aviram and others 2003). Hence, PAs in Iran are experiencing severe pressures from human activities (Kolahi and others 2011, 2012). Considering the sample of KNP, it seems that an ecoguard is required for every 1,000 ha of Iran's PAs to protect those areas effectively.

On the basis of the above descriptions and the findings of the PCA (Fig. 6), it is recommended that a databank be created for the collection of reports and other information. The databank should include all the data and information about PA conditions. It should provide clear reporting and should be available to all the PA staff and other people.

These measures and other capacity building would facilitate the improvement of resource management in KNP as well as in Iran's other PAs and environments. To be successful in conservation, all the necessary facilities or equipment should be procured. New techniques, such as closed-circuit cameras, should be widely used in the PA system. In addition, the existing laws and regulations that control land use and activities have several weaknesses and gaps that have led to problems during their practical implementation (Fig. 5; Table 2). For instance, laws or regulations from different organizations can contradict each other. Therefore, there is an urgent need to make these laws and regulations consistent and operational. It is also very important for KNP management to improve its ability to implement relevant laws and regulations.

Participation of Local and/or Interested People

Studies have indicated that management plans and activities have been carried out successfully in many PAs with the participation of local communities (see Borrini-Feyerabend and others 2004; Leakhena San 2006; Leape and Wolfowitz 2005). However, our results showed that the commitment of local people was very low in KNP (Q24; Fig. 5; see also Table 6 in Appendix). Neither did indigenous people provide adequate input to management decision (Q23; Fig. 5; see also Table 6 in Appendix). These results suggest that this aspect of local commitment must be radically improved.

The past two decades have seen a paradigm shift in natural resource management all over the world. In particular, management decisions have shifted to more decentralized levels of government with increased public involvement in decision making (Leape and Wolfowitz 2005). A new paradigm for PA conservation and poverty alleviation is needed in Iran (Fig. 7). Relationships between the park administration and local communities should be developed and improved to achieve the conservation goals of KNP. Community co-management must be applied as a part of the management of KNP. The roles of indigenous peoples and other local communities as important stakeholders should be recognized through a real co-management process that protects their rights and interests and is based on a management body that represents all of the stakeholders equitably. Such moves toward a participatory and community-based approach are needed as a new direction from the traditional top-down models of policy making that have been historically prevalent since the introduction of scientific PA management in Iran. It is obvious that the current PA management system in Iran is not practical for the sustainable development of communities that live in PA regions. Gradual steps would have to combine PA management objectives with sustainable rural livelihoods to achieve the goal of sustainable PA management. It is thought that joint PA management—the collaborative management of government PAs by government, indigenous, and local communities with joint sharing of benefits—can produce benefits for both PAs and communities. This type of management can increase the community interest and participation, regeneration of degraded habitats, and economic benefits for communities, and can also improve the public stature of official biodiversity agencies. Scientific studies that analyze this shift in management and assess how it might be harnessed to promote sound PA sector management and strengthen links to poverty alleviation are required to develop viable options for the conservation and sustainable management of PA resources. Governments should focus on using the results of related studies to find ways to improve the livelihoods of PA-dependent people who are living in poverty while conserving biological diversity in Iran's PAs.

Planning and Adaptive Management

Regular work plans and management planning (the weakest of the planning indicators), and monitoring and evaluation scored relatively low (Q 8; Fig. 5; see Table 6 in Appendix). One key factor that was repeatedly mentioned was the need to improve the application and use of planning, evaluation, and management tools to deliver good and consistent management on the ground.

The realization of conservation goals requires strategies for managing entire landscapes that are established on science-based management plans (Margules and Pressey 2000). Therefore, master plans and management plans with predefined conservation goals should be updated/developed and implemented in KNP as well as in all the PAs in Iran.

Because KNP and Sorkhe-hesar National Park are adjacent to each other and both have been severely degraded by human activities, there is a need to redefine their boundaries to create an unified national park. As Howard and others (2000) mentioned, larger PAs are essential because only they can maintain viable populations of certain keystone species and the full complexity of ecological interactions and phenomena, such as migration.

Since ME is becoming a keyword in conservation science, there is a growing recognition that good project management is integrally linked to well-designed monitoring and evaluation systems (Stem and others 2005). Monitoring programs should be developed with close relationships to planning and management systems and the objectives of management plans (Alexander and Rowell 1999). It is sometimes better to assess explicitly the linked outputs and outcomes by surveying PA managers and visitors (Moore and Walker 2008). In addition, more work needs to be done to spread out the monitoring of ecological integrity and community effects (Timko and Satterfield 2008). In other words, evaluation tools that are primarily

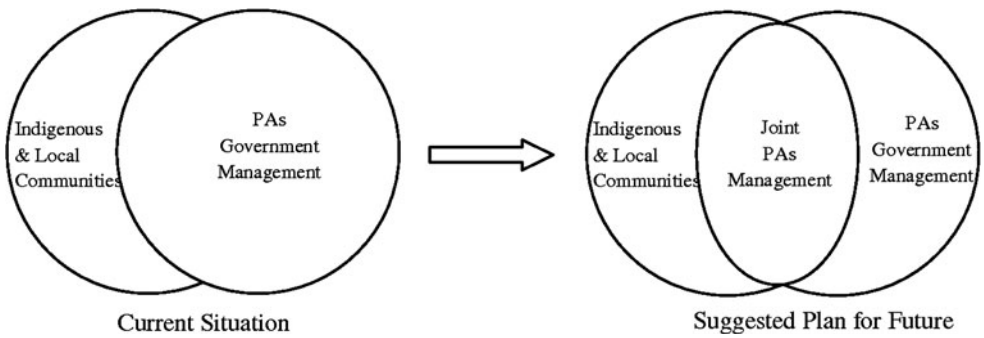

Fig. 7 Schematic diagram of a new paradigm for PA conservation and poverty alleviation in Iran

based on the stated management objectives are unlikely to be very useful for improving the management of PAs (Dahl-Tacconi 2005). Given this scenario and the fact that Iran has international obligations for ME evaluations, it would be beneficial for DoE to adopt METT for ME evaluations of its PAs. Information gleaned from these assessments will go a long way to assist DoE in decision-making, planning, and adaptive management of PAs.

A detailed system of indices for long-term monitoring and evaluation that can provide species-level or other quantitative data that are needed for assessments should be established and applied (Quan and others 2011). It is important for conservation practitioners to agree on the key steps and guiding principles for effective monitoring and evaluation (Stem and others 2005). The results of regular monitoring and evaluations could be used to inform the prioritization of activities and funding for all the PAs, and to modify the management plans and policies (Hockings 1998).

Older PAs tend to receive higher ME scores since their management can be improved, given more time and effort (Quan and others 2011). KNP is one of the oldest of Iran's PAs; thus, it may have received more political and budgetary support from the government compared to other PAs. We still have little detailed information about the states of other PAs in Iran. With one exception, no other PAs in Iran have management plans (BHPAs 2011). Iran is a signatory of the CBD Program of Work on Protected Areas, as mentioned above. Without management plans and monitoring systems, it is difficult to gauge whether progress is being made in PA management, which makes it difficult to motivate and justify the financial resources spent on managing PAs. Assessments would provide key information that is required by the political leaders and stakeholders (Mulonga 2010). If PAs are failing to address the major management problems, their management objectives need to be stated precisely and management plans and activities to achieve those goals need to be implemented, otherwise they may become even less effective as time goes by (Quan and others 2011). Therefore, there is a need for a comprehensive assessment tool for ME evaluation of PAs in Iran that is based on the WCPA framework, to which Iran is a signatory.

Conclusions

This study conducted the first explicit evaluation of ME in one of the oldest PAs in Iran, KNP. The information gathered suggested that no standard ME tool was currently used for tracking ME in Iran's PAs. The results of this study showed that structured interviews (using METT), open interviews, and site visits painted a clear picture of the management strengths and weaknesses. In addition, the current findings confirm that the present systems do not effectively protect natural resources. The indices of legal status, resource inventory, planning for land and water use, regulations, and objectives received the highest average scores, whereas education and awareness, community co-management, regular work plan, boundary demarcation, visitor facilities, budget sources, staff training, protection systems, and management plan received the lowest ones.

The results revealed that major factors that contribute to an ineffective management in KNP stem from inadequacy of resource investment, inability, mismanagement, a lack of support from upper management levels, and policy conflicts among government sectors. The management system of KNP was generally established, but many problems of the management still need to be resolved. To improve ME, some countermeasures should be taken, such as increasing funding, strengthening capacity building, planning, and adaptive management, and implementing community participation. The Government, Parliament, and Judicature should use proper incentives for environmental managers to achieve the desired results. Investments from the government should be strengthened to hire well-trained staff and promote and train existing staff and managers. Also different strategies for budgetary support should be implemented. All necessary facilities or equipment should be procured. And the existing laws and regulations should be consistent and operational.

People should be seen not as a threat but as an opportunity to help achieve broader nature conservation goals. The government should see the human and environmental condition as one intricate system. It is thought that the joint PA management can produce benefits for both PAs and communities. Conservationists are losing the battle to protect the nature because they are failing to connect with the hearts, anxieties, and minds of the Iranian public. If environmentalists are to move beyond their current lonesome, they must reach out and connect to new audiences across the social spectra.

Because KNP and Sorkhe-hesar National Park are adjacent to each other and both have been severely degraded by human activities, it is suggested to redefine their boundaries to create a unified national park. However, without science-based management plans and monitoring systems, it is difficult to gauge whether progress is being made in PA management, which makes it difficult to motivate and justify the financial resources spent on managing PAs. There is also a need for a comprehensive assessment tool for ME evaluation of PAs in Iran that is based on the WCPA framework, to which Iran is a signatory.

The poor ME conditions in KNP, despite its long history and strong management body, suggest that other PAs in Iran may be in even worse condition. It is expected that

efforts will be concentrated on incorporating assessment findings into KNP planning and management, and addressing weaknesses that were revealed by this study. Furthermore, the results of this study will contribute to study and address the issues in other PAs in Iran.

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Appendix

See Tables 5 and 6.

Table 5 The list of threats in Data Sheet 2 of METT

1. Residential and commercial development within a protected area	1.1 Housing and settlement
	1.2 Commercial and industrial areas
	1.3 Tourism and recreation infrastructure
2. Agriculture and aquaculture within a protected area	2.1 Annual and perennial non-timber crop cultivation
	2.1a Drug cultivation
	2.2 Wood and pulp plantations
	2.3 Livestock farming and grazing
	2.4 Marine and freshwater aquaculture
3. Energy production and mining within a protected area	3.1 Oil and gas drilling
	3.2 Mining and quarrying
	3.3 Energy generation, including from hydropower dams
4. Transportation and service corridors within a protected area	4.1 Roads and railroads (include road-killed animals)
	4.2 Utility and service lines (e.g. electricity cables, telephone lines,)
	4.3 Shipping lanes and canals
	4.4 Flight paths
5. Biological resource use and harm within a protected area	5.1 Hunting, killing and collecting terrestrial animals (including killing of animals as a result of human/wildlife conflict)
	5.2 Gathering terrestrial plants or plant products (non-timber)
	5.3 Logging and wood harvesting
	5.4 Fishing, killing and harvesting aquatic resources
6. Human intrusions and disturbance within a protected area	6.1 Recreational activities and tourism
	6.2 War, civil unrest and military exercises
	6.3 Research, education and other work-related activities in protected areas
	6.4 Activities of protected area managers (e.g. construction or vehicle use, artificial watering points and dams)
	6.5 Deliberate vandalism, destructive activities or threats to protected area staff and visitors
7. Natural system modifications	7.1 Fire and fire suppression (including arson)
	7.2 Dams, hydrological modification and water management/use
	7.3a Increased fragmentation within protected area
	7.3b Isolation from other natural habitat (e.g. deforestation, dams without effective aquatic wildlife passages)
	7.3c Other 'edge effects' on park values
	7.3d Loss of keystone species (e.g. top predators, pollinators etc.)
8. Invasive and other problematic species and genes	8.1 Invasive non-native/alien plants (weeds)
	8.1a Invasive non-native/alien animals
	8.1b Pathogens (non-native or native but creating new/increased problems)
	8.2 Introduced genetic material (e.g. genetically modified organisms)

Table 5 continued

9. Pollution entering or generated within protected area	9.1 Household sewage and urban waste water
	9.1a Sewage and waste water from protected area facilities (e.g. toilets, hotels etc.)
	9.2 Industrial, mining and military effluents and discharges (e.g. poor water quality discharge from dams, e.g. unnatural temperatures, de-oxygenated, other pollution)
	9.3 Agricultural and forestry effluents (e.g. excess fertilizers or pesticides)
	9.4 Garbage and solid waste
	9.5 Air-borne pollutants
	9.6 Excess energy (e.g. heat pollution, lights etc.)
10. Geological events	10.1 Volcanoes
	10.2 Earthquakes/Tsunamis
	10.3 Avalanches/Landslides
	10.4 Erosion and siltation/deposition (e.g. shoreline or riverbed changes)
11. Climate change and severe weather	11.1 Habitat shifting and alteration
	11.2 Droughts
	11.3 Temperature extremes
	11.4 Storms and flooding
12. Specific cultural and social threats	12.1 Loss of cultural links, traditional knowledge and/or management practices
	12.2 Natural deterioration of important cultural site values
	12.3 Destruction of cultural heritage buildings, gardens, sites etc.

Table 6 The list of questions in the Assessment Form of METT

S. No.		Issue	Category
1	Legal status	Does PA have legal status (or in the case of private reserves is covered by a covenant or similar)?	Context
2	PA regulations	Are appropriate regulations in place to control land use and activities (e.g. hunting)?	Planning
3	Law enforcement	Can staff (i.e. those with responsibility for managing the site) enforce PA rules well enough?	Input
4	PA objectives	Is management undertaken according to agreed objectives?	Planning
5	PA design	Is the PA the right size and shape to protect species, habitats, ecological processes and water catchments of key conservation concern?	Planning
6	PA boundary demarcation	Is the boundary known and demarcated?	Process
7	Management plan	Is there a management plan and is it being implemented?	Planning
8	Regular work plan	Is there a regular work plan and is it being implemented?	Planning/ Outputs
9	Resource inventory	Do you have enough information to manage the area?	Input
10	Protection systems	Are systems in place to control access/resource use in the PA?	Process/ Outcome
11	Research	Is there a programme of management- orientated survey and research work?	Process
12	Resource management	Is active resource management being undertaken?	Process
13	Staff numbers	Are there enough people employed to manage the PA?	Inputs
14	Staff training	Are staffs adequately trained to fulfil management objectives?	Inputs/ Process
15	Current budget	Is the current budget sufficient?	Inputs
16	Security of budget	Is the budget secure?	Inputs
17	Management of budget	Is the budget managed to meet critical management needs?	Process
18	Equipment	Is equipment sufficient for management needs?	Input
19	Maintenance of equipment	Is equipment adequately maintained?	Process
20	Education and awareness	Is there a planned education programme linked to the objectives and needs?	Process

Table 6 continued

S. No.		Issue	Category
21	Planning for land and water use	Does land and water use planning recognise the PA and aid the achievement of objectives?	Planning
22	State and commercial neighbours	Is there co-operation with adjacent land and water users?	Process
23	Indigenous people	Do indigenous and traditional peoples resident or regularly using the PA have input to management decisions?	Process
24	Local communities	Do local communities resident or near the PA have input to management decisions?	Process
25	Economic benefit	Is the PA providing economic benefits to local communities, e.g. income, employment, payment for environmental services?	Outcomes
26	Monitoring and evaluation	Are management activities monitored against performance?	Planning/ Process
27	Visitor facilities	Are visitor facilities adequate?	Outputs
28	Commercial tourism operators	Do commercial tour operators contribute to PA management?	Process
29	Fees	If fees (i.e. entry fees or fines) are applied, do they help PA management?	Inputs/ Process
30	Condition of values	What is the condition of the important values of the PA as compared to when it was first designated?	Outcomes

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