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Environmental Management

ISSN 0364-152X
Volume 56
Number 1

Environmental Management (2015)
56:176-192
DOI 10.1007/s00267-015-0495-z

Springer

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Do Global Indicators of Protected Area Management Effectiveness Make Sense? A Case Study from Siberia

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Received: 19 June 2014 / Accepted: 1 April 2015 / Published online: 8 April 2015

Abstract Driven by the underperformance of many protected areas (PAs), protected area management effectiveness (PAME) evaluations are increasingly being conducted to assess PAs in meeting specified objectives. A number of PAME tools have been developed, many of which are based on the IUCN-WCPA framework constituting six evaluative elements (context, planning, input, process, output, and outcomes). In a quest for a more universal tool and using this framework, Leverington et al. (Environ Manag 46(5):685–698, 2010) developed a common scale and list of 33 *headline indicators,* purported to be representative across a wide range of management effectiveness evaluation tools. The usefulness of such composite tools and the relative weighting of indicators are still being debated. Here, we utilize these headline indicators as a benchmark to assess PAME in 37 PAs of four types in Krasnoyarsk Kray, Russia, and compare these with global results. Moreover, we review the usefulness of these indicators in the Krasnoyarsk context based on the opinions of local PA management teams. Overall, uncorrected management scores for studied PAs were slightly better (mean = 5.66 ± 0.875) than the global average, with *output* and *outcome* elements being strongest, and *planning* and *process* scores lower. Score variability is influenced by PA size, location, and type. When scores were corrected based on indicator importance, the mean score significantly increased to 5.75 ± 0.858. We emphasize idiosyncrasies of Russian PA management, including the relative absence of formal management plans and limited efforts toward local community beneficiation, and how such contextual differences may confound PAME scores when indicator weights are treated equal.

Keywords Protected area · Management effectiveness · Evaluation · Biodiversity conservation · Krasnoyarsk Kray · Russian Federation

Introduction

Global trends in biodiversity conservation are frequently reported as being inadequate, particularly after the Convention on Biological Diversity (CBD) failed to meet its 2010 targets (2010 Biodiversity Indicators Partnership 2010). Despite a number of notable conservation successes (Sodhi et al. 2011), and the prolific increase in both number and spatial extent of protected areas (PAs) in recent decades (Chape et al. 2005; Coad et al. 2008a), negative anthropogenic impacts on biodiversity continue largely unabated (Dirzo and Raven 2003; Bertzky et al. 2012). While the number of PAs under national or international programs and legislation has been rising on a global level, with now over 209,000 registered PAs in the World Database on Protected Areas (WDPA) (Coad et al. 2008b; Butchart et al. 2010; Bertzky et al. 2012; Deguignet et al. 2014), biodiversity loss continues even within some PAs (Hockings and Phillips 1999; Oates 1999; Bonham et al. 2008; Gaston et al. 2008; Craigie et al. 2010).

Electronic supplementary material The online version of this article (doi:10.1007/s00267-015-0495-z) contains supplementary material, which is available to authorized users.

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While the reasons for the underperformance of PAs in meeting biodiversity conservation and/or socio-economic objectives are complex and obviously contextually driven, one important factor being closely examined is the effectiveness level of PAs management (Mulongoy and Chape 2004; Cantú-Salazar and Gaston 2010; Le Saout et al. 2013). It is increasingly recognized that the effectiveness of PAs in conserving biodiversity cannot be inferred simply as a product of their number and size, but also depends on the quality of habitat, their spatial configuration with other sites (Fahrig 2003; Mortelliti et al. 2010) and, of equal importance, their management (Rodrigues et al. 2004; IUCN-WCPA 2009; Anthony and Szabo 2011). In addition to national efforts, a plethora of studies have been conducted recently seeking to understand how effective PAs are in conserving biodiversity, and what factors influence management effectiveness, both globally (Leverington et al. 2008; Stoll-Kleemann et al. 2008; Leverington et al. 2010) and regionally (Bruner et al. 2001; Nolte et al. 2010; Papp 2011; Anthony and Matar 2012). This was, in part, driven by the CBD obligation for signatory countries to achieve management effectiveness assessments for 30 % of their PAs by 2010, and a 60 % target to be met by 2015 (CBD 2010).

Monitoring and Management Effectiveness Evaluation Tools

Monitoring has been best described as the systematic collection and analysis of repeated observations or measurements to evaluate changes in condition and progress toward meeting a management objective (Elzinga et al. 2001; Tucker 2005). Monitoring is a requisite component of adaptive management (Hollings 1978; Salafsky et al. 2001; Tucker 2005), involving a continuous evaluation of progress toward project goals and e.g., preservation of species from internal or external threats (Margules and Pressey 2000). The field of evaluation itself has expanded rapidly in the last two decades, with increased attention to evaluation goals and levels of evidence (Berriet-Solliec et al. 2014, Patton 2014), as well as the eventual diffusion and use of knowledge gained from evaluation (Blake and Ottoson 2009). There now exists a diverse array of approaches to understand management effectiveness of institutions including formative evaluation, front-end evaluation, institutional evaluation, process evaluation, theory-based evaluation, utilization-focused (UFE), and developmental evaluation (DE) (Weiss 1998; Gamble 2008; Patton 2008, 2010). Both UFE and DE approaches are increasingly being used to understand process-related management activities in (1) dynamic, unpredictable environments, (2) highly complex governance structures, and (3) where social innovation is at an early stage. These different approaches are often combined in the conduct of any specific evaluation study (or project). However, summative evaluation, including indicator-based approaches, has predominated the protected area management effectiveness (PAME) evaluation experience to date, as PAME embodies a wider spectrum of variables including those in the biophysical realm, which are largely overlooked in the aforementioned approaches.

Management effectiveness evaluation (MEE) is defined by Hockings et al. (2006, p xiii) as "the assessment of how well the PA is being managed—primarily the extent to which it is protecting values and achieving goals and objectives. The term management effectiveness reflects three main themes: (1) design issues relating to both individual sites and PA systems; (2) adequacy and appropriateness of management systems and processes; and (3) delivery of PA objectives including conservation of values." The purposes underlying the development of management effectiveness evaluation was that rapid, site level assessments should lead to improved management in changing environments, more effectively allocate resources, enhance transparency and accountability, and build constituency by involving the community and promoting PA values (IUCN 2005; Hockings et al. 2006). To this end, a wide variety of indicator-based PAME evaluation tools have been developed thus far including the widely used Management Effectiveness Tracking Tool (METT) (WWF International 2007), Rapid Assessment and Prioritization of Protected Area Management (RAPPAM) (Ervin 2003), and Threat Reduction Assessment (TRA) (Salafsky and Margoluis 1999; Anthony 2008). Many of these instruments are based on the International Union for Conservation of Nature-World Commission on Protected Areas (WCPA) framework.

World Commission on Protected Areas (WCPA) Framework

The IUCN-WCPA task force responded to the need for management effectiveness tracking tools by developing a framework in 1997 that aims at providing overall guidance in the development of more adapted assessment systems and to encourage the establishment of standards for assessment and reporting (Hockings et al. 2000; Hockings 2003; WWF and WB 2003). The WCPA framework was developed on the concept that sound PA management is based on six elements: context, planning, inputs, processes, outputs, and outcomes. In summary, the management cycle starts by an understanding of the context of values and threats present in the PA. It then progresses through planning, allocating resources, and processing management actions. These result in products and services that have a final impact on management objectives (WWF and WB

2003; Hockings et al. 2006; WWF International 2007). The framework also stresses the importance of establishing comprehensible, measurable, and outcome-based objectives as a basis for the entire management process and for improved monitoring results (MacKinnon et al. 1986; Tucker 2005). The WCPA provided the first consistent approach to managing PA effectiveness, and has been used by many other experts/organizations to develop specific assessment tools.

The Quest for a Universal PAME Tool

As different PA sites and networks have diverse characteristics (e.g., management structure, geographical coverage and variation) and are embedded within various cultural, political, and socio-economic contexts, there is still no one standard tool that is accepted globally (Chape et al. 2005). The absence of a coherent, unified set of indicators to measure PA effectiveness in reaching conservation goals, combined with the significant rise in global impacts of human activities on PA conservation capacity, created a pressing need to improve PAME within the short (2010) deadline of the CBD agenda (Chape et al. 2005). Based on the plethora of scoring and monitoring methodologies, Leverington et al. (2010) compiled over 8000 assessments from more than 50 methodologies to develop a common scale and list of 33 *headline indicators*. These indicators, categorized according to the six evaluative elements embedded within the WCPA framework, are not intended to be the primary means of assessment, but enable practitioners to develop a *common reporting format* across a wide range of assessments and indicators, including METT and RAPPAM. The objectives of developing a common reporting format by Leverington et al. (2008, p 20) are "to (1) represent most indicators found in any MEE methodology; (2) provide a platform for cross-analysis of results from MEE studies using different methodologies, while maintaining as much information as possible; and (3) be flexible, with the potential to add more 'headline indicators' in the future." These headline indicators, and the global assessment by Leverington et al. (2010), have been used in other studies as benchmarks by which to measure PAME in South Africa (Cowan et al. 2010) and the Levant Region (Anthony and Matar 2012).

A recent evaluation by Coad et al. (2013) showed that only 29 % of protected areas worldwide have been assessed for management effectiveness, 23 % of countries have reached the 60 % target, while 54 % of countries have failed to reach even the 30 % target. Juxtaposed with this deficiency, an increasing number of studies are emerging which criticize the utility of such composite PAME tools. One source of criticism lies in the *disparity between the selection and weights of indicators used and stated PA outcomes*, a limitation which has been noted by both Leverington et al. (2010, p 291) in that "… original weighting systems of the methodologies are often not reflected in our analysis," as well as by tool developers and practitioners (Ervin 2003; Hockings et al. 2006; WWF International 2007; Britton 2010; Nolte et al. 2010; Zimsky et al. 2012). Moreover, an increasing number of studies remark that many PAME evaluations have been anecdotal rather than empirical, chiefly due to constraints in terms of funding, staff expertise, and managerial challenges for long-term monitoring and evaluation programs (Parrish et al. 2003; Timko and Innes 2009; Geldmann et al. 2013). This results, in many cases, of selecting indicators that focus on inputs and processes as a proxy measure of biodiversity outcomes, which are rarely substantiated nor involve counterfactual comparisons (Ferraro 2009). Recent examples of these mismatches include an absence of effects/correlation between METT scores with fire occurrence in 41 PAs in the Amazon Basin (Nolte and Agrawal 2013), RAPPAM scores with avoided deforestation in 66 forested PAs in the Brazilian Amazon (Nolte et al. 2013), and RAPPAM scores with avoided conversion of 26 PAs in the Brazilian Cerrado savanna ecosystem (Carranza et al. 2014).

In addition to strengthening efforts to meet these evaluation targets, what is lacking in many of the global assessments and which we also address in this study, is to evaluate (1) how relevant the various headline indicators are at the local level in capturing MEE results, (2) whether weighting of the various indicators should be incorporated into mean scores, and (3) the utility of cross-analysis by which local assessments are compared to global results when score weighting is inconsistent.

Protected Areas in Russia

In Russia and the former Soviet Union (USSR) many actions were taken to conserve biodiversity, one of the most comprehensive being the establishment of an extensive network of modern PAs as early as 1916 (Williams and Woodson 2003). The protected area network of USSR developed across all 15 nations, particularly as state nature reserves (*zapovedniks*), including ecosystems as diverse as forests, mountains, tundra, steppes, and coastlines (Ostergren 2001; Shtilmark 2003). After the fall of the USSR in 1991, each nation redefined its form of government, and consequently the system that protects natural resources. Despite drastic federal funding cuts and increased poaching, and a swing to more decentralized power structures, the number of regional and local PAs expanded rapidly in Russia (Pryde 1997; Ostergren 2001; Shtilmark 2003) and currently covers approx. 11.9 % of the country, although there is continued appeal for network expansion (Krever

Table 1 Organization of protected area system in Russia as of 15.01.2014 (Shestakov 2003; Krever et al. 2009; Tishkov 2009; http://www.wwf.ru/)

Categories	Management level			Equivalent IUCN category	No.	Area (km^2)
	Federal	Regional	Local			
State nature reserve (*zapovednik*)	+			Ia,Ib	102	338,000
National park	+			II	46	120,150
Nature park		+		II	>40	>140,000
Strict reserve (*zakaznik*)	+	+		III,IV (federal)	71 federal	130,000
				IV,V (regional)	>3000 regional	>678,000
Natural monument	+	+		III	28 federal	400
				(federal level)	>10,000 regional	>42,000
Dendrological parks and botanical gardens	+	+	+	V		
Resorts and health spas	+	+	+			

et al. 2009). Traditionally, and still to a large degree today, PAs in Russia are established primarily for nature preservation, scientific research and environmental education, with only negligible efforts to meaningfully integrate PAs into the socio-economic structure of their local regions (Tyrlyshkin et al. 2003; Williams and Woodson 2003; Tishkov 2009). According to the Federal Law 'On Specially Protected Natural Areas' (14.03.1995 No. 33-FZ), the formal definition of a PA is "land, water surface and the air space above them, where are the natural complexes and objects that have special environmental, scientific, cultural, esthetic, recreational and health value, withdrawn by a public authority wholly or partly of economic use and for which a special protection regime is established." There are seven categories of protected areas, organized into three management levels (Table 1).

Krasnoyarsk Kray

The Krasnoyarsk kray (territory) is the second largest administrative territory in Russia encompassing 2,366,800 km^2, constituting 13 % of the country's total area, and a population of 2,893,400 (http://www.krskstate.ru/eng). The territory is located in the basin of the Yenisei River, and belongs to the Siberian Federal District. The climate is strongly continental with large annual temperature variations. The kray experiences conditions of three climate belts: Arctic, Subarctic, and moderate. For the central and southern regions where most of the kray's population lives, long winters and short, hot summers are characteristic. On 1 January 2011, the total area of PAs in Krasnoyarsk kray was 168,039.8 km^2, constituting 7.1 % of the total region area. These include 11 national level PAs (115,405 km^2), and 89 regional-level PAs (52,635 km^2) (RGS 2014). The network of PAs is expanding both in number and spatial extent. Similar to other areas in Russia, the overwhelming majority of intact nature with a low degree of anthropogenic pressure in Krasnoyarsk kray is in the northern part, where PA size tends to be larger (Laletin et al. 2002; Shtilmark 2003).

PAME Evaluation in Russia

Two PAME assessments have been undertaken in Russia that are worth noting. First, an IUCN and WWF-Russia commissioned study by Tyrlyshkin et al. (2003) assessed conditions and management effectiveness of 197 PAs across the country using the RAPPAM methodology, although (1) regional *zakazniks* were excluded from their analysis and (2) as there is no option within the RAPPAM scorecard to indicate a 'non-applicable' indicator, all indicator scores were weighted equally (Ervin 2003). Their findings demonstrated that the degree of pressure and threats faced by PAs is increasing nationally, including in Siberia. On average, *zapovedniks* and national parks received similar PAME scores, which were higher than those of federal *zakazniks. Planning* scores tended to be consistent across all three PA types and was identified as one of the strengths of the Russian PA system. For all PA categories, *input* was considerably the weakest management element. Then, in 2009, a gap analysis was conducted to assess (1) whether the formal categories of the Russian PA network accurately reflected their protection regime, (2) the conservation value of *zapovedniks*, and (3) the geographical representativeness of the PA network relative to the total terrestrial area of the country (Krever et al. 2009). The management gap findings (for *zapovedniks* only) were based on a limited set of biophysical indicators, and not inclusive of the six evaluative elements of the WCPA framework. Nevertheless, the study found that in 21 % of the cases, categories assigned to individual protected areas were incompatible with the official PA status.

The appeal by Hockings et al. (2006, p viii) to "look for common threads… to find trends, themes and lessons

across regions" is particularly relevant in our study, as there is a paucity of documented data on PAME evaluation in the Krasnoyarsk kray, particularly of regional *zakazniks*. Our research provides a more comprehensive evaluation of the current status of management of established PAs in the region, based on the 33 indicators developed by Leverington et al. (2010). In addition, we added a component to our assessment whereby we ask PA managers, and other respondents, how they believe each headline indicator accurately reflects management effectiveness in their local context. Here, we address four pertinent questions:

1. How effective is protected area management in the Krasnoyarsk kray?
2. Which aspects of management are most effective?
3. Which factors are most related to successful outcomes?
4. Which indicators are believed by PA managers to be the most/least reflective of local management effectiveness?

We compare our findings to global results obtained by Leverington et al. (2010) and devise recommendations for both improving the management of PAs in the Krasnoyarsk territory, and for understanding the use of global indicators in local settings.

Methods

Data Collection

In addition to archival research based on published data concerning PAs in the Krasnoyarsk territory, we administered a questionnaire survey from January to March 2013. The questionnaire was e-mailed to directors of state nature reserves (*zapovedniks*), national parks, and regional nature parks, requesting that they be filled out by the most competent staff of the PA, i.e., those who have the most familiarity with the PA and direct on-site management experience (Hockings et al. 2009). Returned questionnaires indicated that management teams consisting of heads of environmental education, heads of research, and/or deputy directors largely completed the questionnaire. Where questions arose, follow-up interviews were conducted by phone. For regional strict reserves (*zakazniks*), contact details were obtained directly from the Directorate on Protected Areas of the Krasnoyarsky Kray Administration, the administrative body responsible for regional PAs. An interactive workshop was conducted in late March 2013 with managers and/or specialists from all regional *zakazniks*, in which each respondent completed the questionnaire for their respective PA.

In total, our study investigated protected area management effectiveness of 37 PAs in the Krasnoyarsk kray, covering over 47,000 km^2 (Fig. 1; Table 2). In addition to these PAs, questionnaires were circulated to three northern state nature reserves [Taimyrskiy (2966 km^2), Putoranskiy (18,873 km^2), Great Arctic (41,692 km^2)]. Respondents did not return questionnaires, as from 13.08.2012 these PAs were in a transition period of reorganization, and were thus excluded from the study. The studied PAs were of four different types: (1) state nature reserve or *'zapovednik'* ($n = 3$), (2) national park ($n = 1$), (3) regionally operated strict nature reserve or *'zakaznik'* ($n = 32$), and (4) regional nature park ($n = 1$). They range in size from 8700 ha (Khabikskiy Strict Reserve) to the 10,188.49 km^2 Central Siberian State Biosphere Nature Reserve. The earliest national designation was in 1925 (Stolby State Nature Reserve), while the Bolshaya Steppe Strict Reserve was designated only recently in 2011.

Survey Questionnaire

The survey questionnaire was based on the 33 indicators developed by Leverington et al. (2010) which comprehensively summarize reviewed indicators from all PAME methodologies (Table 3). The indicators are grouped into the 6 evaluation elements of the WCPA framework.

In contrast to Leverington et al.'s (2010) scoring on a scale from 0 to 1, respondents in our study were asked to allocate a score to each indicator on a scale from 0 to 10, where 0 represented the lowest measurement (0 = no management at all/no progress) and 10 represented the optimum situation (10 = high management standards/ideal situation achieved). To allow for comparison with Leverington et al.'s results, we maintained an equal weight for each indicator, thus the *uncorrected* mean score for an individual PA was computed as the sum of all 33 indicator scores divided by the number of indicators (33), allowing for a mean score to range between 0 and 10. For statistical comparison of the six evaluative elements of the WCPA framework, mean values for each element were used, regardless of the number of indicators within the element.

In addition, we asked respondents to indicate the degree on a scale from 1 to 5 (1 = very poor; 5 = excellent) to which they believed this indicator was appropriate for the associated category (context, planning, input, process, output, and outcome) in their context. This allowed us to calculate a *corrected* mean score for each PA (PA_m) based on the perceived importance level of each indicator to its associated category, in that each of the individual indicator scores (Si) was multiplied by the its perceived importance score (Pi) divided by the sum of all perceived importance scores:

$$PA_m = \frac{\sum SiPi}{\sum Pi}$$

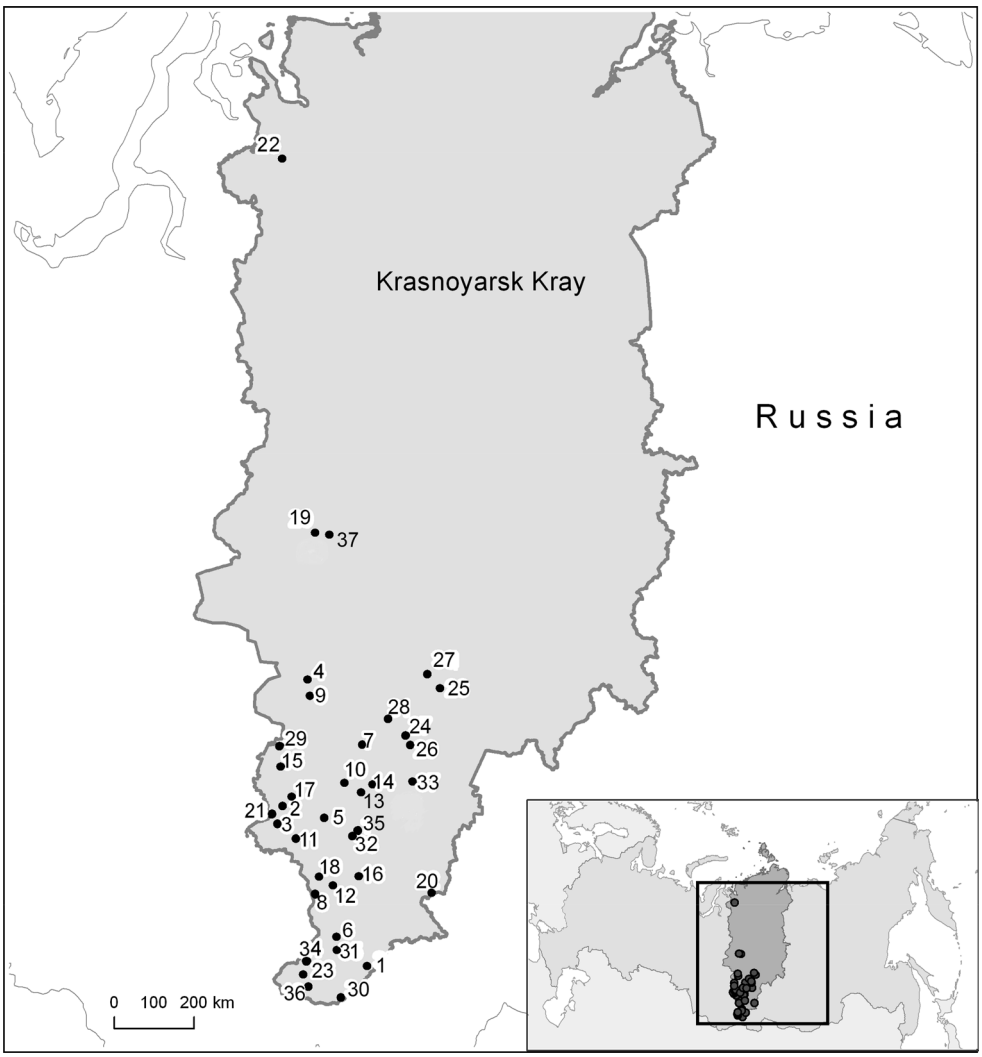

Fig. 1 Location of Krasnoyarsk kray in Russia (*inset*) and 37 PAs included in study

Given the subjective nature of *scoring* (in contrast to *monitoring*), scores are allocated qualitatively, are perception-based, and therefore are only estimates of progress (Hockings 2003; Cook and Hockings 2011). Thus, we recognize this limitation and interpret our results with caution, especially in the absence of complementary quantitative data. Nevertheless, the utility of this scoring does allow a rapid 'snapshot' self-evaluation of PA management status based on which recommendations for improvement can be derived.

Data Analysis

Quantitative data were analyzed using IBM® SPSS® Statistics (ver. 21). Both univariate and bivariate descriptive statistics were used, including measures of central tendency and dispersion, and Pearson's Correlation when exploring correlations between interval level variables. When comparing means, z tests were used to compare sample and population means, dependent t-tests for matched sample means (e.g., uncorrected vs. uncorrected mean scores), and ANOVA was utilized for three or more sample means. If ANOVA indicated significant mean differences, Scheffe post hoc tests were used to identify which means differed (Scheffé 1953). Alpha level for all tests was set at 0.05. Mean scores obtained by Leverington et al. (2010) were multiplied by 10 to account for the scale difference and facilitate comparison. We present data as aggregates and compare these to the global results from Leverington et al. (2010), which serve as a coarse benchmark.

Results

Overall, the management effectiveness scores across the 37 PAs in the studied region ranged from 2.06 to 7.22, with a mean score of 5.66 ± 0.875 (Fig. 2). This value is not significantly greater ($z = 1.288$, $p = .099$) than the mean

Table 2 Thirty-seven protected areas included in the study, including status, year of designation, and area

No.	Name	National designation	Year of National designation	International designation (year)	Area (ha)
1	Ergaki	Regional nature park	2005		342,873
2	Arga	Regional strict reserve	1963		89,900
3	Beryozovaya Dubrava	Regional strict reserve	1963		28,200
4	Bolshye-Kasskiy	Regional strict reserve	1963		71,100
5	Bolshye-Kemchugskiy	Regional strict reserve	1963		66,300
6	Kebezhskiy	Regional strict reserve	1963		21,300
7	Kemskiy	Regional strict reserve	1963		14,900
8	Krasnoturanskiy bor	Regional strict reserve	1963		21,300
9	Makovskiy	Regional strict reserve	1963		108,800
10	Malo-Kemchugskiy	Regional strict reserve	1963		34,200
11	Solgonskiy kryazh	Regional strict reserve	1963		100,800
12	Khabikskiy	Regional strict reserve	1963		8700
13	Talsko-Gaevskiy	Regional strict reserve	1972		32,600
14	Bolshemurtinskiy	Regional strict reserve	1974		84,100
15	Kandatskiy	Regional strict reserve	1974		46,600
16	Sisimskiy	Regional strict reserve	1975		33,800
17	Prichulimskiy	Regional strict reserve	1976		43,500
18	Ubeisko-Salbinskiy	Regional strict reserve	1977		14,860
19	Turukhanskiy	Regional strict reserve	1981		126,900
20	Taibinskiy	Regional strict reserve	1987		61,400
21	Beryozovskiy	Regional strict reserve	1988		27,000
22	Brekhovskiye ostrova	Regional strict reserve	1999	Ramsar (1994)	288,500
23	Bolshaya Pashkina	Regional strict reserve	2001		53,000
24	Motiginskoye mnogoostrovye	Regional strict reserve	2003		14,400
25	Boguchanskiy	Regional strict reserve	2004		201,200
26	Mashukovskiy	Regional strict reserve	2004		46,600
27	Ognyanskiy	Regional strict reserve	2004		108,600
28	Reka Tatarka	Regional strict reserve	2004		71,100
29	Chulimskiy	Regional strict reserve	2006		14,800
30	Gagulskaya kotlovina	Regional strict reserve	2007		24,600
31	Tokhtay	Regional strict reserve	2007		14,400
32	Krasnoyarskiy	Regional strict reserve	2010		348,314
33	Bolshaya Steppe	Regional strict reserve	2011		40,890
34	Shushenskiy Bor	State national park	1995		392,000
35	Stolby	State nature reserve	1925		47,219
36	Sayano-Shushenski State Nature Biosphere Reserve	State nature reserve	1976	UNESCO Biosphere Reserve (1985)	660,000
37	Central Siberian State Biosphere Nature Reserve	State nature reserve	1985	UNESCO Biosphere Reserve (1987)	1,018,849

of 5.30 ± 1.7 (adjusted based on scale difference) reported by Leverington et al. (2010), based on their global set of 3184 assessments.

When we compared the mean scores according to the six evaluative elements (Fig. 3; Table 4), we found that mean *output* scores are significantly greater than mean scores for all the five other evaluative elements. Secondly, both *context* and *outcome* scores are significantly higher than *planning* and *process* scores. In general mean scores were as follows: output > outcome > input > context > planning > process.

When we calculated the mean scores for the 33 headline indicators, no clear patterns emerged (Table 5). Indeed, the variability within the various evaluative elements was quite high, as mean scores for all headline indicators analyzed spanned from 'clearly inadequate' to 'sound' management.

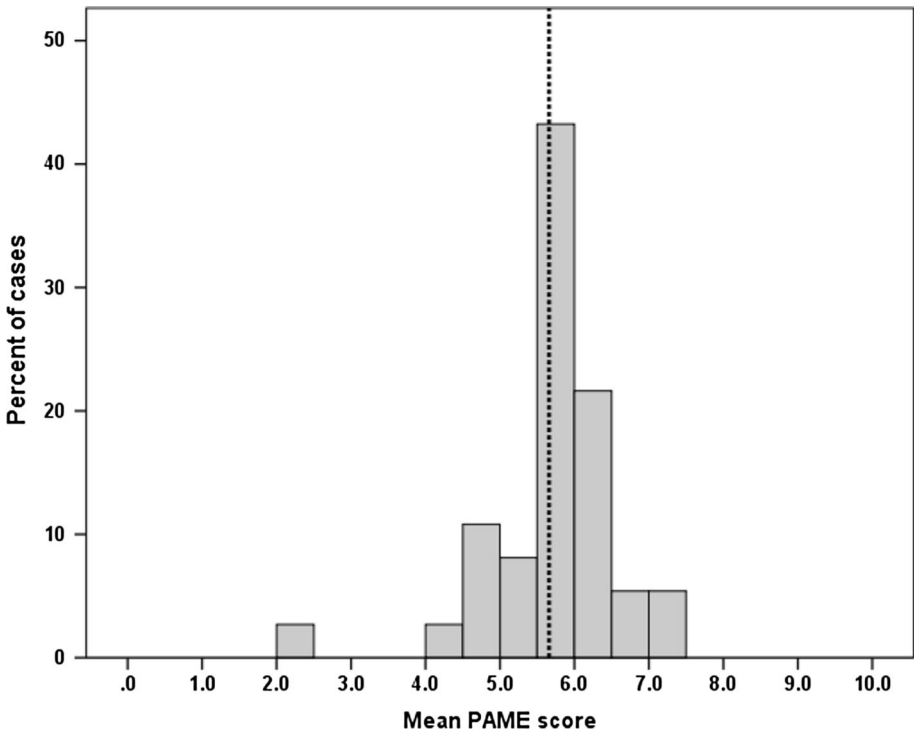

Fig. 2 Distribution of mean scores for protected area management effectiveness assessments in Krasnoyarsk kray, Russia (mean score across all assessments is shown as a *vertical dashed line; N* = 37)

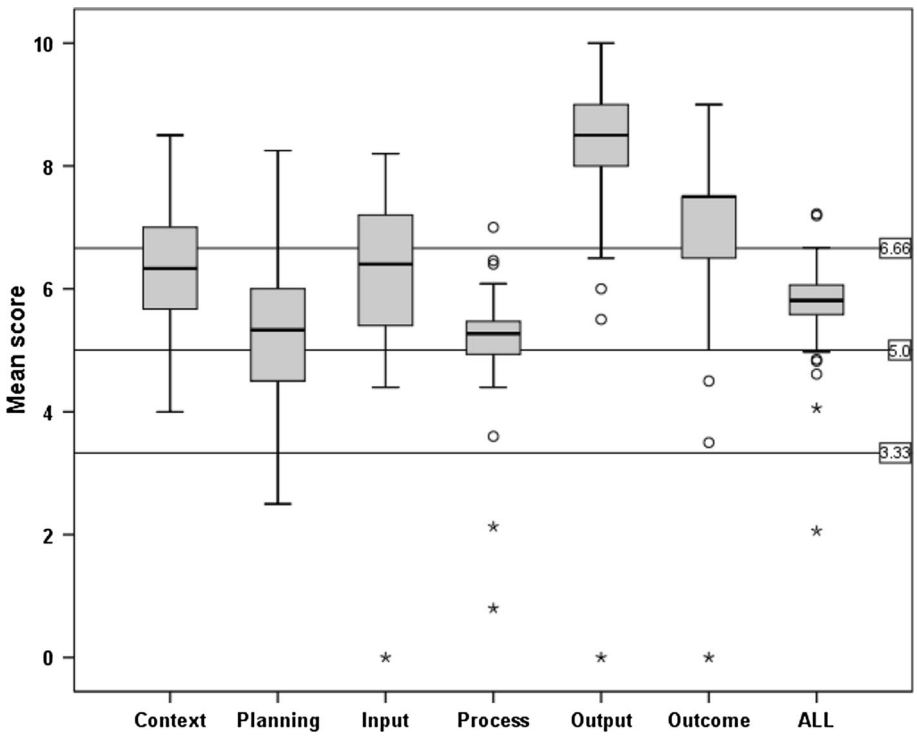

Fig. 3 Distribution of mean scores across the six evaluative elements, and overall mean score. *Note* Mean scores <3.33 = 'clearly inadequate management'; 3.33–5.00 = 'basic management with major deficiencies'; 5.01–6.66 = 'basic management'; >6.66 = 'sound management'

Mean scores of the six evaluative elements and of the overall mean score were also tested for correlation with both age of protected area and area in hectares (Table 6). Age had no effect on the tested variables. However, mean *context* scores were found to be significantly positively correlated with PA size ($R = .482$, $p < .01$). On the other hand, larger PAs tended to have significantly lower *outcome* scores ($R = -.370$, $p < .05$). Separate investigation of correlation of PA size with the two *outcome* indicators revealed that although PA size was not significantly correlated with the *conservation of nominated values—condition* outcome ($R = .070$, $p = .684$), it was significantly

Table 3 The 33 indicators used in the common PAME reporting format, according to evaluation element

Element	Headline indicator
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

and negatively correlated with the *effect of park management on local community* outcome ($R = .541$, $p < .001$).

When we explored correlations between each headline indicator with the two *outcome* indicators (*effect of park management on local community*; *conservation of nominated values—condition*), ten indicators significantly influenced the effect of park management on local community, with two having a negative correlation (*'management plan'* and *'adequacy of building and maintenance systems'*) (Table 7). Only two indicators were significantly correlated with the *conservation of nominated values—condition* outcome indicator, i.e., positively with *'results and outputs produced'* and negatively with *'tenure issues'*.

We controlled for local designation and then determined mean PAME scores across the six evaluative elements, and for total mean PAME scores (Fig. 4). Although our sample comprised only one nature park and one national park to use for comparison, the nature park showed consistently high scores across the elements. Both the strict reserves and nature reserves were more variable, but with mean scores all falling in the 'basic' or 'sound' categories. *Output* and *outcome* indicators scored significantly higher in regional strict reserves compared to state nature reserves, while *context* indicators scored higher in the state nature reserves, compared to regional strict reserves.

Finally, we investigated respondents' opinions as to how accurate the 33 headline indicators used were reflective of the evaluative element which we were attempting to measure (Table 8). Most indicators scored highly, reflecting their appropriateness. However, two (*'Management plan'* and *'Appropriate program of community benefit/assistance'*) only obtained 'average' scores. When mean PA scores were corrected for this relative weighting (see Methods), the mean overall score for the 37 PAs increased to 5.75 ± 0.858, which is significantly greater than the uncorrected scores ($t = 11.557$, $df = 36$, $p < .001$), and approaches being significantly greater than the global results ($z = 1.610$, $p = .054$).

Discussion

The discussion of our results follows the analysis framework made by Leverington et al. (2010) with the aim of establishing a comparison of management effectiveness between the Krasnoyarsk kray and global results. Moreover, we discuss the implications of utilizing global headline indicators in a regional context.

How Effective is PA Management in Krasnoyarsk Kray?

Our results show that, of all PAs studied, only one regional *zakaznik* scored in the 'clearly inadequate' management range (<3.33), 13.5 % scored in the 'basic with major deficiencies' range (3.33-5.00), a majority (75.7 %) in the 'basic' range (5.01–6.66) and 8.1 % in the 'sound' management range (>6.66) (Fig. 2); this contrasts with global score proportions of 13, 28, 37, and 22 %, respectively (Leverington et al. 2010). Qualitatively, although PAs in our sample appear to be managed better than average, the difference is not statistically significant, yet we can

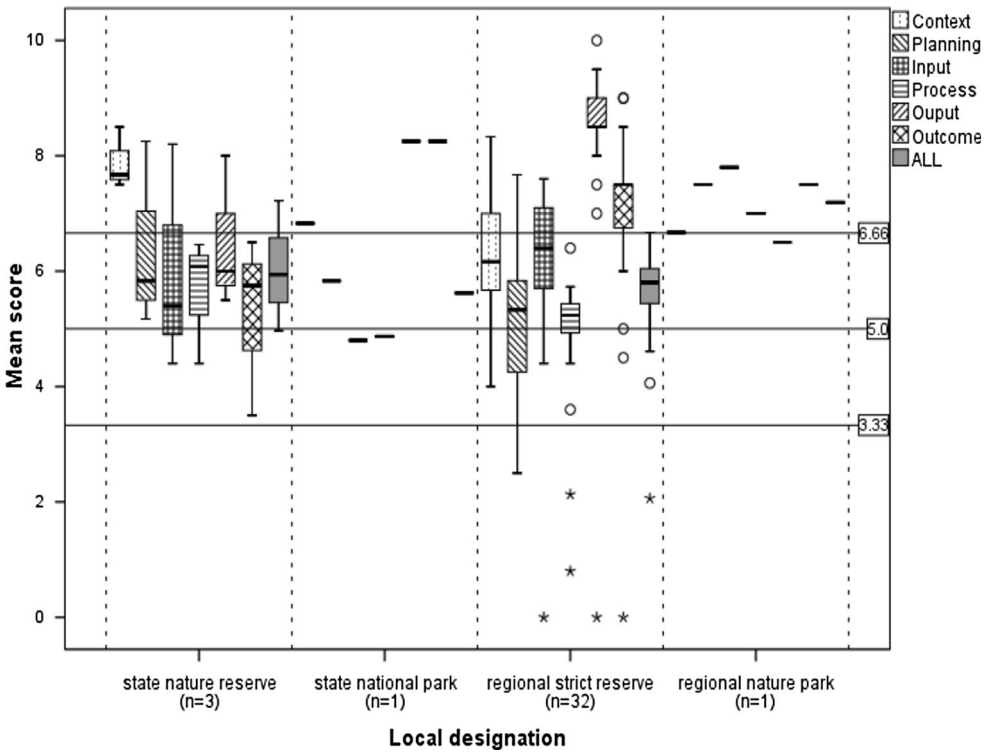

Fig. 4 Distribution of mean scores across the six evaluative elements and four PA types, and overall mean score. *Note* Mean scores <3.33 = 'clearly inadequate management'; 3.33–5.00 = 'basic management with major deficiencies'; 5.01–6.66 = 'basic management'; >6.66 = 'sound management'

conclude that they are doing at least as well as their global counterparts. Considering the four PA types, the regional park scored in the 'sound management' range, the national park in the 'basic management' range, while both state *zapovedniks* and regional *zakazniks* spanned three management ranges, i.e., 'basic with management deficiencies' to 'sound.' These performance levels can be interpreted in light of existing literature and context.

Ergaki Regional Park has a relatively short period of operation but its development was given priority by the Krasnoyarsk kray local and regional authorities in terms of promotion, finance, setting management targets (incl. management plan), and personnel training (Shestakova 2006). This prioritization and support from the local community led to a substantial development of infrastructure, conservation efforts, and a growing popularity of this destination among tourists. Shushenskiy Bor National Park is located near the village of Shusheskoye, where Vladimir Lenin was exiled to from 1897 to 1900. This area was tremendously popular for tourists in the Soviet period and was aimed at protecting historical and cultural heritage, conserving nature, and maintaining tourist interest. The park was reputed for its research work and conservation programs thanks to an efficient and enthusiastic management team. The mixed results for federal *zapovedniks* and regional *zakazniks* are a reflection of both their strengths (e.g., relatively secure funding, strong administrative and legal frameworks, achievement of set work programs, high levels of significance, robust designs, natural resource and cultural heritage protection) and weaknesses (e.g., low community involvement and lack of community benefits, insufficient funding, absence of management plans, inadequate training for staff, and inadequate infrastructure).

Table 4 Significant differences of means across the six evaluative elements (only significant differences are shown)

(A) Element	(B) Element	Mean difference (A–B)
Context	Planning	1.170*
	Process	1.295**
Output	Context	1.813***
	Planning	2.982***
	Input	2.077***
	Process	3.108***
	Outcome	1.223*
Outcome	Planning	1.759***
	Process	1.885***

* $p < .05$; ** $p < .01$; *** $p < .001$

Which Aspects of Management are Most Effective?

According to our results (Fig. 3; Tables 4, 5), *output* scores are significantly higher than most other elements, and represent a notable departure from the global results, and Tyrlyshkin et al.'s (2003) findings, in which *planning* scores were markedly higher. This is certainly reflective of

Table 5 The evaluative element, mean and standard deviation for each headline indicator analyzed

Headline indicator	Element	*N*	Mean	SD
'Sound management' [score > 6.66]				
Security/reliability of funding	Input	37	9.32	2.069
Achievement of set work program	Output	37	9.18	2.161
Level of significance (conservation value, economic/social value)	Context	37	7.87	1.888
Adequacy of human resource policies and procedures	Process	37	7.49	1.995
Conservation of nominated values—condition	outcome	36	7.46	1.091
Natural resource and cultural protection activities undertaken	Process	37	7.24	1.723
Results and outputs produced	Output	37	7.16	1.724
Effectiveness of administration including financial management	Process	37	6.89	2.079
Appropriateness of design (size/shape appropriate for conservation of key habitats/species)	Planning	37	6.87	2.616
Extent and severity of threats (to the protected area)	Context	37	6.85	1.736
Adequacy of relevant and available information for management	Input	37	6.84	1.756
Staff/other management partners skill level	Process	37	6.81	2.402
Protected area gazettal (legal establishment)	Planning	37	6.76	2.100
Effect of park management on local community	Outcome	35	6.76	1.841
Adequacy of law enforcement capacity (by staff mainly)	Process	37	6.70	2.296
'Basic management' [score 5.01–6.66]				
Management effectiveness evaluation undertaken	Process	35	6.51	1.704
Adequacy of staff numbers	Input	37	6.46	2.631
Effectiveness of governance and leadership	Process	36	6.42	1.422
Marking and security or fencing of park boundaries	Planning	37	6.23	2.257
Communication program	Process	37	5.84	2.192
Research and monitoring of natural/cultural management	Process	37	5.70	1.730
Threat monitoring	Process	37	5.56	1.907
Adequacy of protected area legislation and other legal controls	Planning	37	5.46	2.268
Tenure issues	Planning	37	5.05	3.407
'Basic management with major deficiencies' [score 3.33–5.00]				
Adequacy of infrastructure, equipment and facilities	Input	37	4.49	2.077
Constraint or support by external political and civil environment	Context	36	4.24	1.830
Appropriate program of community benefit/assistance	Process	36	3.78	1.312
Adequacy of staff training	Process	37	3.43	1.642
Adequacy of current funding	Input	37	3.35	1.550
'Clearly inadequate management' [score < 3.33]				
Involvement of communities and stakeholders (planning, decision-making etc.)	Process	37	1.93	2.902
Adequacy of building and maintenance systems	Process	37	0.87	2.311
Management plan (presence, adequacy, implementation)	Planning	37	0.76	1.964
Visitor management (visitors catered for and impacts managed appropriately)	Process	37	0.65	2.031

the PA management culture within Russia, whereby PA management systems are largely 'results-oriented' with minimal focus on strategic planning. In this culture whereby state funding is dependent on completed official work plans, considerable effort is extended to fulfill these requirements, and is reported regularly. Explaining the incongruence with Tyrlyshkin et al.'s (2003) study is relatively straightforward: 'management plan' is listed as a *process* indicator in the RAPPAM methodology employed by Tyrlyshkin et al. (2003), while within the *planning* element in Leverington et al.'s (2010) headline indicators, confounding the overall values between these categorical elements. In both studies, although land use planning and design scored high, systematic management plans were identified as weak attributes in the PAs investigated (e.g., *management plan* scores for all 32 *zakazniks* were '0'). Moreover, as Tyrlyshkin et al.'s (2003) study did not consider regional *zakazniks*, we find that our results for

Table 6 Tests of correlation (Pearson's *R*) between six evaluative element mean scores, and PA year of designation, and area ($N = 37$)

Evaluative element	Year of designation	Area
Context	.196	.482**
Planning	.193	.263
Input	−.102	−.185
Process	−.248	−.026
Output	.015	−.323
Outcome	.043	−.370*
All	−.078	−.017

* $p < .05$; ** $p < .01$

zapovedniks and national parks only (Fig. 4) are consistent with their findings which demonstrate that *planning* elements tend to outperform *inputs* (although our sample size is low).

Similar to the global assessment, *process* indicators also scored relatively low in our study. In Krasnoyarsk, PAs chiefly struggle with processes concerning staff training, visitor management, and efforts to engage with local communities.

Which Factors are Most Related to Successful Outcomes?

Individual headline indicators most strongly correlated to overall outcomes (Table 7) show few similarities with the global survey results (Leverington et al. 2010). In our study, both significantly correlated factors influencing the *conservation of nominated values—condition* outcome (*results and outputs produced*; *tenure issues*), were inconsequential in the global study. As mentioned above, PA management culture is largely results-oriented with set work plans which are frequently reported, suggesting the strong correlation with this indicator and *conservation of nominated values*. *Tenure issues* is more difficult to explain as it seems counterintuitive that a conservation outcome should be enhanced by more problematic issues concerning tenure. This indicator was awkward in terms of interpretation by many of our respondents, as the meaning in Russian is somewhat ambiguous and may be confused with *land use*. Secondly, only 2 of 10 factors found to be significantly correlated to the *effect of park management on local community* outcome (*management effectiveness evaluation undertaken; appropriate program of community benefit/assistance*) were shared with the global study results.

This highlights idiosyncrasies that may be specific to Krasnoyarsk territory and could be developed and leveraged in the future. They could also provide interesting case-studies for other territories in Russia, to be more closely studied with the goal of providing learning experiences for regions (or countries) that perform poorly in these areas/indicators. The disparity observed between regional and global results provides an interesting case for further research in order to gain a deeper understanding of the relationship between these two *outcome* indicators and overall management performance in specific PAs.

Finally, PA *context* was found to be positively correlated with PA size (Table 6). This is not surprising, as larger PAs tend to be located further north in the territory, where anthropogenic threats are relatively lower and are

Table 7 Correlation of indicators with two *outcomes* indicators (only significant relationships shown; 2-tailed)

Headline indicator	Evaluative element	Effect of park management on local community	Conservation of nominated values—condition
Achievement of set work program	Output	.447**	
Management effectiveness evaluation undertaken	Process	.430*	
Security/reliability of funding	Input	.427*	
Appropriate program of community benefit/assistance	Process	.427*	
Adequacy of relevant and available information for management	Input	.391*	
Natural resource and cultural protection activities undertaken	Process	.388*	
Effectiveness of governance and leadership	Process	.368*	
Management plan (presence, adequacy, implementation)	Planning	-.355*	
Adequacy of building and maintenance systems	Process	−.342*	
Extent and severity of threats (to the protected area)	Context	.341*	
Results and outputs produced	Output		.390*
Tenure issues	Planning		−.345*

* $p < .05$; ** $p < .01$

Table 8 Mean score as to whether PA manager believed headline indicator was appropriate for evaluative element ($N = 37$; 1 = very poor indicator; 5 = excellent indicator)

Indicator	Mean	Min	Max
Extent and severity of threats (to the protected area)	5	5	5
Adequacy of current funding	5	5	5
Effectiveness of governance and leadership	5	5	5
Adequacy of human resource policies and procedures	5	5	5
Conservation of nominated values—condition	5	5	5
Level of significance (conservation value, economic/social value)	4.97	4	5
Protected area gazettal (legal establishment)	4.97	4	5
Natural resource and cultural protection activities undertaken	4.97	4	5
Research and monitoring of natural/cultural management	4.97	4	5
Results and outputs produced	4.97	4	5
Effectiveness of administration including financial management	4.95	4	5
Staff/other management partners skill level	4.95	4	5
Adequacy of law enforcement capacity (by staff mainly)	4.95	4	5
Constraint or support by external political and civil environment	4.92	3	5
Adequacy of protected area legislation and other legal controls	4.92	4	5
Appropriateness of design (size/shape appropriate for conservation of key habitats/species)	4.92	4	5
Adequacy of infrastructure, equipment and facilities	4.92	4	5
Communication program	4.92	3	5
Achievement of set work program	4.92	3	5
Tenure issues	4.89	3	5
Adequacy of staff numbers	4.89	4	5
Adequacy of relevant and available information for management	4.89	3	5
Management effectiveness evaluation undertaken	4.89	4	5
Adequacy of staff training	4.89	3	5
Threat monitoring	4.89	4	5
Marking and security or fencing of park boundaries	4.86	3	5
Adequacy of building and maintenance systems	4.84	3	5
Effect of park management on local community	4.84	2	5
Visitor management (visitors catered for and impacts managed appropriately)	4.81	3	5
Security/reliability of funding	4.78	0	5
Involvement of communities and stakeholders (planning, decision-making etc.)	4.76	2	5
Management plan (presence, adequacy, implementation)	3.05	3	5
Appropriate program of community benefit/assistance	3.03	2	5

less contentious in terms of political constraint for their establishment. These larger PAs also tend to have higher levels of significance, incorporating large tracts of intact ecosystems (Shestakov 2003). In deciphering its correlation with the *outcome* element, although PA size was not significantly correlated with the *conservation of nominated values—condition* outcome, it was significantly and negatively correlated with the e*ffect of park management on local community* outcome, revealing the oft-quoted disjunct objectives between PAs managed primarily for biodiversity conservation with those for community beneficiation, and the need to decouple these outcomes both from the overall MEE score, and from the combined *outcome* score. In our study area, larger PAs tend to be located in more remote and inaccessible locations, with a clearly stated focus on preserving species/habitats, with very little (if any) adjacent local communities. In these cases, scores for *effect of park management on local community* will be relatively low as little or no effort is extended for community outreach or benefit-sharing, a point we return to in the next section.

Which Indicators are Believed by PA Managers to be the Most/Least Reflective of Local Management Effectiveness?

Overall, our respondents perceived that the 33 evaluative criteria were reliable indicators of PAME in the local

context, with two notable exceptions (*management plan*; *appropriate program of community benefit/assistance*). Formal systematic management plans are not a common PA management practice in Russia, with only 10 federal PAs having approved management plans in 2002 (Tyrlyshkin et al. 2003). Particularly for regional *zakazniks*, formal management plans are non-essential as these PAs are governed by a regional authority and have their own official monthly, quarterly, and annual reporting structures to the Ministry of Natural Resources of the Krasnoyarsk Territory. This planning style may be due to historical practices where plans were habitually broken, and by the relative unpredictability of the Russian economy and politics, whereby many institutions still prefer to make short-term plans on a yearly, quarterly, and monthly basis and avoid longer-term planning. Plans in this context are typically imposed in a top-down fashion and then distributed to the heads of PAs and departments. These plans are usually very specific in nature (e.g., make 58 raids, map 5 salt marshes, publish 10 articles per year) and lack the broader scale elements of formal management plans including mission statements, history of the area, strategic management objectives, etc.

Secondly, historically and even now, the mission and top priority of state nature reserves (*zapovedniks*) and strict reserves (*zakazniks*) is stated as specific species or complex nature protection, and are only negligibly focused on outreach or benefit-sharing to local communities. Even in cases where community interests are being considered in PA management, this aspect of management is still in its infancy, possibly in part due to Russian society being characterized as lacking active participation in public affairs, suffering from a weak civic community, and being suspicious of any activities advocated by power structures (Ostergren 2001; Laletin et al. 2002). Moreover, many PAs simply do not have any adjacent human settlements with which to interact.

Therefore, assigning these (lower) scores with equal weighting to others in such assessment tools would clearly lower the overall score, which was demonstrated in the significant difference found between our *uncorrected* and *corrected* mean scores. By ignoring these differential weightings, it creates the impression that these PAs are performing poorer in terms of meeting their stated objectives than they actually are. This would also have a knock-on effect when comparing mean MEE scores (from e.g., RAPPAM-based assessments) for individual PAs or PA networks with global assessments, and vice versa. This was noted anecdotally in our workshop when some respondents stated that the Russian PA system has largely disparate objectives from other contexts, and had difficulty assigning scores to e.g., tourism, local community benefits, and management plans.

Research Limitations

Not unlike similar studies where respondent scoring is utilized to ascertain data on management effectiveness, our study is admittedly limited by terminology and the subjectivity of our respondents (Tyrlyshkin et al. 2003; Cook and Hockings 2011). We have made every attempt to collect reliable data from those respondents whom we believed had the best knowledge of the management indicators we were assessing, and with the lack (and unfamiliarity) of PAME studies in the region, this is a factor which we could not control for and which may be liable to overstating (or understating) performance by the individual assessors (Burgman 2001). Nonetheless, we use Leverington et al.'s study as the only available benchmark by which to make some comparisons on the effectiveness of our region to the global situation. Further, our results are consistent with the only PAME studies which have been conducted in Russia (Tyrlyshkin et al. 2003), and issues identified in national reporting to the CBD (Tishkov 2009).

Recommendations

With the aim of contributing to PA management and its evaluation in the territory studied, and to address the need to draw regional lessons from PAME studies, we recommend the following:

1. *Develop and adopt appropriate management effectiveness evaluation tools that are based on the 6 evaluative elements, and integrate them into monitoring programs for PAs in the Krasnoyarsk kray.* Understanding PA management strengths and weaknesses should be a core practice for PAs and can better inform management practices. In our region, the superior performance of regional *zakazniks* in terms of *outputs* and *outcomes* should be recognized, while the nuances of relatively weaker *planning* and *process* oriented factors should be investigated. Our results confirm other studies which suggest that comprehensive evaluations based on the WCPA framework (1) provide a good overview of strengths and weaknesses of individual PAs, (2) help identify management gaps, and (3) can lead to more realistic recommendations and responsive management actions to make improvements in the system. This is one realistic recommendation that our research advances, since the implementation of such tools does not appear to be outside the scope of local institutional capacities. On the other hand, we show that there is good cause to decouple *outcomes* from this framework and treat it, and its components, as separate entities in the evaluative process.

2. *Recognize and learn from management policies and practices across various types of PAs.* Our study has demonstrated that differences between PAME scores may not only be features of individual management contexts, but may also reflect management priorities within different categories of PAs, even within the same region. Identifying the often broad mosaic of PA types within a region, and evaluating these collectively, should generate a greater degree of understanding of how PA *networks* function in terms of meeting regional and/or national priorities. Moreover, lessons drawn from other approaches such as developmental evaluation may hold promising improvements in assessing specific management activities, particularly those that (1) can enhance an institution's adaptive capacity to recognize and learn (Laven et al. 2010, 2013), (2) are *process*-related in highly uncertain environments, and (3) are within organizations where innovation is a common trait (Gamble 2008; Patton 2010).
3. *Increase cooperation and networking between PAs and regions for sharing experiences and learning the most promising practices on PA management and monitoring.* This recommendation is aligned with Hockings et al. (2006, p 49) invitation to "… learn from others and use or adapt existing methodologies if possible." In our study, we brought together a diverse group of PA managers, from various management institutions to participate in a shared PAME evaluation exercise. On one hand, this can create an enabling environment for shared learning concerning PA management and its evaluation. However, in underfunded and overstressed institutions (incl. most of the world's PAs), this is not a straightforward outcome. A good deal has been debated and learned in e.g., the fields of education and public health with respect to how knowledge and innovation arising from evaluation could, and should, be disseminated and translated both within and across institutions (Blake and Ottoson 2009; Schorr 2011). We recommend that PA management institutions who are intent on knowledge construction and transfer, explore and incorporate these developments where relevant.
4. *Continue to critically evaluate the evaluation tool itself through local, contextually driven assessments of the indicators used*. Just because PAME tools are being used by large organizations and across 100s or even 1000s of assessments, does not necessarily mean they cannot be improved. Whatever tool we use, we should be aware of what it is, and is not, telling us. If our tools are not measuring what we want them to measure, or in the right way, then we are simply being less effective with our resources. The tool chosen for monitoring management effectiveness should be adapted to the specific settings, capacities, needs, and objectives of the PA or PA network. In parallel with the now commonly used summative approaches, we advocate for further exploration of other approaches (e.g., developmental evaluation), which may bring about improvements to MEEs. However, if indicator-based tools are solely used, then a weighting of those indicators should be incorporated into the final scores and efforts to compare these with other individual, regional, or global assessments should be cognizant of such inconsistencies. Although efforts should be extended to improve and develop a more universal PAME tool, this should not be at the expense of also developing evaluative tools which can better track local/regional nuances in PA management, and by which adaptive management may be dependent.

Acknowledgments We thank the EC Tempus EnGo: Environmental Governance for Environmental Curricula Joint Project (No. 511390) for logistical support, Anna Kirillova and the Directorate on Protected Areas of the Krasnoyarsky Kray Administration, respondents who gave of their time to contribute to this study, and Viktor Lagutov for technical assistance for Fig. 1. We also thank 3 anonymous reviewers for their constructive comments on the manuscript.

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