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REPORT

Philippine protected areas are not meeting the biodiversity coverage and management effectiveness requirements of Aichi Target 11

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Abstract Aichi Target 11 of the Convention on Biological Diversity urges, *inter alia*, that nations protect at least 17 % of their land, and that protection is effective and targets areas of importance for biodiversity. Five years before reporting on Aichi targets is due, we assessed the Philippines' current protected area system for biodiversity coverage, appropriateness of management regimes and capacity to deliver protection. Although protected estate already covers 11 % of the Philippines' land area, 64 % of its key biodiversity areas (KBAs) remain unprotected. Few protected areas have appropriate management and governance infrastructures, funding streams, management plans and capacity, and a serious mismatch exists between protected area land zonation regimes and conservation needs of key species. For the Philippines to meet the biodiversity coverage and management effectiveness elements of Aichi Target 11, protected area and KBA boundaries should be aligned, management systems reformed to pursue biodiversity-led targets and effective management capacity created.

Keywords Birds · CBD · Key biodiversity areas · Management plans · Philippines

INTRODUCTION

The boom in the number of protected areas (PAs) around the world (Soutullo 2010) is widely seen as a major contribution to global biodiversity conservation efforts. How well they are achieving this is not clear, however, owing in part to the diversity of ways in which the contribution of PAs to biodiversity conservation is measured (e.g. Rodrigues et al. 2004; Leverington et al. 2010; Joppa and Pfaff 2011; Butchart et al. 2012; Clark et al. 2013). The need for indicators of PA performance became acute in 2010, when the 193 Parties to the Convention on Biological Diversity (CBD) included an ambitious target for global coverage and management effectiveness of PAs (Aichi Target 11: https://www.cbd.int/sp/) in its 2011–2020 Strategic Plan.

The target involves a complex range of measures for PAs, relating to their extent, representativeness, connectivity, management effectiveness, equitability and integration into wider land- and seascapes (Woodley et al. 2012). The complexity of the target reflects the range of ecological and societal demands now placed on PAs and the political challenges of balancing these aspirations. This, together with the variety of approaches that have been used to define the location and configuration of PAs, means that adequately assessing their contribution towards this target, and thus biodiversity conservation, is a significant challenge. The CBD-mandated Biodiversity Indicators Partnership (BIP) has identified three measures by which to monitor progress towards this target: coverage, overlap with biodiversity, and management effectiveness (http://www.bipindicators.net). While updated analyses of progress on coverage and overlap with biodiversity were promised for 2014 (see Butchart et al. 2015), progress on assessments of effectiveness was left as funding dependent. This was unfortunate, as effectiveness is arguably the hardest to measure yet the most important to achieve: a PA network that satisfies criteria for coverage and biodiversity overlap will still fail if it is inadequately managed. As PA networks are typically managed at the national level, it is appropriate to find ways of assessing the contribution of national networks to Aichi target 11 and we do so here using the Philippines as a case study.

The Philippines (4°40′–21°10′N 116°40′–126°34′E) comprises more than 7100 islands covering c.300 000 km^2. The country is of crucial importance to global biodiversity because of its exceptional levels of narrow endemism, both terrestrial and marine (Myers et al. 2000; Carpenter and Springer 2005; Posa et al. 2008). However, it also suffers from problems relating to an impoverished, large and rapidly increasing human population (c.100 million in mid-2014 or 334 people/km^2: http://www.worldometers.info/world-population/philippines-population/), a gross loss of forest cover especially at lower elevations, and many unsustainable land-use practices (e.g. Sodhi et al. 2010). These factors have resulted in the Philippines supporting by far the largest number (36) of 'Critically Endangered' and 'Endangered' (sensu IUCN) endemic bird species of any country in the world proportionate to its size.

The conservation of seriously threatened taxa requires a network of effective PAs. PAs were first established in the Philippines in the 1930s during American occupation, and followed the Yellowstone National Park model (Pyare and Berger 2003). However, they had no management systems and were considered 'paper parks' until the late-1980s (DENR/UNEP 1997), when the Protected Areas and Wildlife Bureau (PAWB; now Biodiversity Management Bureau, BMB) was created under the Department of Environment and Natural Resources (DENR) to consolidate government efforts to conserve natural biological resources through the establishment of a protected areas system. By 1992, the National Integrated Protected Areas System law (NIPAS) was passed, encompassing 203 terrestrial protected areas.

Two decades after NIPAS, the Philippine National Plan for Protected Areas submitted to CBD stated that, in 2010, the number of protected areas (hereafter PAs) in the Philippines had risen to 240, covering 13.5 % of the land area (40 587 km^2) and 1.5 % of territorial waters (Anon. 2012). However, the presence in the country of 36 CR and EN bird endemics, whose IUCN status is based on significant actual or potential declines in numbers, suggests that its PA network represents an incomplete response to the halting of species extinctions required by Aichi Target 12, because they are failing to address the drivers of habitat loss either outside or inside the PA, or both. In the past 30 years, new evidence plus increasingly sophisticated analyses of biodiversity distributions (e.g. Mallari et al. 2001; Ong et al. 2002) have identified new or better places to establish PAs, revealing a growing mismatch between existing PAs and key sites for biodiversity. Moreover, even well-positioned PAs appear to lack the capacity to manage their biodiversity adequately (e.g. van der Ploeg et al. 2011). Here, by gauging the degree of mismatch between the current network of PAs and their objectives as set-asides for biodiversity conservation, we seek to identify the remedies that government could and should apply. We do this by combining information from various sources to answer clearly articulated questions in a way that should be repeatable in many countries.

MATERIALS AND METHODS

The official list of 240 (170 terrestrial + 70 marine) PAs was obtained from PAWB (version June 2012). For each PA, this database listed its (1) name, (2) location, (3) area coverage, (4) proclamation date, (5) PA category (based on NIPAS) vis-à-vis IUCN category (I–VI), (6) management status (existence of management plan and PA management board) and (7) total income generated. This was then compared with a spatially explicit database on Philippine biodiversity, incorporating data on Important Bird Areas (IBAs; Mallari et al. 2001) and key biodiversity areas (KBAs; Conservation International Philippines, DENR & Haribon 2006) and also with the distribution of Endemic Bird Areas (EBAs; Stattersfield et al. 1998). The criteria used to identify these KBAs have been further developed into a global standard, and consultation is underway prior to publication by IUCN (www.iucn.org/about/work/programmes/gpap_home/gpap_biodiversity/gpap_wcpabiodiv/gpap_pabiodiv/key_biodiversity_areas). We then assessed the mismatch of key biodiversity distribution and PA coverage and capacity by answering four questions, each of which was carefully designed to generate crucial measurements relating to position, process, personnel and practice in a simple, replicable manner.

1. *Are PAs appropriately positioned to protect areas of particular importance for biodiversity?* To answer this, we compared the coverage of KBAs and Endemic Bird Areas (EBAs) with that of the current coverage of the PA network in the Philippines (on the reasonable assumption that PAs represent the most effective tool for conserving key biodiversity worldwide). KBAs have been identified in the Philippines on the basis of the distribution of vulnerable and irreplaceable biodiversity, which we use here as a measure of 'particular biodiversity importance', as required by Aichi target 11.
2. *Is the land zonation system used in PAs, where present, appropriate to protect key biodiversity?* To address this, we selected five exemplar PAs from Luzon (Northern Sierra Madre Natural Park), Mindoro (Mt Iglit-Baco National Park), Negros (Mt Kanlaon Natural Park), Palawan (Puerto Princesa Subterranean River National Park; hereafter PPSRNP) and Mindanao (Mt Apo National Park). These exemplars were chosen because of their size and importance in conserving Philippine biodiversity (each representing a distinct biogeographical region and, in terms of wildlife, arguably the most highly regarded PA on their respective islands), and because they have completed the full cycle of the PA process defined under NIPAS law. We compared the coverage of the various land management regimes with the

conservation requirements of key birds occurring within them, examining the altitudes of core/strictly protected zones and multiple-use zones.

3. *Are management systems in place to allow PAs to function effectively?* To test this, we calculated the proportions of the 240 PAs that have management plans, approval by Congress, operational management boards and dedicated funding.
4. *Is there adequate capacity in the current PA system to implement and monitor biodiversity conservation management?* To answer this, we analysed the staff complement, budget allocations and management/monitoring activities of the five exemplar PAs to assess their capacity to manage the units.

RESULTS

1. *Are PAs appropriately positioned to protect areas of particular importance for biodiversity?* No. Within the Philippines, an estimated 106 552 km^2 (70 850 km^2 terrestrial only, 19 601 km^2 marine only) have been categorised as KBAs (Ambal et al. 2012). There are 128 KBAs in Philippines, 117 of which are also IBAs (Mallari et al. 2001). If complete KBA coverage were used as the primary criterion for establishing PAs, coverage of PAs in the Philippines would be c.27 % of total land area, i.e. more than double the current area under protection. However, there is only a 36 % overlap between terrestrial KBAs and established PAs (Table 1), indicating a massive 64 % shortfall. None of the Philippines' ten Endemic Bird Areas (EBA) has more than half its land area covered by PAs. This shortfall is particularly apparent in small islands like Siquijor (100 % unprotected), the Sulus (98 %), Batanes/Babuyanes and Greater Negros/Panay (both >75 % unprotected) (Table 2). These islands contain many avian and non-avian endemics and large numbers of threatened birds within the highest threat categories (Mallari et al. 2001; Ong et al. 2002).
2. *Is the land zonation system used in PAs, where present, appropriate to protect key biodiversity?* No. Much of the altitudinal range of most of the 40 IUCN threatened bird species known from the five exemplar Philippines PAs falls below 1000 m (Table 3). Within these sites, only seven of these 40 species have known upper ranges at 1500 m or higher, while 24 have only been found at 1000 m or lower. Twenty-nine species are 'highly dependent' on forest, and only one is classed as having low forest dependence. Twenty-four (60 %) have high forest dependence, and are known to occur only from 1500 m downwards.

   The proportion of land below 1000 m differs widely across the five PAs (Table 4). It is very low in Sierra Madre (11 %) and low in PPSRNP (19 %), moderate in Mt Iglit-Baco (34 %) and Mt Apo (44 %), and >50 % only in Kanlaon, although all this lower-lying land is designated for 'multiple use' and is therefore far from secure in biodiversity terms. Areas of Core Zone or Strict Protection Zone above 1000 m were substantial in all PAs, but the proportion of land designated SPZ below 1000 m averaged just 17 % and was only 10 % in Sierra Madre and actually 0 % at Kanlaon.
3. *Are management systems in place to allow PAs to function effectively?* No. Although 85 % of the Philippines' 240 PAs have a Presidential Proclamation giving them legal status, over 40 % lack even an outline management plan, derived from a very cursory appraisal of the site through a process called the Protected Area Suitability Analysis (PASA). Only 15 % of all PAs have revised or finalised management plans based on ampler site inventory and mapping work (Table 2).

   More PAs have protected area management boards (PAMBs) than finalised management plans. Consequently, many PAMBs have no agreed/documented basis for doing the job for which they were established. Other PAs have management plans but no management authority (PAMB), structure or budget to implement them.
4. *Is there adequate capacity in the current PA system to implement and monitor biodiversity conservation management?* No. Budgets differed greatly across the five PAs, with one hundred-fold differences across PAs in dollars available per hectare (Table 5). Likewise, levels of staffing differed widely, with the huge Sierra Madre having no permanent staff and PPSRNP being the only PA employing a permanent terrestrial biologist. While all five PAs had baseline species inventories, only two had bespoke studies of key wildlife. Finally, while three of the five PAs had active 'biodiversity monitoring schemes' (BMS; Danielsen et al. 2005), none had actually analysed these regularly collected data (only one had the capacity, in the form of a biologist, to undertake such an analysis) and therefore had achieved no monitoring and were in no position to adapt their management according to the available evidence.

DISCUSSION

Around 11 % of the Philippines' land area is currently designated as PAs, a figure exceeding that for many other biodiversity-rich countries of the world (Jenkins and Joppa

Table 1 Distribution of existing terrestrial protected areas in relation to terrestrial key biodiversity areas (KBAs) in the Philippines. Data are split into the nation's ten Endemic Bird Areas (Stattersfield et al. 1998). *N* Number of KBAs and number of protected areas in each region

Endemic Bird Area (EBA)	Target: area covered by terrestrial KBA (km^2) with corresponding number of KBAs	Total land area (% coverage of KBA)	Actual: area protected with corresponding number of PAs	% shortfall in land area needing protection
Batanes and Babuyanes	801 ($N = 2$)	822 (97 %)	201 ($N = 1$)	75
Greater Luzon	34 095 ($N = 34$)	107 912 (32 %)	14 911 ($N = 18$)	56
Greater Mindoro	2119 ($N = 8$)	10 190 (21 %)	894 ($N = 2$)	58
Greater Palawan	9552 ($N = 15$)	13 719 (70 %)	3396 ($N = 7$)	64
Sibuyan, Romblon, Tablas	349 ($N = 4$)	1356 (26 %)	153 ($N = 1$)	56
Greater Negros/ Panay	4942 ($N = 8$)	25 500 (19 %)	925 ($N = 2$)	81
Cebu	634 ($N = 5$)	5088 (13 %)	300 ($N = 2$)	53
Siquijor	17.8 ($N = 1$)	344 (5 %)	0	100
Greater Mindanao	26 263 ($N = 36$)	123 464 (21 %)	7947 ($N = 14$)	70
Greater Sulu	1454 ($N = 4$)	1679 (87 %)	33 ($N = 1$)	98
TOTAL	80 227 ($N = 117$)		28 758 ($N = 48$)	64

Table 2 Numbers and proportions of Philippine protected areas (PAs) which have management plans, approval by Congress, operating Protected Area Management Boards (PAMBs) and trust funds in place to allot monies for their running. PASA is Protected Areas Suitability Analysis

	Total	Terrestrial	Marine
Total number of PAs	240	170	70
PAs assessed (PASA) with management plans (initial)	142 (59 %)	108 (64 %)	34 (49 %)
PAs with (initial) management plan with a PAMB	111(46 %)	80 (47 %)	31 (44 %)
PAs assessed (PASA) with management plans (final)	36 (15 %)	29 (17 %)	7 (10 %)
PAs with (final) management plan and PAMB	36 (15 %)	29 (17 %)	7 (10 %)
Approved by Congress	27 (11 %)	24 (14 %)	3 (4 %)
Proclaimed by President	205 (85 %)	147 (86 %)	58 (83 %)
PAMB operating (total)	154 (64 %)	118 (69 %)	36 (51 %)
PAMB operating with no management plan	7 (3 %)	6 (4 %)	1 (2 %)
PAs with no management plans and no PAMB	58 (24 %)	25 (15 %)	33 (47 %)
Trust fund in place	85 (35 %)	66 (39 %)	19 (27 %)

2009; Beresford et al. 2011). It represents a substantial commitment to conservation for a developing country with huge stresses on its land. It is important to acknowledge that, after a period in the 1970s and 1980s when logging was rampant inside PAs (Myers 1988), PA management in the Philippines has greatly improved in recent years (Posa et al. 2008), although a recent assessment still describes the state of PA management in the country as 'poor' (Guiang and Braganza 2014). Nevertheless, Aichi Targets 11 on PAs, and 12 on species extinctions, inevitably imply that all Parties must make additions and alterations to their PA networks. Our analysis, with negative responses to each of our four questions, reveals just how extensive these additions and alterations need to be in the Philippines, which is underperforming in all three indicators currently used to measure progress towards Aichi Target 11.

As noted in a parallel study, the many and serious deficiencies in PA management in the Philippines are being

Table 3 Altitudinal preferences of threatened bird species in five exemplar PAs in the Philippines. *RL* Red List category of threat (*CR* critically endangered, *EN* endangered, *VU* vulnerable). *FD* Level of forest dependency (taken from BirdLife Datazone accessed 8/12/14). *S* Source. *Short dash* (–) No specific lower limit recorded. *NSMNP* Northern Sierra Madre Natural Park. *PPSRNP* Puerto Princesa Subterranean River National Park. *1* Collar et al. (1999). *2* Mallari et al. (2001). *3* BirdLife Datazone entry. 'Median upper range taken' = observer gave range of elevations for the record. Unrepeated record of Negros striped-babbler (*Stachyris* [*Zosterornis*] *nigrorum*) from Mt Kanlaon omitted here. Taxonomy follows BirdLife International (2012); order of species alphabetical by genus name

Park	Scientific name	RL	Lower	Upper	FD	Comment	S
NSMNP	*Bubo philippensis*	VU	–	400	High		1
	Ceyx melanurus	VU	–	750	High		1
	Ducula carola	VU	150	2100	High	Elevations from elsewhere on Luzon, most <1000 m; altitudinal migrant	1
	Erythrura viridifacies	VU	50	1500	Low	Most records 750–1000 m; irrupts into lowlands	1
	Hypothymis coelestis	VU	150	750	Medium		1
	Muscicapa randi	VU	300	1050	High	Upper limit was migrant at Dalton Pass	1, 2
	Nisaetus philippensis	VU	300	1050	High		1
	Oriolus isabellae	CR	50	440	High		1
	Pithecophaga jefferyi	CR	50	1200	High	Lower elevation inferred from Dinapigue record; Cetaceo record at 1500 m anomalous	1
	Pitta kochi	VU	360	2200	Medium		1
	Prioniturus luconensis	VU	300	700	Medium		1
	Ptilinopus marchei	VU	850	1500	High		1
	Rhinomyias insignis	VU	950	2400	High	950 m is for only site in/near NSMNP	1,2
	Robsonius rabori	VU	0	1300	High		3
	Zoothera cinerea	VU	400	1100	Medium		1
Iglit-Baco	*Centropus steerii*	CR	–	760	High		1
	Coracina mindanensis	VU	0	1000	Medium	'Great majority of records well below 1000 m'	1
	Dicaeum retrocinctum	VU	–	1000	Medium	Once in montane forest at 1200 m	1
	Ducula mindorensis	EN	700	1800	High	Once commonest at 700 m	1
	Gallicolumba platenae	CR	30	575	High		1
	Penelopides mindorensis	EN	15	900	High	'Rarely to 1000 m' (no specific evidence)	1
Kanlaon	*Aceros waldeni*	CR	300	950	High		1
	Coracina ostenta		–	1100	High	Range up to 2150 m discounted	1
	Dasycrotapha speciosa	EN	–	1180	High		1
	Dicaeum haematostictum	VU	0	1000	Medium		1
	Nisaetus philippensis	VU	900	1000	Medium	Figure of 1290 m now doubted	1
	Penelopides panini	EN	60	1100	High		1
	Ptilinopus arcanus	CR	–	1100	High	Speculated a lowland species	1
	Rhinomyias albigularis	EN	300	1200	Medium	Median upper range taken	1
	Todiramphus winchelli	VU	0	600	High	Only 600 m recorded on Negros (see below)	1
PPSRNP	*Anthracoceros marchei*	VU	0	900	High		1
	Ficedula platenae	VU	50	650	High		1
	Polyplectron napoleonis	VU	0	800	High		1
	Prioniturus platenae	VU	0	300	Medium		1
	Ptilocichla falcata	VU	0	760	High		1

Table 3 continued

Park	Scientific name	RL	Lower	Upper	FD	Comment	S
Mt Apo	*Actenoides hombroni*	VU	100	2400	High	"Generally above 1000 m"	1
	Alcedo argentata	VU	500	940	High	One record 1120–1250 m	1
	Bubo philippensis	VU			High	No data, but 0–400 m Luzon, 750–1250 m Leyte	1
	Coracina mindanensis	VU	–	1000	Medium	'Great majority of records well below 1000 m'	1
	Ducula carola	VU	0	2400	High	Mt Apo at 2400 m once; generally 'bird of lower levels'; altitudinal migrant	1
	Eurylaimus steerii	VU	100	<1000	Medium	One anomalous record 1200 m; other records 'well below' 1000 m	1
	Ficedula basilanica	VU	150	1000	Medium	Records from 1200 m withdrawn	1
	Nisaetus philippensis	VU	300	1000	Medium	Published upper record 600 m, but record from Sitio Siete taken as c.1000 m	1
	Otus gurneyi	VU	60	1300	High		1
	Phapitreron brunneiceps	VU	150	1350	High	Median upper range taken	1
	Pithecophaga jefferyi	CR	100	1200	High	100 inferred from Luhan record (coast)	1
	Todiramphus winchelli	VU	0	1000	High	Single record from Apo dates back to 1882	1

Table 4 Areas (km^2) within Northern Sierra Madre National Park (Luzon), Mt Iglit-Baco (Mindoro), Mt Kanlaon (Negros), PPSRNP (Palawan) and Mt Apo (Mindanao) below and above 1000 m a.s.l. and conservation area management zonation for these areas

	Area < 1000 m	Area > 1000 m
Northern Sierra Madre (Luzon)		
Core zone or strict protection zone	304.3 (10 %)	2182 (71 %)
Multiple-use zone	0.3 (<1 %)	600.3 (19 %)
Mt Iglit-Baco (Mindoro)		
Core zone or strict protection zone	382.7 (28 %)	294.3 (36 %)
Multiple-use zone	87.8 (6 %)	403.3 (30 %)
Mt Kanlaon (Negros)		
Core zone or strict protection zone	0 (0 %)	93.2 (41 %)
Multiple-use zone	136.1 (59 %)	0
PPSRNP (Palawan)		
Core zone or strict protection zone	48.1 (19 %)	137.2 (71 %)
Multiple-use zone	0	20.7 (10 %)
Mt Apo (Mindanao)		
Core zone or strict protection zone	195.8 (29 %)	204.2 (32 %)
Multiple-use zone	92.2 (15 %)	157.0 (24 %)

recognised and remedied, at least in some PAs, through new practices that clarify roles and bind in more stakeholders (Guiang and Braganza 2014). Encouragingly, the Philippine government is seeking to improve the PA system by crafting a Protected Areas Masterplan. This represents a one-off opportunity for bilateral and multilateral funding mechanisms to support a complete system overhaul and upgrade, and for the scientific community to lend technical support and engage with government partners. Moreover, since the 1990s PAWB (now BMB) has been making creditable efforts to address the shortcomings of the PA system, as indicated in its recently initiated 'New Conservation Areas in the Philippines Project' (www.newcapp.org). Nevertheless, the urgency of the situation is extreme: at the time of writing, the deadline for the Aichi Targets is only 5 years away. Below, we offer our judgement on the most appropriate remedial actions, however radical or problematic these may appear, and hope this may be a template for all countries as they work towards meeting Aichi Target 11.

Table 5 Capacity within key Philippine PAs to undertake key conservation management tasks

	Northern Sierra Madre	Iglit-Baco	Kanlaon	PPSRNP	Mt Apo
Total land area (km^2)	3087	1168	229	206	649
Annual budget (US$1000s)	4.5	110	227	170	6.6
Budget per ha (US$)	0.015	0.94	9.9	8.3	0.10
Number of permanent staff	0	30	25	45	10
Biologists employed	No	No	No	Yes	No
Foresters employed	No	Yes	Yes	Yes	Yes
PAMB in place	Yes	Yes	Yes	Yes	Yes
METT Score[a]	60 %	None	65 %	None	64 %
Baseline species inventories	Yes	Yes	Yes	Yes	Yes
Focal study of key species	No	Yes[b]	No	Yes[c]	No
BMS undertaken[d]	Yes	No	Yes	Yes	No
BMS data analysed	No	No	No	No	No

[a] Management effectiveness tracking tool (Stolton et al. 2003)

[b] Research on the Mindoro endemic and 'Endangered' tamaraw (*Bubalus mindorensis*)

[c] Mallari et al. (2011)

[d] Biodiversity monitoring scheme (Danielsen et al. 2005)

Align protected area placement with key biodiversity areas

Governments have often established PAs in relatively unimportant ('rock and ice') locations for biodiversity or economic development (e.g. Scott et al. 2001; Joppa and Pfaff 2009). In the Philippines, the mere 36 % overlap between established PAs and terrestrial KBAs reflects something of this trend towards irrelevance, but such mismatch is not unusual; for example, a negligible proportion of the ranges of seriously threatened African bird species falls within the continent's current PA system (Beresford et al. 2011). Nevertheless, Philippine KBAs have been identified on the basis of species vulnerability, irreplaceability (endemism) and population concentrations, all of which constitute high biodiversity value, and the small ranges of these species in relative terms render the case for immediate and radical action compelling. It is worth adding that, with the application of modern techniques involving genetic and acoustic analysis, and with continuing investigations in what is, perhaps surprisingly, a still under-explored country (Mallari et al. 2004), many new species continue to be discovered and, as a consequence, new localised centres of endemism are being identified, each requiring protection (Posa et al. 2008; Balete et al. 2011).

The time is therefore ripe both to reassess the positioning of the Philippines' existing PA network, which may involve some de-gazetting, and to optimise placement of new reserves with respect to threatened taxa. The Philippines acknowledges that addressing gaps in the PA network is a priority (Anon. 2012), but the KBA mismatch is so large that sweeping measures are needed not only to accommodate unprotected KBAs but also to replace PAs that offer only marginal biodiversity benefits (see, e.g. Fuller et al. 2010).

Put key habitats at the heart of protected area management

Many Philippine threatened species are forest dependent. Density estimates for key species in pristine and altered habitats are rare, but most endemic bird species prefer little-disturbed lowland forests, as in Mindoro (Lee 2005), PPSRNP (Mallari et al. 2011) and Luzon (Española et al. 2013); on Luzon the same is true of small mammals, which have also demonstrated an important capacity to recolonise forest regenerating after logging (Rickart et al. 2011), indicating that PAs which contain such habitat can be of great value in the longer term. Traditionally, however, the 'core zones' of Philippine PAs (areas where NIPAS law prohibits all human activity except traditional practices by indigenous people) are generally above 1000 m, an elevation widely accepted as the crude uppermost level of what may be considered 'lowland' (Catibog-Sinha and Heaney 2006). Areas below 700 m tend to become buffer zones, which are open access areas for multiple use including permanent or swidden agriculture, settlements and tourist infrastructure.

Nevertheless, under NIPAS law, any part of a PA containing globally threatened species should be included within the core zone. Clearly, therefore, significant areas of lowland natural ecosystems within PAs should now be re-designated as core zone. A key step to achieve this is for government to reform its policy on zoning PAs so that forests are no longer defined solely by slope and elevation but instead by ecological parameters of conservation relevance. This will help management authorities redraw boundaries with appropriate land-use management regimes. Moreover, any new PAs need greater institutional flexibility than those in the old system. Alternative models of governance are already being tested as part of the Philippines' contribution to the CBD's Programme of Work on Protected Areas (Anon. 2012).

Reform protected area management systems

The third indicator of Aichi Target 11 is a measure of management effectiveness and, at present, the Philippines falls far short. Other than a Presidential Proclamation, only around one in ten PAs has a functional infrastructure and unequivocal legality by which to operate effectively. The lack of management plans, dedicated budgets, operating management boards or even Congressional approval undermines efforts to promote biodiversity conservation in 38 000 km^2 of theoretically protected land. The great majority of Philippine PAs therefore remain 'paper parks'.

All PAs, present and future, must have clear strategic/management plans and infrastructure in place. They should meet measurable biodiversity-led targets, not merely execute particular management activities. For example, PPSRNP has expanded its area of 'protection', but without appropriate resources this cannot translate into effective biodiversity protection. New PAs, for which we anticipate the Philippine eagle (*Pithecophaga jefferyi*) as a key species, must establish specific targets relating to the conservation of key species and addressing sub-population sizes and other IUCN Red List criteria measures (Rodrigues et al. 2006).

A further consideration here is that different departments of government have different, unreconciled mandates (Guiang and Braganza 2014). The Department of Agriculture promotes the production of high-value vegetable crops, the Bureau of Mines and Geosciences of DENR promotes mining and the Forest Management Bureau of DENR promotes logging, each of these activities often taking precedence over conservation, even in PAs. Added to this are the jurisdictional conflicts with local government units where, for example, PAs overlap with ancestral lands under the management of the National Commission on Indigenous Peoples (e.g. Mallari 2009). Stable, sustainable biodiversity conservation will depend on the harmonisation of these mandates (e.g. Miller et al. 2009).

Create effective biodiversity conservation capacity

The capacity to deliver conservation management and monitoring varies across Philippine PAs but is undoubtedly low in terms of legal authority, management standards, funds, staff and expertise. Some targeted research and general monitoring are undertaken at a few sites, but there has been no analysis or feedback to inform management changes. PA authorities must now acquire sufficient capacity to develop and implement biodiversity-led management plans in direct line with the targets they set. Such capacity is needed

(1) to generate baseline ecological data so that the status of species and habitats is understood and, therefore, appropriate biodiversity conservation targets and appropriate management programmes of work are set, and measurable outcome indicators are identified;
(2) to improve the PA planning process by drawing on analytical and scenario modelling methods to explore the outcomes of management decisions for species and habitats;
(3) to promote the role of PAs and their long-term sustainability as important for local and national government, private sector partners, civil society organisations and other stakeholders; and
(4) to develop and implement a work programme outside PA boundaries to address drivers of habitat destruction and degradation and other threats to biodiversity.

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