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A Global Analysis of Protected Area Management Effectiveness

Fiona Leverington · Katia Lemos Costa · Helena Pavese · Allan Lisle · Marc Hockings

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Abstract We compiled details of over 8000 assessments of protected area management effectiveness across the world and developed a method for analyzing results across diverse assessment methodologies and indicators. Data was compiled and analyzed for over 4000 of these sites. Management of these protected areas varied from weak to effective, with about 40% showing major deficiencies. About 14% of the surveyed areas showed significant deficiencies across many management effectiveness indicators and hence lacked basic requirements to operate effectively. Strongest management factors recorded on average related to establishment of protected areas (legal establishment, design, legislation and boundary marking) and to effectiveness of governance; while the weakest aspects of management included community benefit programs, resourcing (funding reliability and adequacy, staff numbers and facility and equipment maintenance) and management effectiveness evaluation. Estimations of management outcomes, including both environmental values conservation and impact on communities, were positive. We conclude that in spite of inadequate funding and management process, there are indications that protected areas are contributing to biodiversity conservation and community well-being.

Keywords Protected area · National park · Management effectiveness · Global · Evaluation · Assessment · Biodiversity · Conservation

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F. Leverington · K. L. Costa · M. Hockings (✉)
School of Integrative Systems, University of Queensland, St. Lucia, QLD 4067, Australia
e-mail: m.hockings@uq.edu.au

H. Pavese · M. Hockings
UNEP World Conservation Monitoring Centre, Huntington Road, Cambridge, UK

A. Lisle
School of Land, Crop and Food Sciences, University of Queensland, Gatton, QLD 4343, Australia

Introduction

In this article, we compile, for the first time, information from assessments of management effectiveness of protected areas across the world, and draw some conclusions about strengths and weaknesses in management.

Society is continuing to invest resources into acquiring and managing protected areas, believing that they are the backbone of biodiversity conservation and that they deliver a range of other social, economic and environmental benefits. Over 12% of the earth's terrestrial surface is now in nationally designated protected areas (UNEP-WCMC 2008) but global biodiversity continues to decline at an alarming rate (Butchart and others 2010). We need to evaluate the extent to which these reserves really do protect their values and deliver benefits to the community (Hockings and Phillips 1999; Ervin 2003a; Southworth and others 2006; Timko and Innes 2009), and demonstrate proper accountability, good management practices and transparency in reporting (Hockings and others 2006, 2009).

This need for protected area effectiveness evaluation echoes calls to measure, evaluate and communicate the effectiveness of conservation strategies more generally (Saterson and others 2004; Sutherland and others 2004;

Brooks and others 2006). It has been brought into a sharper focus by the increasing threats to protected areas through climate change, and debate about whether protected areas remain relevant in periods of rapid biophysical and social change (Dunlop and Brown 2008; Hannah and others 2007; Shadie and Epps 2008).

Management effectiveness evaluation has been included in the Programme of Work on Protected Areas adopted by the Convention on Biological Diversity in 2004 at its seventh Conference of Parties. The Programme of Work sets ambitious targets towards which many countries have been working (Ervin and others 2008) and includes commitments that "by 2010, frameworks for monitoring, evaluating and reporting protected areas management effectiveness at sites, national and regional systems, and transboundary protected area levels [will be] adopted and implemented by Parties" and that the results of such studies will be used to improve management (Convention on Biological Diversity 2004; Coad and others 2008). This and related policy work has reinforced that it would be highly advantageous to synthesize site-specific information to gain some understanding of success factors in conservation approaches, and to integrate site-level studies into global biodiversity monitoring, as proposed by Saterson and others (2004).

Current Approaches to Assessing Effectiveness

Effectiveness of protected areas can be considered at four different, complementary levels.

Coverage

At the first level, many studies have been conducted to evaluate the coverage of protected area systems (Chape and others 2005; Coad and others 2008; Jenkins and Joppa 2009) and the extent to which biodiversity is represented within these systems (see, for example Rodrigues and others 2004).

Broadscale Outcomes

At the second level, a number of meta-studies in recent years have investigated relationships between protected areas and large-scale environmental impacts such as forest clearing, primarily using remote sensing data on forest cover changes over time (Bruner and others 2001; Naughton-Treves and others 2005; Figueroa and Sánchez-Cordero 2008; Joppa and others 2008; Nagendra 2008; Whitehurst and others 2009; Gaveau and others 2009; Scharlemann and others 2010). Protected areas are considered to be an effective conservation strategy if there are no gross ecological changes or destruction of habitat, or if these changes are less in protected areas than in comparison sites (Ahrends and others 2010).

These studies provide essential and objective information about conservation success at a broad level, but have significant limitations. They rely on a limited suite of indicators and may not detect other important changes, such as the loss of animal populations which lead to the "half-empty forest" syndrome (Carrillo and others 2000; Redford and Feinsinger 2003; Stoner and others 2007). Measuring gross changes through remote sensing is more difficult in non-forest environments such as grasslands or marine parks. Level two studies raise a number of questions: would the protected areas be likely candidates for clearing anyway? If forests are not cleared, to what extent is this due to good management? Has the protection of some areas led to more clearing in other places (Andam and others 2008; Ewers and Rodrigues 2008)?

While this second level of assessment is important in countries where major large-scale threats operate, it is not particularly relevant in many more developed countries where it is unlikely that gross alienation or developments will take place within a protected area.

Protected Area Management Effectiveness Assessments (PAME)

The third level, using a quite different approach, comprises the many thousands of assessments of protected area management effectiveness (often known as PAME) conducted by protected area agencies or conservation non-government organizations since the 1990s (Rivero Blanco and Gabaldon 1992; Cifuentes and others 2000; Hockings 2003). These studies are directed to one or more of four basic purposes: improving protected area management, increasing accountability, communicating with the public, and assisting in prioritization of resourcing (Leverington and Hockings 2004). Over the past ten years, many countries have made significant efforts to develop and apply PAME methodologies to assess the effectiveness of their protected area sites and systems. Funding agencies including the World Bank, Global Environment Fund and Worldwide Fund for Nature (WWF) now require such evaluations for all project interventions that involve protected areas (Belokurov and others 2009).

These methods relate to the framework for evaluating management effectiveness developed by the International Union for Conservation of Nature (IUCN) World Commission on Protected Areas IUCN-WCPA Framework (Hockings and others 2004, 2006), which groups indicators according to six elements in the management cycle: context, planning, inputs, processes, outputs and outcomes.

Detailed Monitoring

The fourth level of assessment consists of detailed monitoring and reporting on the condition and trend of specific protected area values such as animal populations, forest condition, cultural values and socioeconomic impacts. Methodologies for directing, undertaking and reporting on such detailed studies in a systematic way that aids adaptive management have been developed by groups such as the Nature Conservancy (Parrish and others 2003) and park management agencies in Canada and South Africa (Timko and Innes 2009; Parks Canada 2010).

Ideally, such detailed information should underlie judgments about outcomes that may be made in the third-level assessments. However, many monitoring and research projects on protected areas are not incorporated into adaptive management and do not provide useful feedback loops into management. Combining fourth level studies with third level (management effectiveness) information is an efficient way to overcome this issue.

This article primarily draws information from third level assessments. We used raw data and reports from a range of different methodologies to investigate some questions of concern to the conservation community: the extent to which PAME evaluations have been undertaken, the level of management effectiveness in places which have been assessed, and factors which appear to be most highly correlated with effective management.

Methods

Obtaining Data

The global study on management effectiveness was conducted through the auspices of the IUCN World Commission on Protected Areas (WCPA) so we were able to work with the support of partners and co-workers across the world in government and non-government organizations to source and obtain information.

First, we compiled a database of where and when individual *assessments* of management effectiveness had been undertaken, with associated metadata on methodology and indicators used. We recorded over 8000 assessments from 100 countries, derived from more than 50 methodologies.

Second, we obtained and analyzed *original data* for as many assessments as possible. Some data holders were reluctant to release potentially controversial data for analysis, but we were able to access results for 4092 evaluations from 3038 protected areas. This information was from studies based on 14 methodologies, including the most widely applied. (Table 1).

Third, we reviewed and analyzed some 50 evaluation reports—the written conclusions of studies using a range of methodologies. These reports were valuable because they synthesized and interpreted results for studies across a country or region, and supplied valuable context and explanation. In some cases, study reports were available but original data were not, while for other assessments we have data but no written reports have been prepared.

In many cases information has been obtained on the understanding that it will not be used to identify countries, so in our analyses we avoided using the information to compare sites or to draw conclusions about management of individual protected areas or countries.

Analyzing Data

The task of analyzing the large and diverse set of raw data and reports was complicated, as each methodology uses different indicator sets and scoring systems. In order to gain an overall picture from this and future data-sets, we needed a common reporting platform so we could cross-analyze results from the wide range of PAME studies while retaining as much information as from the original assessments as possible. To do this, we developed a nested set of headline indicators into which indicators from any PAME methodology could be grouped and matched, and a process for transforming the diverse data sets into these indicators. For example, different methodologies include a wide range of indicators about management planning: the common reporting platform allowed us to group any of these into one relevant 'headline indicator' to give a general assessment of management planning across all methodologies.

To develop the headline indicators, we analyzed and coded over 1800 indicators used in a range of PAME methodologies. We aimed to include as much as possible of the diversity of evaluation topics and indicators in a manageable set of headline indicators (Table 2). These headline indicators were widely discussed with colleagues working in the field before finalization.

Converting to a Common Scale

The next challenge in cross-analysis was the range of different rating and scoring systems used in management effectiveness methodologies. Most methodologies define the ideal situation for each indicator and use scores or ratings—usually from a minimum of zero or one up to a maximum of three, four, ten or 100—to measure the progress towards achieving that ideal. Some data was quantitative (though often 'best estimate') ratio data, for example where people estimated the amount of funding needed for a protected area and then calculated what

Table 1 Assessment data used for this study (note only 'most recent' assessments with available data are counted)

Methodology name	Abbreviation[a]	Organization/Affiliation and/or reference	Number of assessments with data used
Rapid Assessment and Prioritization of Protected Area Management	RAPPAM	WWF (Ervin 2003b)	939
Management Effectiveness Tracking Tool	METT	World Bank/WWF Alliance (Stolton and others 2007)	865
Central African Republic	Central African Republic	Academic/WWF (Blom and others 2004)	16
TNC Parks in Peril Site Consolidation Scorecard	PIP Site consolidation	TNC/USAID (The Nature Conservancy Parks in Peril Program 2004)	300
PROARCA/CAPAS scorecard evaluation	PROARCA/CAPAS	PROARCA/CAPAS (Corrales 2004)	483
Parks profiles	Parks profiles	Parkswatch (ParksWatch 2007)	62
AEMAPPS: PAME with Social Participation—Colombia	AEMAPPS	Parques Nacionales Naturales de Colombia/ WWF Colombia	89
Metodología de Evaluación de Efectividad de Manejo (MEMS) del SNAP de Bolivia	MEMS	SERNAP (Guachalla and Zegada 2001)	19
Indian Management Effectiveness Evaluation	MEE Indian	Mathur (2008)	30
Korean Protected Area System Evaluation	Korea MEE	Korean National Parks Service, Ministry of Environment (KNPS 2009)	39
Enhancing our Heritage	Enhancing our Heritage	IUCN and UNESCO World Heritage Centre (Hockings and others 2008)	3
Monitoring Important Bird Areas	Birdlife	Birdlife International (Birdlife International 2006)	506
Victoria's State of Parks	Victorian SOP	Parks Victoria (Parks Victoria 2007)	102
New South Wales State of Parks (Australia)	NSW SOP	NSW DEC (NSW Department of Environment and Conservation 2005)	639

[a] These abbreviations are for convenience and are used in following graphs and tables: they are not always formally used in the method itself

proportion of this funding was available. However, most of the data we obtained was ordinal, where the ratings were in order from lowest to highest, but the gaps between the different scores were not entirely even and consistent, and were often difficult to quantify (example given in Table 3).

The variation of scoring systems posed the question of how best to use different data types using different scales without losing validity. We mapped all ratings onto a zero to one scale, where zero represented the lowest measurement and one the optimum situation (example given in Table 4).

While this approach minimized loss of information and gave a comparative picture of the state of protected areas, we recognize that the nature of the underlying data means that results were estimates of progress and need to be interpreted with care.

Matching Indicators from Individual PAME Methods to the Headline Indicators

We then cross-matched individual indicators from each methodology to the headline indicators in Table 2. In most cases the matching process was straightforward, but in some cases the indicator was difficult to allocate due to the way the question was phrased or because it covered two topics. To ensure consistency, one of us undertook this task for all the methodologies, with another cross-checking. Where possible, the matching was also checked with the developer of the methodology.

Commonly, multiple indicators matched to one headline indicator. In these cases we averaged the component indicators to derive a score for the headline indicator that could vary between 0 and 1. However, in some cases one indicator was clearly more important than another, especially where a key indicator (for example the existence of a management plan) was complemented by supplementary indicators (such as currency or scope of the plan). For this reason, each of the n individual indicators (S_j) was allocated a weight (W_j) between zero and one in terms of its contribution to a headline indicator (I) such that the sum of weights was equal to 1 (see Table 5 for an example).

$$I = \sum_{j=1}^{n} S_j W_j$$

There is considerable variation as to which headline indicators are matched by the available indicators from different methodologies. No methodologies populate every

Table 2 The PAME common reporting format headline indicators

Element	'Headline indicators' reported in this article
Context	Level of significance
	Extent and severity of threats
	Constraint or support by external political and civil environment
Planning	Protected area gazettal (legal establishment)
	Tenure issues
	Adequacy of protected area legislation and other legal controls
	Marking and security or fencing of park boundaries
	Appropriateness of design
	Management plan
Input	Adequacy of staff numbers
	Adequacy of current funding
	Security/reliability of funding
	Adequacy of infrastructure, equipment and facilities
	Adequacy of relevant and available information for management
Process	Effectiveness of governance and leadership
	Effectiveness of administration including financial management
	Management effectiveness evaluation undertaken
	Adequacy of building and maintenance systems
	Adequacy of staff training
	Staff/other management partners skill level
	Adequacy of human resource policies and procedures
	Adequacy of law enforcement capacity
	Involvement of communities and stakeholders
	Communication program
	Appropriate program of community benefit/assistance
	Visitor management (Visitors catered for and impacts managed appropriately)
	Natural resource and cultural protection activities undertaken
	Research and monitoring of natural/cultural management
	Threat monitoring
Outputs	Achievement of set work program
	Results and outputs produced
Outcomes	Conservation of nominated values—condition
	Effect of park management on local community

Table 3 Example of scoring system for one of the indicators in the Management Effectiveness Tracking Tool (Stolton and others 2007)

Indicator and questions	Possible responses	Score
Protected area boundary demarcation	The boundary of the protected area is not known by the management authority or local residents/ neighboring land users	0
Is the boundary known and demarcated?	The boundary of the protected area is known by the management authority but is not known by local residents/neighboring land users	1
	The boundary of the protected area is known by both the management authority and local residents/ neighboring land users but is not appropriately demarcated	2
	The boundary of the protected area is known by the management authority and local residents/ neighboring land users and is appropriately demarcated	3

one of the headline indicators. Some headline indicators (such as management planning) are almost always populated, while others (for example, staff morale) are matched in only one or two methodologies.

Analyzing Data

Using this process, we converted all the datasets into the common reporting platform and created one database that

Table 4 Examples of mapping of original methodology scoring systems onto a common scale

Methodology		Ratings				
		Lowest		Mid		Best
RAPPAM	Original response	No	Mostly no		Mostly yes	Yes
	Translated score	0	0.33		0.67	1
METT (see Table 3 for example of responses	Original general meaning of responses	No progress in the topic	Work begun		Quite good progress	Very good—ideal situation achieved
	Translated score	0	0.33		0.67	1
PROARCA-CAPAS	Original score	1	2	3	4	5
	Translated score	0	0.25	0.5	0.75	1

Table 5 An example of the matching and weighting process for some indicators from the Management Effectiveness Tracking Tool (Stolton and others 2007) across to the headline indicators

Question	Headline indicator	Weight
Does the protected area have legal status?	Park gazettal (legal establishement)	1
Are inappropriate land uses and activities (e.g. poaching) controlled?	Adequacy of law enforcement capacity	0.5
Can staff enforce protected area rules well enough?	Adequacy of law enforcement capacity	0.5
Is there a management plan and is it being implemented?	Management plan	0.5
Have objectives been agreed?	Management plan	0.125
The planning process allows adequate opportunity for key stakeholders to influence the management plan	Management plan	0.125
There is an established schedule and process for periodic review and updating of the management plan	Management plan	0.125
The results of monitoring, research and evaluation are routinely incorporated into planning	Management plan	0.125

was used for subsequent analysis. We marked each assessment according to whether it was a repeat assessment (using the same methodology at the same protected area). Using only the most recent assessments for each protected area, we analyzed the pooled data to obtain and compare averages and standard deviations for total overall management effectiveness and for each headline indicator at regional and global level.

As discussed above, headline indicators were populated variably by different methodologies, so the number of records in the global data set varied for each headline indicator.

Overall averages and standard deviations for each assessment were derived from whichever headline indicators were available, and therefore varied widely in their composition depending on the methodology used. To confirm whether the arithmetic averages would be significantly biased according to the fields used to calculate them, a comparison was made between the least square means (which take into account which indicators are missing) and the overall arithmetic averages. The correlation between the two methods was very strong ($r = 0.9958$, $P < 0.001$) as long as six or more indicators were included, so we concluded that the simple approach of calculating the average of available indicators appears to be sound. We excluded any samples with less than six indicators from the analysis.

As the mean scores are based on headline indicators rated between zero and one, they reflect a continuum from no management at all to high management standards. The lowest third of this continuum (below 0.33) means that overall protected area management is clearly inadequate. Scores between 0.33 and 0.67 indicate that while basic management is in place, considerable improvement is still needed. As most scores fall in this category, we further split this into those between 0.33 and 0.5 (basic but with major deficiencies) and those between 0.5 and 0.67. Generally a "sound" level of management would begin at a score of around two-thirds (0.67). Scores above this mean that the area is being managed relatively well. These cut-off points accord with the meaning of the most common assessment systems that provided the data for this analysis, as shown in Table 4.

Correlations Between Headline Indicators and Averages

To investigate which factors of management appear to be most closely linked to each other and to overall effectiveness, we analyzed the data using Pearson's Correlation

Coefficient. For this analysis, we used all data including earlier assessments where there were repeat studies. We tested the strength of the correlations between these individual headline indicators and the overall average score for management effectiveness. We used corrected item-total correlation calculations, where the score for the individual item is not included in the average against which it is correlated (Guilford 1954). Correlations with outcome indicators (the current status of values and the effect of the protected area on the community) were also calculated.

In addition, for 264 repeat studies—where two or more assessments have been conducted over time in the same protected area using the same methodology—we compared mean scores for the first and last assessments to investigate the extent to which protected area management changed over time.

Analyzing Reports

To complement interpretation of the raw data, we read all available assessment reports and summarized the management strengths and weaknesses reported in each.

Constraints in Interpretation

There were inevitable constraints in this process and results need to be interpreted with care. We considered only information from studies already conducted, and the protected areas evaluated in these studies were not a representative sample of the world's protected areas. Many of the studies were undertaken by non-government conservation organizations in sites where they were conducting aid projects. In other cases, government agencies evaluated all or a sample of their protected areas. We did not attempt to moderate these results: they reflect the picture of the available assessments. We conducted statistical analysis only on the assessments for which we were provided with usable raw data, about 50% of the known assessments. Most of the information in this report was derived from qualitative assessment methodologies, where the scoring may vary depending on the point of view and knowledge of the evaluators.

Translation of raw data into the common reporting format enabled cross-analysis but has inevitably led to a loss of the richness in data, especially for information obtained from more detailed studies. The information content of the headline indicators varied widely: some methods asked numerous questions about one broad topic, which were then combined into only one headline indicator, while other methods asked only one question relating to this topic. This also means that original weighting systems of the methodologies are often not reflected in our analysis.

Results

What Studies Have Been Undertaken?

We identified 8163 PAME assessments from 6200 protected areas, derived from 54 different methodologies. The distribution of these across regions is shown in Fig. 1 (details by methodology are given in the supplementary online material).

The most commonly applied methodologies we recorded were:

- RAPPAM (Ervin 2003b) which measures effectiveness across a group of protected areas in a region or country and has assessed over 1600 protected areas in 49 countries across the world
- The Management Effectiveness Tracking Tool (Stolton and others 2007) which has been applied more than 1500 times across 1150 reserves in 86 countries and is a requirement for all Global Environment Fund project on protected areas
- ProArca/CAPAS scorecard evaluation (Corrales 2004) which has been applied in 156 protected areas in six Central American countries and (over 675 assessments overall)
- Assessments of Important Bird Areas (Birdlife International 2006): 506 assessments over 392 IBAs in 57 countries (only those IBAs with more than 80% represented in protected areas were recorded in our database)

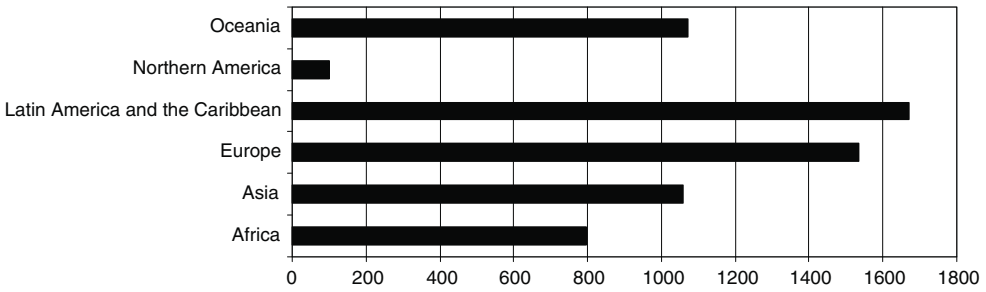

Fig. 1 Number of recorded PAME assessments in each United Nations Region

- Parks in Peril Site Consolidated Scorecard (The Nature Conservancy Parks in Peril Program 2004) which was applied in 56 protected areas over 15 Latin American countries (325 assessments) as part of the Parks in Peril aid program
- New South Wales State of Parks evaluations (NSW Department of Environment and Conservation 2005) which have assessed all reserves (650+) in one Australian state three times.

How Effective is Protected Area Management?

The overall mean score for management effectiveness was 0.53 out of a maximum of one (standard deviation 0.17) for the 3184 "most recent" assessments where more than six headline indicators could be calculated (Fig. 2). Scores for individual protected areas varied from zero to nearly one. Only 13% were in the clearly inadequate range (<0.33) while 22% were in the sound management range (>0.67). Most protected areas were therefore clustered in the middle third (basic management), with 28% of the total in this range but below 0.5 (major deficiencies) and 37% above 0.5.

For the 264 repeat studies, the overall means increased by an average 0.13 on the zero to one scale (individual assessment increased by an average of 113% over the initial score) between the first and last assessments. Overall, 204 of the protected areas improved between successive assessments, five stayed the same and 55 declined, though the declines were mostly small. Sites where the management effectiveness assessment was being undertaken in concert with specific donor funded management programs (PiP Site Consolidation which is part of the TNC Parks in Peril program and the Tracking Tool which has been applied in association with WWF and Global

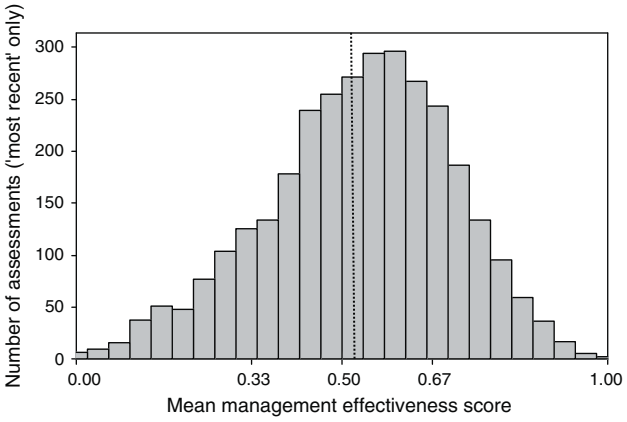

Fig. 2 Distribution of average scores for 'most recent' assessments (mean score across all assessments is shown as a *vertical line*)

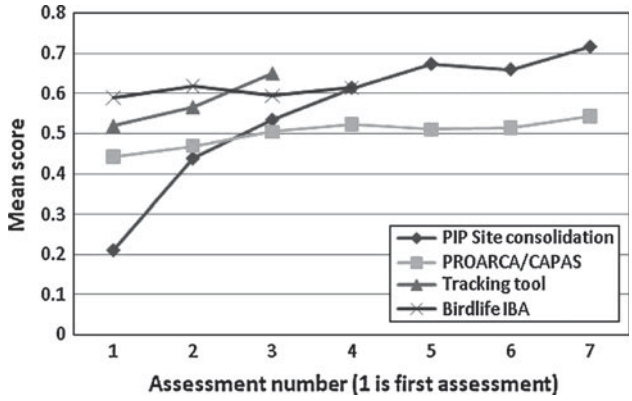

Fig. 3 Average scores for repeat assessments

Environment Facility funded projects) showed the greatest improvement (Fig. 3), at least while the project intervention was current or recent. Future evaluations would be needed to assess the long term sustainability of these improvements.

Which Aspects of Management are Most Effective?

When we reviewed mean scores for different headline indicators (Table 6), we found clear patterns in the strengths and weaknesses of management and these patterns were consistent across most methodologies and regions. *Planning* indicators (as defined in the IUCN-WCPA Framework) relating to establishment of national parks, including gazettal (legal establishment), design, resolution of tenure issues and boundary marking were strong, though management planning was relatively weak. A number of reports and papers discuss serious issues relating to tenure resolution and land rights, but the data indicates that these are limited to a minority of protected areas. *Inputs* of funding, equipment and infrastructure were assessed as seriously lacking. Many *process* measures were also weak, especially those relating to research, monitoring and evaluation, and the provision of programs designed to benefit local communities. *Output* and *outcome* measures were below the 'sound' level but fall in the top 40% of headline indicators.

Which Factors of Management are Most Related to Overall Effectiveness and Successful Outcomes?

We found that the individual headline indicators most strongly related to overall average management effectiveness (as reflected in corrected item-total correlations) were the adequacy of infrastructure, equipment and facilities, natural and cultural resource management processes, effectiveness of governance, and the communication program (Table 7).

Table 6 Number of assessments (N), mean and standard deviation (SD) for each headline indicator analyzed

Headline Indicator	N	Mean	SD	C	Pl	I	Pr	Op	Oc
Park gazettal (legal establishment)	2280	0.86	0.27		■				
Effectiveness of governance and leadership	967	0.68	0.35				■		
Level of significance	1588	0.67	0.23	■					
Appropriateness of design	1892	0.65	0.25		■				
Adequacy of PA legislation	260	0.63	0.25		■				
Marking and security/ fencing of park boundaries	1968	0.62	0.34		■				
Tenure security and issues	1050	0.60	0.38		■				
Threat monitoring	699	0.59	0.24				■		
Effect of park management on local community	1882	0.58	0.27						■
Adequacy of relevant, available information	3121	0.57	0.27			■			
Conservation of nominated values -condition	1968	0.56	0.28						■
Constraint or support by external environment	1299	0.55	0.24	■					
Results and outputs have been produced	507	0.53	0.28					■	
Effectiveness of administration	2084	0.52	0.28				■		
Adequacy of law enforcement capacity	2395	0.52	0.27				■		
Management planning	3182	0.52	0.31		■				
Involvement of communities and stakeholders	2320	0.51	0.26				■		
Extent and severity of threats	415	0.51	0.29	■					
Staff/ other management partners skill level	979	0.51	0.29				■		
Adequacy of hr policies and procedures	1904	0.50	0.25				■		
Communication program	2426	0.49	0.28				■		
Adequacy of staff training	1823	0.49	0.27				■		
Natural resource and cultural protection activities	2937	0.49	0.26				■		
Adequacy of infrastructure, equipment and facilities	2441	0.47	0.29			■			
Visitors catered for and impacts managed	2687	0.46	0.33				■		
Research and monitoring	1996	0.45	0.28				■		
Adequacy of building and maintenance systems	2071	0.45	0.32				■		
Adequacy of staff numbers	2131	0.43	0.28			■			
Management effectiveness evaluation undertaken	1412	0.39	0.29				■		
Security/ reliability of funding	1763	0.39	0.32			■			
Adequacy of current funding	2054	0.37	0.28			■			
Appropriate program of community benefit/ assistance	865	0.30	0.36				■		

The element from the IUCN-WCPA Framework is indicated in the right-hand columns: *C* context, *Pl* planning, *I* inputs, *Pr* process, *Op* outputs, *OC* outcomes

Factors most closely correlated with positive outcomes relating to values conservation included the skills of staff and other management partners, constraint or support by the external civil and political environment, achievements of outputs, adequacy of law enforcement. Community–related indicators such as the involvement of communities and stakeholders, the communication program, and appropriate programs of community benefit were most highly correlated to the outcome measure of impacts on communities. Though this indicates which aspects of management were most closely linked with overall performance, it should be stressed that these correlations do not necessarily establish causation.

Corrected correlations were not strong between the mean score of overall effectiveness and headline indicators relating to the conservation of values (0.37) or effect on the community (0.30). This indicates that while measures of planning, inputs and processes give us important information, they do not appear to be adequate predictors of successful outcomes.

Discussion

Progress with Assessing Management Effectiveness

This study has documented that countries around the world are making considerable progress in undertaking PAME studies, in accordance with their obligations under the CBD Program of Work for Protected Areas. To date, data has been most freely available from the non-government organizations that supported this study (WWF and TNC), but we have found that assessments are increasingly being conducted by government agencies to assist them in

Table 7 Correlation of headline indicators with overall mean (corrected correlation), conservation of values and impact on community

Headline indicator	Corrected correlation with mean	Correlation with conservation of values (outcome)	Correlation with effect on community (outcome)
Adequacy of infrastructure, equipment and facilities	**0.70**	0.30	0.20
Effectiveness of administration	**0.70**	0.30	0.21
Natural resource and cultural protection activities	**0.67**	0.30	0.28
Communication program	**0.67**	0.31	**0.33**
Adequacy of law enforcement	**0.66**	**0.38**	0.16
Adequacy of building and maintenance	0.63	0.31	0.15
Staff training	0.61	0.29	0.24
Research and monitoring	0.60	**0.36**	**0.25**
Security and reliability of funding	0.59	0.25	0.14
Adequacy of relevant and available information	0.57	0.31	0.17
Management planning	0.57	0.18	0.23
Adequacy of funding	0.56	0.25	0.17
Visitor management	0.56	0.23	0.24
Management effectiveness evaluation undertaken	0.54	0.26	**0.29**
Involvement of communities and stakeholders	0.54	0.23	**0.32**
Effectiveness of governance and leadership	0.53	0.32	0.12
Human resource management	0.52		
Constraint or support by external political and civil environment	0.52	**0.42**	0.07
Appropriate program of community assistance	0.52	0.23	**0.29**
Achievement of set work program	0.52	**0.36**	na
Staff/other partners skill level	0.51	**0.43**	0.13

The five most highly correlated items in each case are *bold*; only 21 highest corrected correlations (over 0.50) with mean are shown

tracking and improving their management. It is hoped that future global studies will be able to include more of these datasets. Some of the apparent regional imbalance in assessments may reflect real differences in adoption of management effectiveness evaluation but some will be the result of difficulties in locating and obtaining data from countries, especially from government-conducted assessments.

The great variety of methodologies used has made cross-analysis challenging, but we consider that this means that there is an emphasis on 'utilization-based' evaluation (Patton 2008) where indicators are designed to meet local needs and are likely to be used in adaptive management, rather than only in obligatory reporting. For this reason WCPA has presented guidelines and a framework for management effectiveness (Hockings and others 2006) but does not recommend any particular methodology.

While a range of indicators are used across the methodologies, they tend to reflect a finite number of common themes, and they can be reflected and combined in a common reporting platform which will be of continuing use to the international community and in the implementation of multi-national environmental agreements. The area that appears to be most in need of further focus for assessment and reporting is that of measuring outcomes, both of biophysical and cultural conservation, and of impacts on local communities. It is highly desirable that such outcome assessment is linked with broader remote sensing data and with detailed site ecological monitoring to ensure that it is as accurate and objective as possible.

Strengths and Weaknesses of Protected Area Management

Results of the assessments overall (Fig. 2) indicate that protected area management leaves much to be desired. While some areas are reportedly being soundly managed, these are in the minority across this dataset. About 42% of the protected areas in the study sample have major deficiencies (scoring less than 50% of the ideal) in their most recent assessment, and 13% show very inadequate management, where basic activities are unlikely to be undertaken. If protected areas are to be effective conservation strategies in the longer term, it would seem important that these inadequacies are addressed. In many cases, the very low-scoring protected areas are currently the target of

specific programs of improvement through projects funded by external agencies which will hopefully result in improvement in these scores.

This study is probably biased towards poorer-performing parks as data from the predominant methodologies in the sample include many protected areas that are targeted for development aid programs (which require management effectiveness assessments to be completed).

Establishment of protected areas*:* Protected area establishment indicators (gazettal, design, boundary marking, tenure resolution and adequacy of legislation) score relatively well, indicating that the basics of protected area systems are in place. However, there is low item-total correlation between these indicators and the overall mean, with the exception of the adequacy of legislation: the establishment of a protected area is not closely linked with the development of adequate management systems. Tenure resolution remains a serious issue in a minority of areas, particularly for places in transition from one form of governance to another (such as some of the eastern European countries).

Inadequate resourcing: Many protected areas still lack basic requirements to operate effectively. Very low scores for security of funding in many assessments are a concern: 60% of the protected areas which rated this indicator scored it at 0.33 or less. There is a very high correlation between adequate inputs—especially adequate equipment and infrastructure—and the overall mean score. The low scores for inputs and the strong correlation of these with overall management effectiveness indicate that continued or increased financial and logistical support for protected areas, especially those in poorer countries, is an important component of increasing management capacity.

Communication and community relations: Communication, community involvement and programs of community benefit are generally inadequate. In all regions, these factors score poorly but are strongly correlated with both overall effectiveness and good management outcomes. Frequently, reports mentioned that protected area staff have inadequate skills and training in this area.

Resource management: Indicators relating to specific resource management activities, law enforcement, and monitoring and research also score poorly over the full dataset, but are strongly correlated with values conservation. This suggests that if we wish to conserve the values of protected areas, a focus is needed on specific activities to manage and monitor the values: general improvement to resourcing or to overall management is not sufficient to guarantee better outcomes.

Management planning and adaptive management: Management planning (weakest of the planning indicators), monitoring and research, and management effectiveness evaluation (second and fourth weakest of the process indicators) score comparatively poorly, but all are strongly linked with good overall effectiveness. A key factor mentioned repeatedly in reports is the need to improve the application and use of planning, evaluation and management tools to deliver good and consistent management on the ground.

Outcomes-values conservation: For questions about whether protected areas are conserving their values, the overall mean score was 0.56, while the indicators relating to the contribution of protected areas to the well-being of their adjacent communities scored a mean of 0.58. For both these indicators, over half the assessments scored in the 'sound' range. These results indicate that in spite of deficiencies in inputs and management processes, many protected areas are achieving success in management. The positive scores might be questioned given that most assessments contributing to this study used primarily qualitative ratings, but there is no reason to believe that these indicators of outcome would be reported any more positively than other indicators.

Other studies based on questionnaires (Bruner and others 2001) and on empirical evidence of land-cover change (Naughton-Treves and others 2005; Andam and others 2008; Gaveau and others 2009) also suggest that on a larger scale protected areas are reducing the rate of deforestation, even where there is lack of funding and weak institutions. A recent analysis of 49 locations from 22 countries found that protected areas had significantly lower rates of clearing compared to outside their boundaries and compared to before their gazettal, though clearing was still significant especially in the African and Asian regions (Nagendra 2008). More work needs to be done to expand monitoring of ecological integrity and community impact (Timko and Satterfield 2008) and correlate the findings of questionnaire-based PAME studies with these empirical studies. Questions needing attention include the relative advantage of protected areas as a conservation tool, especially compared with other managed natural areas, and the effectiveness of different protected area categories and governance approaches in achieving biodiversity conservation, community development, poverty alleviation and other management goals.

Improvement over time: Where time-series data is available (Fig. 3), most protected areas are showing improvements in management, with some scores increasing dramatically. The concept of protected areas becoming "consolidated" through defining and working towards minimum standards of management across a number of factors makes intuitive sense and has been applied, for example in the Parks in Peril Program (The Nature Conservancy 2007). This process takes time, so long-term commitments to protected area improvement are essential, as are efforts to build sustainability into all externally-funded programs.

Factors Correlated with Effective Management

There is a high level of internal consistency between most of the headline indicators of input and process, shown by the fact that most of these corrected item–total correlations were between 0.5 and 0.7. This implies that while detailed evaluation studies are essential for adaptive management—that is, for understanding and working with strengths and weaknesses in individual areas—overall a valid estimation of process and inputs can be constructed from these headline indicators. However, there is low item-total correlation of outcome measures and low consistency between measures of values conservation and community impacts. For this reason it is essential that PAME studies include or are complemented by objective and accurate assessments of management outcomes, as discussed above.

Conclusions

This study has shown that the diverse methodologies used for evaluating the effectiveness of protected area management paint a remarkably similar picture of management strengths and weaknesses across the world. We consider that the progress many countries have made in undertaking PAME assessments, encouraged by the CBD Program of Work on Protected Areas, has been valuable and should be further supported by national governments, non-government agencies, and international support.

Most importantly, the assessment process provides an opportunity for managers and partners to learn from each other and to raise the standard of their protected area management. This is a particularly successful technique when it is combined with a concerted effort to apply the findings of the evaluation and to strengthen management to acceptable levels. Further work is needed to ascertain the extent to which the increased evaluation effort is now being coupled with focused efforts to incorporate assessment findings into planning and management, and to address any weaknesses the studies reveal. We believe that effective protected area management is an essential tool in tackling current and future threats to biodiversity: only if evaluation results in improved management, is it a worthwhile investment.

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