LETTER

Global Review of Social Indicators used in Protected Area Management Evaluation

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Abstract

Social considerations in conservation are increasingly recognized as important for successful environmental outcomes. However, social measures lack consistency and may underreport key issues. This article analyzes social indicators and well-being dimensions used in protected area effectiveness tools, with specific attention to local communities and Indigenous peoples' contexts. Using the Global Protected Area Management Effectiveness database, we reviewed 2,736 indicators from 38 methodologies applied in over 180 countries. We analyzed: (1) representation of human well-being dimensions, (2) direction of impacts, and (3) level of neutrality in indicators. We found limited diversity and representation of important well-being dimensions such as health and governance. While impacts on communities and nature are similarly measured, positive wording is used three times more often than negative, which may unintentionally bias evaluations. We recommend using and developing indicators with greater diversity, increased clarity, and reduced bias to enhance management and policy responses for biodiversity and human well-being.

Introduction

Science increasingly seeks to understand complex human dimensions that affect the success of conservation initiatives and their social impacts (Ferraro & Pressey 2015). Similarly, many international agreements and policies are calling for enhanced monitoring of human well-being to reach global conservation and sustainability targets (Butchart et al. 2015). Despite trade-offs between social and environmental considerations in conservation initiatives (Halpern et al. 2013), accounting for social dimensions of conservation practice, especially at the local level, can improve both ecological and social outcomes (Berkes et al. 2000; Porter-Bolland et al. 2012). This requires the use of social measures, such as well-being, that respond at local and global scales (Weeratunge et al. 2014), and are neutral enough to track both positive and negative changes resulting from human-nature interactions and their management (Schreckenberg et al. 2010).

Though social indicators are underused in sustainability policies, there is increased capacity within the conservation field to adopt social science practices (Kareiva et al. 2014) and encouraging developments are underway, e.g., the agreement and identification of well-being indicators, such as having control over material environment and sustaining physical health (Hicks et al. 2016). However, developing suitable social indicators to represent complex phenomena associated with human values, measuring the depth of cultural components, and including

quantitative and qualitative features is challenging (Hicks *et al.* 2016).

Despite these challenges, framing and measuring social dimensions of conservation is important, since both objective and subjective measures are crucial for policy making (Jones *et al.* 2017). A number of frameworks exist for understanding social aspects of environmental management. Well-being frameworks move beyond a focus on physical or material wealth, as typical in deprivation-centric frameworks, to include broader dimensions reflecting human aspirations and values (Weeratunge *et al.* 2014); they also apply at scales that bridge local and global approaches (Weeratunge *et al.* 2014). Several well-being frameworks and associated dimensions have been reviewed or proposed (Leisher *et al.* 2013; Weeratunge *et al.* 2014; Beidenweg *et al.* 2016), with example well-being dimensions including living standards, health, education, social cohesion, security, environment, and governance (Leisher *et al.* 2013). Despite variations in dimensions among frameworks, most studies agree that diversity and balance of dimensions are key considerations.

Conservation interventions, such as protected areas, can have both social costs and benefits that influence well-being (Coad *et al.* 2008). Assessing social dimensions requires understanding local impacts of and on the people most reliant upon natural resources. Because Indigenous peoples are often those living closest to and within areas containing significant biodiversity, their well-being is intricately linked to ecosystem health (Gadgil *et al.* 1993; Burgess *et al.* 2009). Local communities and Indigenous peoples are increasingly recognized for their positive contributions to biodiversity conservation (Kothari *et al.* 2012; Rao *et al.* 2016) and the importance of traditional knowledge and local practice is included in several Aichi Targets of the Convention on Biological Diversity (CBD 2010). In response, conservation and sustainable development policy agendas have been reshaped to safeguard cultural and social benefits that enhance local community rights, decision-making authority, and values (Daniel *et al.* 2012; Robinson *et al.* 2016). Thus, ensuring the use of appropriate social measures in conservation monitoring, especially in the context of well-being, is critical.

To explore local/global social indicators used in a key conservation mechanism—protected areas—we use the Global Protected Area Management Effectiveness database (GDPAME): the only global database that contains detailed management assessments from protected area sites (Coad *et al.* 2015). Despite the lack of coordination for monitoring of social issues in conservation at large scales (Fox *et al.* 2014), this database provides unequivocal opportunity for comparison. No study has considered how current effectiveness methodologies incorporate social measures. We analyze nearly 3,000 indicators from GDPAME methodologies applied in 180 countries to achieve two key objectives: (1) understand the nature of social indicators currently used in evaluating local aspects of conservation initiatives and (2) explore potential limitations in these indicators' capacities to capture well-being dimensions.

We hypothesize that a diversity of social indicators would be required to capture the range of social dimensions (Hicks *et al.* 2016) associated with protected area effectiveness and that a balance of indicators (those measuring both negative as well as positive impacts on local communities) would be least biased (Schreckenberg *et al.* 2010). We also consider a relatively even distribution of human well-being dimensions over indicators as ideal (Beidenweg *et al.* 2016). Uneven distribution may suggest certain categories require additional or revised indicators. Overall, we anticipate this research could guide further development of standard measures for a broader set of protected area and conservation governance regimes, particularly those led by local, Indigenous, and private entities.

Methods

Reviewing protected area management effectiveness indicators

The GDPAME hosts a range of information on assessments of the effectiveness of protected area management carried out around the world by government agencies, NGOs (e.g., WWF), and funding institutions (e.g., GEF and World Bank; see Coad *et al.* 2015 for details). The GDPAME: (1) contains both social and ecological indicators from effectiveness evaluation methodologies used in protected areas, (2) is used in international and local conservation decisions, and (3) contributes data for assessing global targets, e.g., CBD Aichi Targets. GDPAME "indicators" are traits related to protected areas as reported from standard questions in each methodology. Data were accessed from the January 2015 version of the GDPAME which, after removing incomplete entries, included 2,736 indicators from 38 management effectiveness methodologies.

We reviewed all GDPAME indicators to identify those specifically related to local communities and Indigenous peoples given the affiliation with their well-being (e.g., subsistence or cultural practice) to protected areas. Any indicators referencing local or Indigenous contexts are considered social indicators in our study. We differentiate social indicators (e.g., "Do Finnish Protected Area management objectives harmonize with wider cultural objectives including those relating to the Sami?"[27];

"Stakeholder participation includes representation from the various ethnic, religious and user groups as well as representation from both genders[4]"; superscript numbers correspond to methodology number as listed in Table 1) from other indicators used in PAME methods that represent broader protected area contexts, e.g., administrative, political, legal, and planning activities.

Our analysis of social indicators includes three parameters: (1) coverage of well-being dimensions, (2) balance of impact on people or nature, and (3) directionality of indicators, for example, whether they are positive or negative in connotation.

Distribution of social indicators in protected area effectiveness methodologies

To understand the extent of social indicators used in each of the 38 GDPAME methods, we tabulated the number of social indicators as a percentage of total indicators used. For comparison, a previous global PAME review included 14 methods in total (Leverington *et al.* 2010) and did not focus on social analysis.

Distribution of well-being dimensions in social indicators

We applied and compared two existing well-being frameworks to further explore the distribution of well-being dimensions among social indicators in PAME tools. The first of these is a framework developed by Leisher *et al.* (2013) who reviewed 31 indices for measuring well-being, finding among them 11 key dimensions for measuring social impacts of conservation initiatives, the emphasis of our study. The second widely used framework, included in and recommended by the Leisher *et al.* (2013) review, was developed for social progress indicators by the Commission on the Measurement of Economic Performance and Social Progress (Stiglitz *et al.* 2009).

Measuring local impact and directionality of social indicators

To assess local impacts, we developed a coding system for all social indicators to identify: (1) the recipient of impact (i.e., people or environment) and (2) directionality associated with the indicator's phrasing (i.e., tendency of the indicator toward positive, negative, or neutral measure). For the first code, we assigned each indicator a recipient of impact: "environment" if the main recipient of impact was the environment and "social" if the main recipient of impact was a human community, adapting a methodology developed by Binder *et al.* (2013; Table S1). In rare cases where the recipient could be either, a third category

"both" was assigned. In cases where the indicator was a static measure, such as number of stakeholders, impact recipient was not applicable (N/A). The second code—directionality— was assigned using the original phrasing of each indicator to designate a positive, negative, or neutral direction, i.e., $+1$, -1, or 0. If the indicator was a static measure, directionality was N/A. Table S2 presents examples of each code.

Results

Use of social indicators varies in management effectiveness evaluation methodologies

We found that one-fourth (25.1%; 686) of total GDPAME indicators are locally relevant and considered social indicators (Table 1). Table S3 lists all 38 methodologies and sources. Number of indicators used per methodology ranges from 13 to 429, with social indicators comprising between 7% and 60% of total indicators (Table 1). Of the 38 methodologies, two use well-being dimensions in over 50% of their indicators. The three most widely used PAME methodologies (see * in Table 1) have fewer social indicators than over half of the remaining methodologies we reviewed. The marine PAME evaluation methodology, called "How is Your MPA Doing?" (Pomeroy *et al.* 2005), is the most sensitive to recording social measures in local communities.

Well-being dimensions are not distributed equally among social indicators

Over 85% of social indicators used in PAME methodologies were ascribed a well-being dimension (Figure 1). When applying the Leisher and Stiglitz well-being frameworks to GDPAME social indicators (see Figure 1 and Table S4), "living standards" is the most prevalent dimension (~34%), followed by environmental and security issues, all largely related to natural resource access, use, or quality. While "culture" ranked fourth highest in the Leisher framework, the Stiglitz framework does not include a "culture" category, leaving the nuances of cultural context subsumed within more generalized categories.
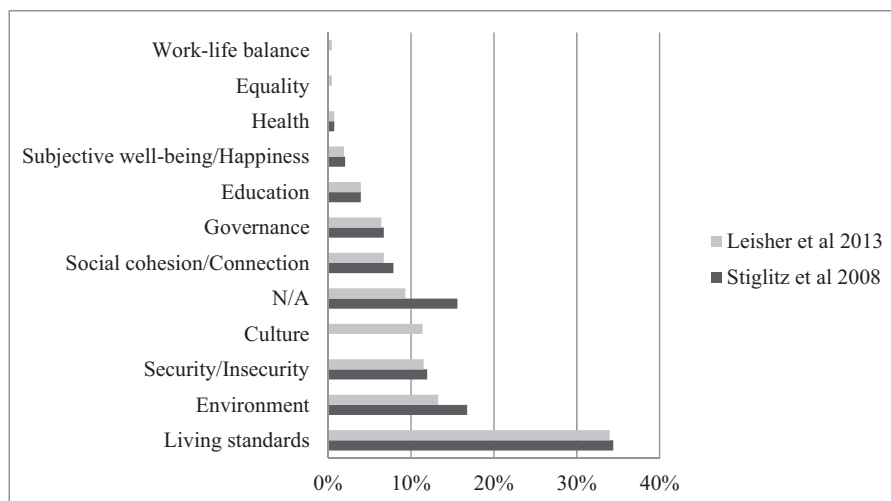
In both frameworks, well-being dimensions relating to social connections (i.e., interpersonal, intra- and intercommunity) accounted for fewer than 8% of social indicators. Less than 7% of social indicators comprised governance dimensions. Indicators in connection and governance dimensions focused largely on engagement of local communities. However, only four GDPAME indicators (0.6%; from PAME methods 4, 10, 19, and 24; see Table 1) specifically addressed Indigenous engagement. Dimensions of personal happiness, work-life balance, and

Table 1 Extent of social indicators used in management effectiveness evaluation methodologies

Number	Methodology	Social indicators	% of total	Total indicators
1.	How is your MPA doing? Management effectiveness evaluation	25	60%	42
2.	Evaluation of conservation potential of protected areas, Central African Republic	8	57%	14
3.	Monitoring and assessment with relevant indicators of protected areas of the Guianas	37	43%	87
4.	WWF-World Bank marine protected area score card	28	41%	68
5.	Visión 20001: Situación Actual del Sistema de Parques Nacionales de Venezuela	16	39%	41
6.	Degree of implementation and the vulnerability of Brazilian federal conservation areas	5	38%	13
7.	Rapid evaluation of management effectiveness in marine protected areas of Mesoamerica	27	38%	72
8.	WWF/agricultural center of tropical investigation and teaching evaluation methodology	24	38%	64
9.	Governance of biodiversity assessment of success factors for biosphere reserve management	9	35%	26
10.	Enhancing our heritage	33	32%	102
11.	IUCN conservation outlook assessments	19	30%	63
12.	Korea state of parks management effectiveness evaluation	15	29%	51
13.	Africa rainforest protected areas study	10	29%	35
14.	US state of parks	46	27%	171
15.	Rapid assessment and prioritization of protected area Management, KwaZulu Natal Province methodology, South Africa	21	26%	80
16.	Parks profiles, Queensland, Australia	108	25%	429
17.	Belize national report on management effectiveness	14	24%	58
18.	Quality criteria and standards of German national parks	17	24%	71
19.	*New South Wales state of parks, Australia	22	23%	94
20.	Analysis of management effectiveness of protected areas with social participation, Colombia	11	23%	48
21.	Parks and wildlife northern territory management effectiveness, Australia	15	23%	66
22.	National Park Authority performance assessment, UK	8	22%	37
23.	Evaluation of the effectiveness of the system of protected areas in Catalonia, Spain	18	21%	85
24.	*Management effectiveness tracking tool	9	21%	43
25.	Queensland park integrity statements, Australia	42	21%	204
26.	Parameters and procedures for the certification of conservation	13	20%	65
27.	Management effectiveness study, Finland	7	19%	37
28.	PROARCA/CAPAS scorecard evaluation Medición de la Efectvidad del manejo de Áreas Protegidas, Central America	6	19%	32
29.	European site consolidation scorecard	4	18%	22
30.	*Rapid assessment and prioritisation of protected area management	25	18%	139
31.	State of protected areas, Valdiviana Ecoregion, Argentina	7	18%	39
32.	The nature conservancy parks in peril site consolidation scorecard	3	18%	17
33.	Metodología de Evaluación de Efectividad de Manejo del SNAP de Bolivia	3	16%	19
34.	Protected area consolidation index	4	15%	26
35.	Conservation international management effectiveness tracking tool	4	13%	32
36.	World heritage periodic reporting	14	10%	140
37.	Scenery matrix	6	10%	63
38.	German nature parks quality campaign	3	7%	41
	Total indicators	686		2,736

Table S1 lists methodology sources.

*Denotes three most widely used PAME methodologies (Coad *et al.* 2015).

Figure 1 Distribution of human well-being dimensions from two frameworks across social indicators used in protected area management effectiveness evaluation (n = 686).

equality each had minimal representation, ranking at 2% or less. The "health" dimension was lowest in frequency among social indicators (0.7%). Overall, the difference in distribution of indicators among human well-being dimensions was found to be statistically significant in both frameworks (Leisher: $P \leq 0.001$, df = 10; Stiglitz: $P \leq 0.001$, df = 7).

Indicators balance environmental/social impacts but demonstrate positive bias in assessment

Social indicators measuring impact on environmental resources (346) slightly outnumbered those measuring impact on the local community (305; Figure 2; see Table S5 for full numbers). Less than 1% of social indicators could be interpreted as bidirectional (6), i.e., capable of measuring impacts in either direction, or were not relevant (4%; 29). There was no significant difference between the numbers of indictors measuring impact on environmental or social elements.

For social indicators, positive measures (250) were present 3.4 times more often than negatively associated ones (73; Figure 2). Nearly half (47%) of the indicators were neutral (321), or directionality was not relevant (6%; 42). Impacts on community were associated with positive phrasing (144 of 305; 47%) more often than environmental impacts (102 of 346; 29%), and environmental impacts were associated with negative phrasing (58 of 346; 17%) more often than community impacts (15 of 305; 5%). A Chi-square test showed statistically significant differences among directional indicators suggesting bias resulting from the framing ($\chi^2 = 35.6$,

$P < 0.001$; df = 2). Several neutral indicators were vague ("stakeholders receive benefits[3]"), and some indicators used terms interchangeably, such as "stakeholders" and "community."

Discussion

One-quarter of all GDPAME indicators include social aspects and are local in nature, suggesting that conservation evaluation is making progress on using social measures, especially in protected area management. However, some PAME methodologies include more well-being dimensions in indicators than others, highlighting the variation of the approaches, some of which have been adapted from global to local contexts (Coad *et al.* 2015). This inconsistency influences how we understand effectiveness. Also, significant gaps exist in the coverage of human dimensions associated with effectiveness, and possibly in PAME approaches themselves. Understanding the social parameters of conservation is critical for sustainable success and methodologies are needed to assess these human dimensions (Hicks *et al.* 2016). To potentially improve indicator development and methodologies that will be used in future social assessments, we recommend three key actions.

First, expand representation of human well-being dimensions in social indicators used in PA assessments. The majority of indicators currently reflect dimensions of living standards and environmental factors like physical resource quality and use, leaving many aspects, such as community relations and happiness, underevaluated. Few indicators consider equality, which relates to equity (Borrini-Feyerabend & Hill 2015) and effectiveness
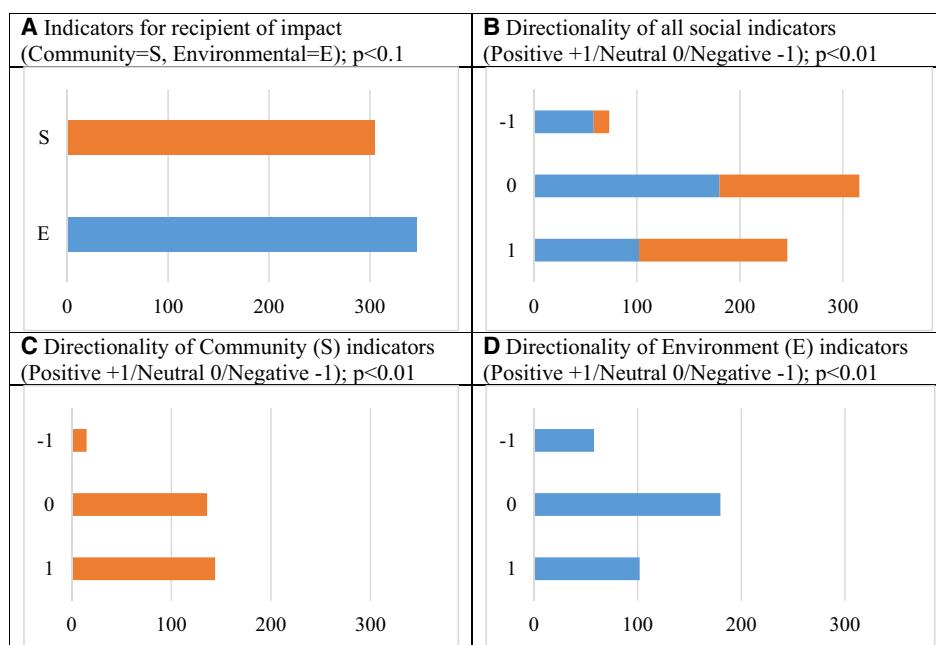
Figure 2 Comparison of directional measures and recipients of impacts exhibited by social indicators used in protected area management effectiveness evaluation (n = 686; [$\chi^2 = 35.6$, $P < 0.001$; df = 2]). Indicators with community impacts (S) are orange and with environment impacts (E) are blue.

(McDermott *et al.* 2013). Though governance indicators are present, they are underrepresented despite their centrality to effective conservation decisions (Borrini-Feyerabend & Hill 2015). Social indicators in our study generally lack detail about governance concerns such as process and timing (exceptions exist, e.g., "public participation during the elaboration of the management plan[23]").

Furthermore, despite the high level of engagement indicators in GDPAME methodologies (e.g., "is public participation on board?[23]"), numerous indicators address local involvement only after decisions have been made ("do residents acknowledge PA existence?[16]"). Similarly, GDPAME monitoring of Indigenous engagement is minimal given its importance in conservation outcomes (Berkes *et al.* 2000), and mode of engagement is often missing in social indicators. Consequently, engagement may be too late in the process to sustain participation or community support of conservation initiatives over the long term. To improve social measures in conservation, we recommend using or developing social indicators that elucidate known processes regarding effectiveness (e.g., capacity building during early phases is important; Brooks *et al.* 2013 and empowerment is considered a critical element in the social and ecological success of protected areas; Oldekop *et al.* 2016).

While culture is covered sufficiently in GDPAME indicators when using certain well-being frameworks (e.g., Leisher *et al.* 2013), it is missing in others (e.g., Stigliz

et al. 2009), which could be problematic given its increasing incorporation into global policy (Diaz *et al.* 2015) and its qualities that underpin many human dimensions (Daniel *et al.* 2012). Because cultural values of biodiversity support the context and outcome goals of conservation (Pretty *et al.* 2009; Cocks *et al.* 2012), giving attention to both physical cultural features and less tangible elements (Satterfield *et al.* 2013) could enhance protected area evaluation of social objectives. Furthermore, GDPAME cultural indicators specific to Indigenous peoples are rare, missing critical Indigenous issues, especially health (Anderson *et al.* 2016) and intergenerational knowledge transfer (McNamara & Westoby 2016). Using indicators to understand decision making and qualities of governance, especially in varying cultural contexts, could help disentangle complex aspects of human dimensions.

Second, indicators that assess distribution of impacts should be balanced. Impact evaluation helps assess factors, both social and environmental, that influence conservation success (Ferraro & Pressey 2015). Though GDPAME indicators seem to balance their attention to measures of impact on both human communities and environment, they tend toward phrasings that result in greater numbers of positive measures, especially those focused on impacts to humans. While this beneficial outlook might satisfy protected area investment, an unintended bias in positive social measures may mask underlying causes that result in failure to reach management objectives. Evaluating mostly positive aspects of protected

areas, with particular emphasis on social benefits, could ignore critical threats or imbalances and their core causes, such as poverty-exacerbated poaching, resulting in loss to both natural and cultural resources. Natural/cultural resources may be more effectively protected if there is greater integrity in measurement. Similarly, the current bias toward measuring environmental impacts in a negative light may supersede the merits of community-driven conservation (Berkes 2007), or miss the critical data that provide robust evidence and clear understandings of complex mechanisms in socioecological relationships (Ferraro & Hanauer 2015). Giving greater attention to distribution of impacts in evaluation could improve multiple aspects of effectiveness.

Last, we recommend using clear, specific indicators (Schreckenberg *et al.* 2010) to reduce positive/negative directional bias, which is closely affiliated with impact distribution in our study. While many neutral GDPAME indicators are flexible enough to capture positive or negative changes ("change in engagement with community[21]"), vague wording leaves some indicators difficult to track over time or open to misinterpretation, and translation of global indicators to other languages has proved challenging (Anthony & Shestackova 2015). Using vague indicators can also make it difficult to discern factors in well-being such as intracommunity dynamics, equity issues, or gender concerns. Moreover, some GDPAME indicators use stakeholder terms indiscriminately even though stakeholder opinion is deemed important in protected area effectiveness assessment (Jones *et al.* 2017). With global policies emphasizing diverse participation and adherence to the UN Declaration on the Rights of Indigenous Peoples, being particularly clear about who is involved is critical. A lack of clarity may lead to confusion or inconsistency among those who use the methodologies. Using indicators that are sensitive to either positive or negative changes would reduce the potential for prejudgment of impacts (Schreckenberg *et al.* 2010) and allow for more accurate and less biased evaluations of effectiveness.

Ultimately, finding ways to integrate local measures of social dimensions into the broader suite of planning, management, and evaluation is critical for meeting multiple objectives of contemporary protected areas and global goals for biodiversity conservation and sustainable development. Using well-being frameworks that promote diversity and representation of different human dimensions is important for measuring relationships between people and nature (Beidenweg *et al.* 2016), and this allows for more accurate assessment of protected areas' overall impacts. Addressing shortcomings in social indicators not only presents opportunities to more comprehensively assess progress in achieving CBD Aichi Targets,

but offers better evaluation of other global policies and commitments, such as the UN Sustainable Development Goals. If environmental policies are to meet human well-being targets, they need to include local communities and Indigenous peoples as active participants and leaders in conservation.

Acknowledgments

Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's web site:

Table S1. Sources of methodologies used in the Global Database on Protected Area Management Effectiveness.

Table S2. Distribution of well-being dimensions among social indicators used in protected area management effectiveness (n = 686).

Table S3. Recipient of impact assessed by social indicators used in protected area management effectiveness (superscript numbers on indicator examples correspond to methodology number as listed in Table S1).

Table S4. Directionality of social indicators used in protected area management effectiveness (superscript numbers on indicator examples correspond to methodology number as listed in Table S1).

Table S5. Comparison of directional measures and impact recipients of social indicators used in protected area management effectiveness evaluation (n = 686).

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