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Quality of governance and effectiveness of protected areas: crucial concepts for conservation planning

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Protected areas (PAs) are a key tool for biodiversity conservation and play a central role in the Convention on Biological Diversity. Recently, the effectiveness of PAs has been questioned, and assessing how effective they are in enabling the future persistence of biodiversity is not trivial. Here, we focus on terrestrial PAs and clarify the terminology related to PA effectiveness, distinguishing between management and ecological aspects. We suggest that the quality of governance affects both aspects of effectiveness but recognize a lack of synthetic understanding of the topic. We present a conceptual framework linking the underlying mechanisms by which the quality of governance affects conservation outcomes in PAs and how this relates to conservation planning. We show that it is crucial to separate pressure and response and how these together will lead to the observed conservation outcomes. We urge for more focused attention on governance factors and in particular more empirical research on how to address causality and how to account for the quality of governance when prioritizing actions. Our framework is linked to the classic concepts of systematic conservation planning and clarifies the strategies available to achieve a comprehensive and effective network of PAs.

Keywords: protected area; PA management; PA effectiveness; governance; conservation planning

Introduction

The global network of protected areas (PAs) has increased in number and extent, now totaling 209,000 legally designated PAs and covering about 15.4% of the world's terrestrial land area.[1] The coverage of PAs is expected to further increase, as the Aichi Biodiversity Targets set in 2010 committed each signatory country to protect at least 17% of its terrestrial land area and 10% of its marine area by 2020.[1] Despite this increase in PA coverage, more species are threatened with extinction than ever,[2] and biodiversity is still declining.[3] While the extent of PAs is used as an indicator of progress toward conservation goals, the question of whether these PAs are effective is slowly receiving increasing attention.[1,4–6]

The focus of research on the effectiveness of PAs has developed on two fronts: on one hand, international initiatives have established standards and conducted assessments of management effectiveness,[7] while, on the other hand, researchers are increasingly assessing the ecological outcomes of PAs, following conceptual and methodological developments in the field.[8–12] These different types of effectiveness are often confused and rarely linked. In this review, we aim to clarify the different approaches and terminologies, provide an overview of the evidence for linking the different effectiveness types, and identify the existing knowledge and conceptual gaps. In addition, we have chosen to focus on governance as an emerging important component in effectiveness assessments[13–15] and conservation planning.[16–18] Here, we clearly recognize a lack of synthetic understanding of the role that the type and quality of governance plays in PA effectiveness at large, and hence whether and how it should be accounted for both in effectiveness assessments and when planning to expand the global network of PAs.

To take the first steps in developing this underresearched topic, we summarize the literature

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linking governance to PA effectiveness and propose a framework to account for the quality of governance in conservation planning. In bridging between different fields of science, we choose to follow generalized terminology, but we refer interested readers to recent works that have examined the processes and terminology at more detailed and specialized levels.[5,19]

Definitions of protected area effectiveness

The term *protected area effectiveness* is often associated with very different aspects of the functioning of PAs, from investments to the protection of biodiversity or the reduction of threats, necessitating a clarification of the concepts and terminology. The aspects of effectiveness receiving the most attention in the literature can be classified as those evaluating *ecological effectiveness/conservation outcomes* and those evaluating *management effectiveness*. Among those investigations evaluating the conservation outcome, some focus more on pressures and others on the state of biodiversity. Recent studies have put considerable effort into classifying different aspects of effectiveness[5] and the links between conservation outcomes and governance.[19] However, these include a high level of detail and often do not incorporate the main concepts or terms abounding in the literature. While these are invaluable contributions for specialists, such detail may impair the conceptual understanding of the main components, definitions, and interlinkages. Here, we instead adopt a simpler framework based on the DPSIR approach (drivers, pressures, state, impact, response; an approach adopted by the European Environmental Agency; see Fig. 1A), which is an extension of the pressure–state–response framework (used by the Organisation for Economic Cooperation and Development).[20] By structuring the different dimensions of PA effectiveness in this way, we also clarify some of the confusing terminology and integrate novel approaches from different fields, trying to bridge the so-called "dialogue of the deaf " between political science and conservation biology.[21]

In the DPSIR framework (Fig. 1A), management effectiveness is considered a *response* measure, and it is connected to the *conservation outcome*, which corresponds to *pressures, state*, or *impact*, either in isolation or combination. The following sections aim at clarifying the ecological and management sides of effectiveness while searching for the evidence linking them.

Ecological effectiveness and the conservation outcome

With the concept of *ecological effectiveness*, we choose to refer to changes in the state or impact of PAs from a biodiversity point of view (e.g., changes in the extent of forest cover, animal population trends (Fig. 1A)). Studies usually focus on either (1) habitat cover, such as changes in the extent or rate of forest loss, or (2) animal population trends.[22] In relation to population trends, the evidence is limited and inconclusive.[10,22,23] Overall, PAs are experiencing wildlife declines,[23,24] yet they have an important role in reducing the rates of decline or even in reversing it.[10,25,26] Such patterns of reducing the decline have been shown to be stronger for birds than for mammals.[10,25,26]

A plethora of studies have reported that deforestation (sometimes substantial) also takes place inside PA borders (see Ref. 27 for a review of cases). Despite the severity of such illicit extractions, research has turned to address whether PAs have a role in reducing the pressure of deforestation compared with areas outside the PA borders. There appears to be agreement that most PAs have lower deforestation rates compared with deforestation outside PA borders,[22,28–30] which has led to the conclusion that PAs are effective.[22] However, PAs are often established in remote and less attractive regions for extractive uses[31] and consequently face less pressure than other regions.

Hence, more recent assessments comparing PAs with nonprotected sites have started to account for confounding factors linked to deforestation pressure, whether geographical, topographical, sociopolitical, or economic.[9,32] This counterfactual analytical approach, referred to as "matching methods,"[9,33] is increasingly being employed to measure PA outcomes.[9,11,13,34] Terms such as *PA effectiveness*[9,11,13] or *PA impact*[5] are used in this context to describe the success of PAs in reducing threats or the land conversion avoided compared with the expected situation if land were unprotected. Here, we retain the term *PA effectiveness* to refer to this concept, as it is the term most often used in empirical studies on the subject.[9,11,13] These empirical studies in tropical parts of the world have consistently shown that PAs are effective overall,[9,11,13,32]

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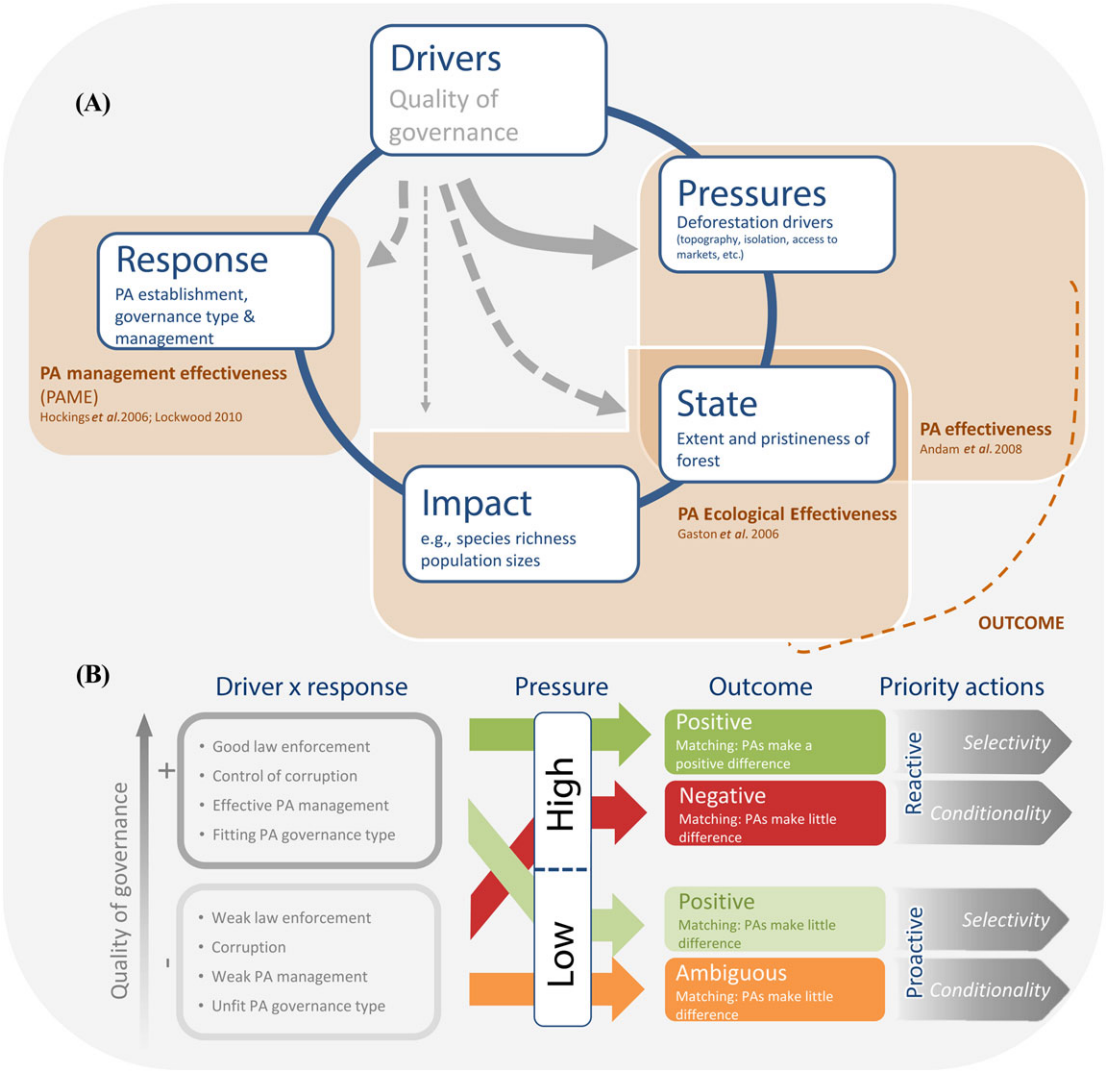

Figure 1. (A) Figure clarifying the PA effectiveness terminology within a DPSIR framework. The arrows within the circle illustrate the influence of *drivers* (in this case, the quality of governance being considered) on *pressures, state, impact*, and *response*, with arrow thickness related to the strength of influence. Many measures of effectiveness have been computed in isolation from each other and without links to an overall conceptual framework. Comparisons of, for instance, deforestation inside versus outside protected areas quantify changes in *state* (PA ecological effectiveness). Counterfactual matching approaches implicitly link *pressure* with *state* (PA effectiveness). We refer to these different ways to examine changes in *state, impact*, and/or *pressure* as *conservation outcomes*, whereas management effectiveness, together with governance type, falls under *response*. (B) Combinations where the *response* may take place in a context of strong or weak governance and the *pressures* may be high or low. The column for outcomes includes two types of measures: (1) a direct evaluation of the *state/impact* (PA ecological effectiveness), with only those in green having positive outcomes; and (2) counterfactual matching outcomes (PA effectiveness), with only dark green showing PAs as being effective, and not being able to distinguish between the other three combinations. Good governance in combination with high pressure can result in avoided deforestation (dark green) and thus a positive outcome also reflected by matching approaches. Instead, poor governance and high pressure result in negative outcomes (e.g., with high deforestation within and outside PAs). On the other hand, low pressure will also result in few differences between protected and nonprotected sites, regardless of whether there is scope for effective management. Responses should be adapted to the setting. The type of response would depend on whether a proactive or a reactive approach to conservation is taken, and different approaches to achieve effective conservation outcomes under the prevailing governance setting can be identified using selectivity or conditionality.

although accounting for the confounding variables reduces the perceived effect compared with simple inside–outside comparisons.

Counterfactual studies are still relatively rare,[22] computationally demanding, and almost completely lacking in assessments of species population trends, where comparative data are not available owing to the difficulties in conducting extensive surveys outside PAs.[23] The lack of data for species population trends poses a serious challenge in adapting research results for policy-making purposes. To date, studies on PA effectiveness[9,11,13,14] have all concluded that PAs make a difference in relation to avoiding habitat conversion, but research on species can only report population declines without any measure of how much worse the situation might have been had the area not been protected.

In Figure 1A, we relate the above discussion and concepts to the DPSIR framework. Our broad term *conservation outcome* refers to changes in *pressure*, *state*, or *impact* or the interaction between them. Simple inside–outside comparisons of deforestation would correspond to *state*, whereas counterfactual approaches are a combination, integrating the linkages and not allowing for a separation between *pressure* and *state*.

Misleading effectiveness outcomes?

We note that one should interpret counterfactual measures of effectiveness with caution and be aware of what they mean. Effectiveness is a relative measure, and a PA can appear to be effective by virtue of good management or by virtue of high pressure. Outcomes for two differing sites, one having high effectiveness and the other with low effectiveness, do not necessary indicate that the former is better managed or better at preserving its biodiversity. Instead, the site with lower effectiveness may simply be a site facing lower pressure (with similar pressures inside and outside PAs) despite having better management and a better state than the site showing higher effectiveness, with the latter being in a context of higher pressures.[13,14] In temporal assessments, a decrease in the effectiveness of a particular PA could be due to a decrease in management effectiveness, but it could also be due to better policies at higher levels and reduced pressures overall. Such complexities call for careful use of effectiveness measures and a good understanding of the context and the assessment methods employed, especially with the current surge in counterfactual assessments[5,35] (see later sections on links to governance and how to prioritize actions).

In summary, ecological aspects of effectiveness have been measured in different ways, with methodological advances now changing our views on how effective PAs are. Most of the current evidence addresses deforestation, while the same type of evidence is largely lacking for species/populations. However, while deforestation and habitat loss lead to species loss, reports of the "empty forest syndrome"[36] reveal that wildlife can be dramatically lost even in the absence of forest loss. Large knowledge gaps still exist regarding how different taxa are faring in the global network of PAs, especially under varying pressures.

Management effectiveness

PA management refers to the inputs needed and actions taken to manage a PA, and it thus corresponds to the *response* side of the DPSIR framework (Fig. 1A). As such, PA management effectiveness should be seen as a composite index, consisting not only of input for staffing, infrastructure, and equipment, but also for training, communication, the capacity for enforcement, and related governance aspects.[37] Management effectiveness has received increasing attention in the conservation literature, mostly because of a concerted effort by international donors and nongovernmental organizations (NGOs) to develop questionnaires for PA managers that assess threats, the local setting, and management effectiveness. Many of these assessments are based on concepts outlined in the management effectiveness framework developed by the International Union for Conservation of Nature (IUCN) World Commission for Protected Areas[7] and include elements of context, planning, input, process, output, and outcome. All of these elements, including output and outcome, mostly refer to the management process and were originally developed as tools for adaptive management.[6] Examples include the rapid assessment and prioritization of protected area management methodology and the management effectiveness tracking tool (METT).[37]

These surveys have been undertaken in 90 countries,[38] and analyses indicate that management in most PAs is "barely acceptable:"[37,39] About 13% are "paper parks" and lack any management activity, while 62% have basic management but with

significant deficiencies.[37] The management aspects that appear to be most strongly in place were those related to PA establishment (legal status, design, demarcated borders) and governance effectiveness (mainly leadership).[40] The weakest aspects of management included community considerations and financing.[40] Average scores have been reported to increase with repeated assessments, giving an indication that they might serve their role in strengthening management in an adaptive way.[40] However, the data on PA management effectiveness have been criticized because they rely on the responses of managers, consultants, or government officials and ratings based on their own perceptions, which could produce biased results if respondents want to present positive outcomes.[41] Others argue that, under time and budget constraints, tools for rapid evaluations based on expert knowledge are also needed.[42]

Protected area management can be directed either at reducing threats, such as poaching or illegal logging (e.g., through law enforcement, patrolling, surveillance), or at explicitly improving the state of the area, such as through the restoration or management of populations of species or habitats. Thus, one would expect to find links between management effectiveness and *pressure*, and between management effectiveness and *impact* or *state* (Fig. 1A). However, these links have rarely been sought, and few studies have examined the links between management effectiveness and threat reduction.

Linkages between management effectiveness and ecological outcomes

Since the threat-reduction capacity (i.e., PA effectiveness as defined above) is dependent on effective management (otherwise there would be no difference from the counterfactual of not being protected), it is natural to assume a correlation between PA effectiveness and PA management effectiveness. While there are still too few accounts linking the two, the nature of management assessments may explain why recent studies from Brazil found no correlation between PA management effectiveness scores and the reduction in fire occurrence[43] or habitat conversion.[44] Similarly, for PAs in Madagascar, no clear links were found between average management effectiveness scores and effectiveness in avoiding deforestation or between avoided deforestation and managers' perceptions of the PA outcome.[14]

Assessments of PA management effectiveness were originally developed to support adaptive management at the site or network level,[6] and they are usually completed over the course of a few days by local managers and partners and sometimes by representatives of local governments, local communities, or NGOs. More recently, however, assessments of PA management effectiveness have started to be used by funders for project evaluation purposes, whereby project performance is measured as change in the METT score, with the assumption that an increase in management effectiveness will affect the biological performance/effectiveness of PAs.[6] This of course gives local managers a high incentive to report positive changes over time. However, if respondents exaggerate management effectiveness in their PAs, this would make the findings of global surveys[37,39,45,46] of PA management effectiveness an even greater cause for concern.

In summary, there are global concerns about the resources available for PAs to manage pressures and report trends. However, even in cases where improvements in management have been reported, little is known about the causes or consequences of such improvements. Have the pressures changed? Have changes had an impact on ecological outcomes? Furthermore, in order to give policy-relevant recommendations, it is crucial to separate the part of management that can be influenced by managers at the local level from the aspects that will need to be addressed at higher levels of policy making and budgeting. This leads to considerations of the sociopolitical and economic settings in which PAs are established.

Governance, governance type, and quality of governance

PAs are not established and managed in a vacuum but within existing governance frames. Various institutional arrangements or governance systems have been examined in relation to social–ecological systems,[47] and there is a wealth of literature on the importance of governance in determining various aspects of conservation outcomes.[19,48–50] Governance concerns the structuring of authority and setting of rules, and thus refers to how power is structured and how institutions are built, as well as how different institutions interact with each other. There are different approaches to governing the resources of a PA, from more strict

protection to less-regulated extractive uses (PA management categories), and this can be done through different institutions, from top-down to bottom-up initiatives (PA governance type). Coarsely categorized, there are four types of PA governance: governance by government, shared governance, private governance, and governance by indigenous or local communities.[51] These are independent from, but can be analyzed in relation to, the PA management categories (e.g., IUCN categories I–VI related to the strictness of protection and level of resource use allowed).[15] We consider both the governance type and the management category as fitting into the *response* side of the DPSIR framework (Fig. 1), as the first deals with *who* governs and the second with *how* or for *what purpose* a PA is governed.

While, historically, PAs were often established and governed by governments, more recently there has been a massive upswing in community approaches to PA governance.[52] Evidence regarding how the governance type affects PA outcomes[13] and how the PA management categories relate to PA ecological effectiveness[12,27] appears inconclusive. Some studies point to strict protection being more effective than sustainable-use areas,[12] while others indicate the opposite.[27] The different outcomes are due to how effectiveness has been conceptualized, but differences between regions can also exist. Counterfactual studies (accounting for pressures) suggest that strictly PAs are more effective compared with sustainable-use areas.[13,14,53] However, under exceptionally high pressures, indigenous lands have been shown to outperform PAs.[13]

It therefore seems that the governance type or management category does not always explain differences in the ecological effectiveness of PAs. There are, however, other sociopolitical factors that should be accounted for, affecting both pressures and responses. The list is endless, including education, livelihood options, land tenure, the possibility to self-organize and affect decisions, and transparency in decision-making processes. The concept of quality of governance can be used as a proxy for this multitude of dynamic feedback mechanisms at all societal levels. For example, the contradictory evidence from the studies above could be explained by the overall quality of governance at the national level. This leads to questions such as whether a bottom-up governance type (e.g., community-managed areas) works better compared with a top-down governance type in a setting of weak governance and/or vice versa. This aspect of governance is, however, rarely investigated in the context of conservation effectiveness.

Our definition of *quality of governance* focuses on the general policy environment within which institutions are framed or arranged. In doing so, it mostly refers to the control of corruption and transparency, political stability, the rule of law, and government effectiveness but also aspects of equity and fairness.[54,55] As such, some level of strong governance is required to produce a sufficiently stable policy environment in which to start building the institutions that determine the governance of a specific activity. The concept of *good governance* appeared in the 1990s as a way to measure the quality of governance (Box 1), especially to inform decisions on where to focus development aid or business investments (Box 2). This link between the quality of governance and effectiveness in achieving outcomes makes it particularly relevant for conservation but is often neglected. From the conservation point of view, these conventional measures of governance quality at the national level (Table 1) have been criticized for being crucial for building a market economy, but not necessarily vital for successful conservation outcomes, where the quality of more specific environmental policies is viewed as more important.[56] This is, however, not always the case. We will next address the links between the quality of governance and different measures of conservation outcomes.

Linkages between governance and conservation outcomes

There have been attempts to link the quality of governance to the biodiversity state and PA outcome, finding that national corruption scores correlate with population trends of both the African elephant and black rhinoceros[57] as well as with forest fire reduction within PAs.[58] However, links between the quality of governance and conservation outcomes are complex. The problem is that the possible links span multiple levels and take place at different scales, and conflicting interests often exist between different actors within and between levels.[59–61] This means that different problems at different scales can drive the overall outcome in the same or in opposite directions (Table 2), with the

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Table 1. A selection of governance indicators and some of their key features

Name of indicator	Developed by	For whom	Aspects of governance	Scale	Since	How often	How many countries (and territories)	Subjective/ objective	Estimates of error
International Country Risk Guide	The PRS Group Inc.[a]	Clients for international business operations	22 variables in three subcategories of risk: political, financial, and economic	Global, per country	1980	Monthly	140	Partially objective	No
Freedom in the world	Freedom House[b]	Open	Freedom, political rights, and civil liberties	Global, per country	1972/1998	Yearly	192	Subjective	No
Corruption perceptions index	Transparency International[c]	Open	Corruption	Global, per country	1995	Yearly	176	Subjective	Yes
Country policy and institutions assessment	World Bank[d]	Aid allocation within the Bank	16 criteria grouped into 4 clusters: economic management, structural policies, policies for social inclusion and equity, and public sector management and institutions	Global, per country	1977	Yearly	77		
Worldwide governance indicators	The World Bank Institute[e]	Open	6 dimensions of governance: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption	Global, per country	1996	Biannually, nowadays yearly	212	Subjective	Yes
Ibrahim Index of African Governance	Mo Ibrahim Foundation[f]	Open	Safety and rule of law, participation and human rights, sustainable economic opportunity, human development	Africa, per country	2007	Yearly	52		Yes

[a]http://www.prsgroup.com
[b]http://www.freedomhouse.org/
[c]http://www.transparency.org/research/cpi/overview
[d]http://go.worldbank.org/EEAIU81ZG0
[e]http://www.govindicators.org
[f]http://www.moibrahimfoundation.org/iiag/

quality of governance potentially affecting the pressures and the responses in opposite directions: better quality can lead to greater pressures but more effective management. For example, governments that are less corrupt and have more efficient bureaucracies will produce more effective policies.[59] This will have positive effects on the governance of natural resources, such as forests, forest products, and biodiversity. It is also likely to improve management effectiveness and lessen the extent of illegal actions, such as poaching or extraction. However, corrupt countries are also less likely to attract foreign direct investments by multinational industries or invest in infrastructure development in rural areas,[60] slowing economic growth and sometimes reducing the pressure on the environment.[59]

The conservation impacts of the quality of governance on local peoples' livelihoods are similarly context specific, as reducing poverty can reduce the overexploitation of natural resources on a local scale,

Box 1: Measuring good governance

Different governance metrics have been developed to overcome the difficulty in finding suitable proxies for the quality of governance. Some of these address only one aspect of governance, such as corruption, while others incorporate many dimensions (Table 1). The different governance metrics used to measure governance quality are generally national-level metrics and measure people's perceptions.[79] This reliance on perception data has been criticized because it becomes a vicious circle, where respondents give low scores to countries that they know have performed poorly in past assessments.[80] Other criticisms of these metrics focus on the misapplication of data, both in relation to ranking countries or measuring trends on the basis of scores with levels of uncertainty and combining highly correlated factors into one good governance metric.[79] There is also the issue of whether national metrics can help us understand processes that occur at a more local scale. This is particularly relevant for understanding management effectiveness and requires an understanding of the number of levels at which the quality of governance affects conservation (Table 2 and Fig. 1). More local-level assessments have also been suggested, using key informant interviews and participatory methods to try to answer questions related to the design of a governance framework, but also how it performs and how it is perceived to perform.[81,82] Certainly, both types of governance quality measurement are needed from the PA perspective, especially as the local-level ones are more prone to addressing the equity and participatory aspects of governance quality.

It could be argued, however, that these scale issues also apply to business and development, and both these sectors use national-level metrics in decision making. For example, they are widely used by companies when making investments, and major development donors also use good governance metrics to allocate funds (see Ref. 83). Good governance metrics also appear to explain the pattern in global allocations of conservation funds.[18] Similarly, research studies that identify priority countries for conservation investment have also used national measures of governance quality[16,74,78] (see Table 1). More controversial are studies that investigate correlations between national-level metrics of governance quality and conservation outcomes.[57,58,84] However, there are two reasons for expecting national-level metrics to have some relevance. The first is that some metrics, such as bureaucratic quality and corruption, are strongly influenced by central government and will consequently be similar throughout a country. The second is that broad national metrics may detect trends that trickle down to local levels. For example, the change in presidential power after Madagascar's coup d'état in 2009 led to increased illegal logging[85] and increased poaching and declines in lemur populations in national parks.[86] The trade in tropical timber has been able to flourish owing to great uncertainty in the political future and also because of contradictory legislation.[85]

as people become less reliant on natural resources,[62] can have no impact if pressures are driven from outside,[63] or can increase overexploitation because people have more resources to invest in damaging activities, such as hunting with sophisticated weapons.[64] Similarly, the conservation outcomes of increased enforcement will not be positive if they damage links with PA neighbors or drive up the value of desired goods, such as rhino horn or ivory.[65–67]

The renewed and increasing attention that PA effectiveness and PA management effectiveness are receiving[5,6] calls for new assessments of the links between PAs and the quality of governance. We suggest doing this in the light of the framework proposed in Figure 1, as it allows the inference of some mechanisms that could explain the patterns observed. The quality of governance can affect *pressures* directly, it can affect management effectiveness (and the governance type and management category) and thus the *response*, but it only indirectly affects the *state/impact* through pressures and management effectiveness (Fig. 1A). Because of these complexities, in the following sections we summarize the evidence linking (1) governance and management effectiveness and (2) governance and PA effectiveness.

Links between governance and management effectiveness

Good governance has previously been linked to management effectiveness.[51,68] Lockwood[68] suggested seven principles of good governance in relation to PAs—legitimacy, transparency, accountability, inclusiveness, fairness, connectivity, and resilience—and how the performance outcome of

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Box 2: Governance and aid

In general, richer countries have better governance and poorer countries suffer most from weak governance.[87] This is why the importance of governance quality in achieving development outcomes has been an extended debate in the development sector. Studies originally suggested that aid will only lead to development in better governed countries,[88–90] on the basis of the argument that better-governed countries use aid money more effectively and therefore achieve the expected development outcomes. This result has since been disputed, with some claiming that aid is never effective[91] and others claiming that aid is effective irrespective of the governance setting.[92] Despite this controversy, aid effectiveness, and all the policy implications that it comes with, is now recognized as key to achieving development goals such as the Millennium Development Goals.[93] The increasing criticism that donor funds have not always been effective has led to debate about whether selectivity or conditionality should be used in allocating the aid. Conditionality involves setting policy conditions for aid[94] so that recipient countries have to carry out certain policies or reforms in order to receive the aid (*ex ante*). Selectivity, on the other hand, involves choosing which countries will receive aid, and is therefore more a mechanism for rewarding good performance: a country first has to perform and will only then qualify for aid (*ex post*). Proponents argue that selectivity rewards those who deserve it, who then serve as role models and motivators for states that are not selected.

these could be measured. He also presented a framework for how governance effectiveness is linked to the PA management effectiveness framework proposed by Hockings *et al.*,[7] recognizing that effective governance is a prerequisite of effective management. Suggested linkages include corrupt managers allowing law breaking or poor enforcement leaving illegal activity undetected. Furthermore, unstable or weak governance might affect budgets, but weak governance may also make the conservation process less efficient, as time and money are lost through corruption and dealing with inefficient bureaucracies.[69]

While the reasoning seems intuitive, the evidence is less straightforward. The fact that, for example, PA management effectiveness scores at the

Table 2. Examples of sociopolitical constraints and limitations for conservation at different levels

Level	Example	Actors involved	Types of constraint/ limitation
Global	International environmental agreements and conventions	Top-level politicians, state heads, and influential lobbying organizations	Political rhetoric, lack of political will, lack of funding
National	National state machinery, judicial institutions, and conservation laws	Government, national lobbying organizations, NGOs, ministries	"Paper parks," "paper laws," lack of funding allocated for implementation
Regional	Regional bureaucracy, implementation stage	Civil servants, officials	Lack of decision-making authority, lack of implementation, lack of resources, lack of motivation, lack of feeling of responsibility, bribery, lack of knowledge, lack of money
Local	Local protected area	Managers, rangers, local people using PA, tourists, researchers	Bribes, illegal actions, poaching, logging, over-exploitation, lack of knowledge, conflicts, lack of funding

national level are correlated with the Human Development Index[39] gives an indication of how management effectiveness varies globally, with developing countries showing lower management effectiveness. Studies have linked development to the quality of governance (see Box 2). However, the fact that management effectiveness has been reported to improve with time gives cause for concern. In Madagascar, for example, management effectiveness appears to have increased, while the quality of governance has substantially decreased in connection with a political crisis.[14] In relation to this, it is important to recognize that time lags might be involved, that the adaptive idea of the PAME actually does work and strengthens the local institutions, even under more challenging national governance periods, or simply that the management effectiveness data are biased. In conclusion, studies are lacking and inference is difficult, and while indicators of good governance exist for most nations (Table 1), assessments of management effectiveness tend to be carried out at the local PA level. Thus, while national governance indicators could allow for global comparisons and an analysis of the role of governance quality in PA management effectiveness, there is a lack of understanding of how governance quality at such a level is linked to variation in the quality of governance at subnational or local management levels.

Links between governance and pressures (and hence PA effectiveness)

The fact that better management effectiveness does not lead to improvements in PA effectiveness[43,44] might indicate that pressures are what largely determine the conservation outcomes of PAs. This seems plausible, as a whole range of factors are beyond the reach of local managers and are more related to global drivers of change. For example, drivers of deforestation are usually analyzed though a framework of broad underlying driving forces, such as demographic, economic, and technological factors, but also governance factors and cultural aspects,[70] all affecting proximate causes, such as infrastructure development, agricultural expansion, and wood extraction.[70]

Governance may be a driver in itself or a regulator of other drivers and thus pressures. There is some indicative evidence for linkages between governance quality and pressures. For example, it has been shown that the effect of agricultural intensification on the expansion of agriculture is dependent on the type of governance: high scores on conventional governance metrics (Table 1) are associated with the expansion of agriculture, and hence with increased land conversion pressures. However, a high score for environmental governance quality is linked to the contraction of agriculture and lower pressures.[56] As such, it appears that good governance might be a prerequisite for economic growth (see Box 2), but this might only increase the pressures on natural resources, and, to curb these, a high quality of environmental governance is particularly needed.[56]

Evidence to support the links from national policies or the quality of governance through the changes in pressure to PA effectiveness has only very recently started to accumulate. In Brazil, increased efforts by the government to control deforestation since around 2005 through different policy changes such as certification and market access[71] have clearly reduced the pressure on PAs.[13] Owing to the counterfactual nature of the study (see section "Misleading effectiveness outcomes"), this was reflected in the decreased effectiveness of PAs (in avoiding forest loss) in the second time period from 2006 to 2010 compared with the previous period from 2001 to 2005, meaning that lower pressures to mitigate deforestation have led to lower perceived effectiveness.

A few aspects emerge from these reflections. First, when discussing the role of governance quality in conservation, we need more sophisticated models that allow for complexities and context-specific factors. Second, in interpreting effectiveness measures from counterfactual approaches, it is important to consider the effect of changes in pressures (and hence governance) in addition to the management aspects. However, if our research seeks to offer insights that improve management effectiveness and PA conservation outcomes, we need to make practical and politically acceptable recommendations. Thus, there is little point in recommending broad-scale changes that are beyond the power and remit of the conservation sector. Given the complexities in assessing the effectiveness of PAs and the limited evidence for linkages between pressures, responses, and impacts, how should we proceed with goals, such as expanding the PA network? How should priorities be set, and how should the quality of governance be accounted for? We explore these questions in the following section.

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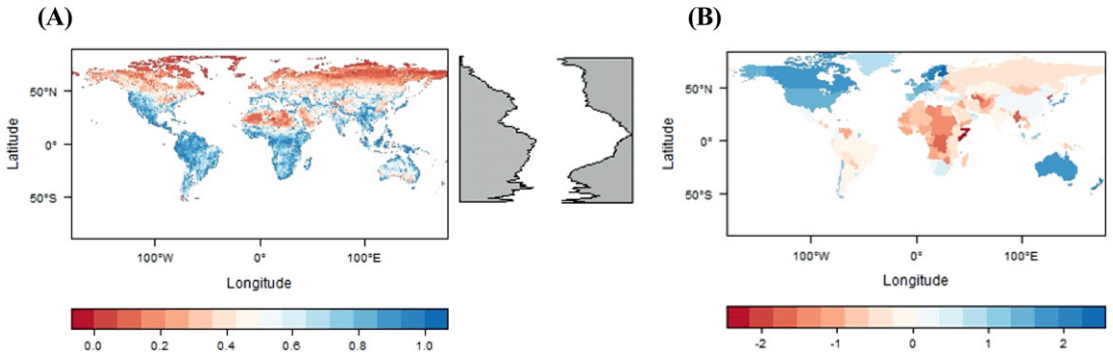

Figure 2. The spatial alignment of (A) global mammal conservation priorities with (B) government effectiveness. (A) The darker the blue, the higher the priority for a cell in a complementarity-based additive benefit function (abf) prioritization with Zonation (modified from Ref. 16, using abf instead of core-area Zonation (caz) as the cell removal rule in Zonation[95]). (B) The darker the blue, the more effective the government (data are from the Worldwide Governance Indicators project 2012 (http://www.govindicators.org)). The gray bars between show that priority cells for mammals peak around the equator, but this is also where governments are least effective.

Prioritizing action

One important way in which research on the quality of governance can inform conservation decisions is in prioritizing conservation action. It is recognized that priority regions for biodiversity conservation are often found in weakly governed parts of the world (Fig. 2),[16] posing a clear challenge for conservation. Governance could or should influence two aspects of conservation planning: where to establish new PAs and where and how to allocate funds for the management of existing PAs. The field of systematic conservation planning has mostly centered on the former, with a few recent exercises addressing governance in global priority setting.[16,72–74] For example, O'Connor *et al.*[74] presented the first return on investment framework for how governance quality could be incorporated into conservation priority setting. They explored different biodiversity-value and sociopolitical-factor weightings and found that governance quality could alter global conservation priorities.

However, one problem with incorporating good governance into conservation prioritization frameworks is how much weight it should be given compared with other factors, such as economic costs or aspects of spatial design. Research that has specifically investigated this problem has revealed enormous variation between regions prioritized according to the relative weightings, meaning, for instance, that if corruption increases management costs, conservation budgets will be more effectively allocated to countries with better governance.[16] Similarly, others have found that areas with the highest performance certainty (with a high likelihood that investments would lead to effective conservation accounting for governance aspects) were prioritized over areas with higher biodiversity values or higher threats.[17,73] In any case, all these prioritization studies appear to conclude that global conservation should invest in nations with a high quality of governance.[16,73–75] However, should only sites with a high quality of governance be allocated funding, or could conservationists aim for effective outcomes by the alternative strategy of setting policy conditions for their funding? This debate between selectivity and conditionality, although common and heated in other fields (Box 2), has remained largely ignored in conservation. If conditionality is preferred, we lack any formal guidance on how this should be achieved in the conservation sector (Fig. 1B); if selectivity is preferred, whether based on national governance indicators or improved models of cost-efficiency under different governance contexts, important biodiversity may remain completely unprotected.[16] Here, the fields of development aid and biodiversity conservation differ: strict selectivity for biodiversity is problematic as (1) there are successful conservation projects in countries with weak governance and (2) leaving countries with weak governance without conservation funding will compromise the number of species that can be saved. This becomes clear when examining the spatial alignment of conservation

priorities with governance factors (Fig. 2), and especially when considering that these regions are especially vulnerable, meaning that the levels of threat are high[76] and biodiversity is often irreplaceable.[77]

In prioritizing actions for conservation, the type of response will depend on whether a proactive or reactive approach is favoured,[76] and we clarify how this links to the selectivity/conditionality debate in our framework (Fig. 1B). Reactive approaches address high-pressure situations, with an imminent need to act in order to avoid the loss of biodiversity. Effective conservation outcomes in such settings require a selective approach, prioritizing areas with a high quality of governance. Alternatively, if conservation targets require that an area of weak governance is chosen, it could come with conditionalities to improve the governance situation, such as focusing on the improvement of PA management capacity or finding the most appropriate PA governance type for the challenging setting. Similar conditionality and selectivity approaches apply to proactive prioritizations, whereby conservation investments can be made in view of forecasts of threat (i.e., prioritizing areas of low threat now but with a foreseen increase in threat in the future). Low pressure, good governance areas could selectively be chosen as potentially effective, whereas low pressure, weak governance areas should follow a conditional approach to become effective.

The field of conservation planning thus has only a few studies and approaches aiming at including the quality of governance in prioritization assessments, and rather coarse measures of governance quality, such as WGI data, have often been used.[16,78] The question of how weak governance is linked to long-term conservation outcomes measured through ecological effectiveness remains unresolved, and therefore also leaves scope for improvements in how to account for the likelihood of success in allocating funds.

Concluding remarks

PAs are not fully effective at stopping threats, but do seem to mitigate some pressures, and, compared with the counterfactual of no protection, PAs have made a difference in saving biodiversity. Assessing their effectiveness is not trivial, however, and requires a multifaceted approach and an understanding of their contextual setting. Governance certainly plays a role at several stages, but the link between PA effectiveness and the quality of governance is rarely made, not even correlatively, and even less frequently identifies cause and effect. This is something that requires greater consideration, especially since the topic has received considerable attention in other research fields, such as development aid. While the quality of governance should already be included as a consideration in conservation planning, and we suggest alternatives for doing so, more effective conservation plans could be achieved by furthering our causal understanding of the role of quality of governance in all phases of the conservation effectiveness framework. Nonetheless, we wish to highlight the links to the conditionality/selectivity debate in allocating development aid, but emphasize that the irreplaceability aspect (i.e., species being endemic to a specific region) makes the conservation setting less straightforward.

We acknowledge that our exploration and suggestions do not include all possible aspects related to the topic, such as local-level livelihoods, land tenure and poverty concerns, common pool governance systems, and the links between appropriate types of governance for a specific setting. Nevertheless, we hope our framework can serve as a useful basis for addressing the important issue of governance quality in conservation and encourage contributions linking our proposed framework to other or different aspects of governance, especially the dynamics between governance quality and PA governance type and how this might affect the conservation outcome but also the relationship between general governance quality and specific environmental governance quality.

In conclusion, in this review, we have highlighted that (1) the links between governance, management effectiveness, and ecological effectiveness need to be clarified; (2) incorporating aspects of governance (both type and quality) into the framing of effectiveness concepts can help to explain some of the contradictory evidence in relation to PA effectiveness and PA management effectiveness; and hence (3) the quality of governance (at least at national scales) needs to be incorporated into conservation planning.

Through our review of the existing literature, we have also identified the following list of what we believe are the most pressing issues that call for urgent research and action:

- More studies are needed to address the linkages between management effectiveness and PA effectiveness at the individual PA level.
- Links between management effectiveness scores and the quality of governance at the global level need to be examined.
- Links between general governance quality and specific environmental governance quality and how they relate to PAs require investigation.
- Considerations of "policy leakage" are needed (i.e., how policies in a well-governed country/region can lead to negative conservation outcomes in countries with weak governance).
- Potential time lags in the assessments of all of the above-mentioned need to be considered.

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Conflicts of interest

The authors declare no conflicts of interest.

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