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## The rapid expansion of Madagascar's protected area system

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Running head: Protected area evolution in Madagascar

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24 **Abstract**

25 Protected areas (PAs) are our principal conservation strategy and are evolving rapidly, but we  
26 know little about the real-world management and governance of new forms. We review the  
27 evolution of Madagascar's PA system from 2003-2016 based on our experience as  
28 practitioners involved. During this period PA coverage quadrupled and the network of strict,  
29 centrally-governed protected areas expanded to include sites characterized by: i) multiple-use  
30 management models in which sustainable extractive natural resource uses are permitted, ii)  
31 shared governance arrangements involving non-governmental organizations (NGOs) and local  
32 community associations, and iii) a management emphasis on livelihood-based approaches and  
33 social safeguards. We discuss the principal challenges for the effectiveness of the expanded  
34 system and detail management/policy responses. These include i) enhancing stakeholder  
35 participation, ii) ensuring financial sustainability, iii) enforcing rules, iv) ensuring the  
36 ecological sustainability of PAs faced with permitted resource extraction, v) reducing the  
37 natural resource dependence of local communities through transformative livelihood change,  
38 and vi) developing long-term visions to reconcile the differing objectives of conservation  
39 NGOs and other stakeholders. In general PAs have had limited effectiveness in reducing  
40 deforestation and other threats, which may be related to their rapid establishment processes  
41 and the complexity of management towards multiple objectives, coupled with insufficient  
42 resources. While Madagascar's achievements provide a basis for conserving the country's  
43 biodiversity, the challenge faced by its protected areas will continue to grow.

44

45 **Keywords:** community-based conservation; conservation finance; governance; Madagascar;  
46 poverty alleviation; sustainable natural resource use;

47

48 **1. Introduction**

49 Covering 15% of the Earth's land surface and 7% of the oceans, protected areas are our  
50 principal tool for the conservation of biodiversity (WDPA 2017). However, while much  
51 conservation research is carried out within PAs and the study of where to establish them –  
52 systematic conservation planning – has become one of the most sophisticated and productive  
53 fields of conservation science, we know little about the realities of PA governance and  
54 management on the ground. This knowledge gap is a particular concern given that recent  
55 decades have seen the rapid evolution of both protected area theory and practice (Dudley et al.  
56 2014; Watson et al. 2014), and a progressive global transition from centrally-governed, strict  
57 PAs managed for conservation, research and recreation to more complex institutions managed  
58 for multiple conservation and human development objectives through shared-governance  
59 structures. For example, almost 40% of the global PA estate is now managed in multiple-use  
60 categories (i.e. IUCN category V and VI, UNEP-WCMC & IUCN 2016), and 25% of  
61 sampled PAs in sub-Saharan Africa are administered by institutions other than State agencies  
62 (Belle et al. 2015).

63

64 An improved understanding of contemporary PA management is critical to inform policy,  
65 orient research agendas and generate best practice, and thus ensure that PAs are effectively  
66 managed in line with requirements of the Convention on Biological Diversity (CBD; Watson  
67 et al. 2016). This is particularly pressing as CBD signatories are expected to extend their PA  
68 portfolios to cover 17% of terrestrial and inland water areas and 10% of coastal and marine  
69 areas by 2020 (CBD 2010). Meeting this target will require the most rapid expansion of PAs  
70 in history (Venter et al. 2014), and will largely be achieved through the establishment of  
71 multiple-use PAs (McDonald & Boucher 2011): however, recent experiences with the  
72 implementation of such PAs have been poorly documented. Here we review Madagascar's  
73 efforts to expand its protected area system in the period 2003-2016, based on our experience

74 in policy development and the establishment and management of a range of PAs throughout  
75 this period. Specifically, we highlight three major changes in PA policy and practice, and  
76 discuss six principal challenges for current and future management.

77

## 78 **2. Madagascar context**

79 Madagascar is a top global conservation priority with unparalleled endemism rates at species  
80 and higher taxonomic levels (Brooks et al. 2006). However the country is extremely poor, and  
81 its predominantly rural population is characterized by low education levels, rapid population  
82 growth and high dependence on small-scale agriculture and natural resources for food, fuel  
83 and income (Fritz-Vietta et al. 2011). As a result remaining forests are highly threatened by  
84 shifting cultivation, charcoal production, artisanal (and industrial) mining, bushmeat  
85 consumption and overharvesting of varied resources (Cook & Healy 2012; Fritz-Vietta et al.  
86 2011; Razafimanahaka et al. 2012; Urech et al. 2015); wetlands are threatened by overfishing  
87 and riculture (Bamford et al. 2017); and coastal areas suffer from overfishing, destructive  
88 fishing and environmental change (sedimentation, bleaching) (Harris 2011). Additionally,  
89 certain high-value resources (e.g. rosewood, tortoises, sea cucumber, shark fin) are  
90 increasingly threatened by intensive illegal collection fuelled by foreign (particularly Chinese)  
91 demand (e.g. Barrett et al. 2010; Cripps & Gardner 2016; Randriamalala & Liu 2010).

92

## 93 **3. The ‘Durban Vision’**

94 Madagascar’s first PAs were created in 1927 and the network had grown to 36 sites by the  
95 mid-1980s when a domestic environmental agenda began to emerge (Kull 2014). In 1991 the  
96 country launched Africa’s first National Environmental Action Plan, created the para-statal  
97 ANGAP to oversee management of PAs, and began the promotion of community-based  
98 natural resource management (CBNRM, hereafter management transfers) through the transfer

99 of limited management rights from the State to local community user associations (Ferguson  
100 et al. 2014; Pollini et al. 2014). The policy focus shifted back to protected areas in 2003 when,  
101 at the Vth World Parks Congress in Durban, South Africa, the Malagasy government  
102 committed to tripling the coverage of the protected area network (the ‘Durban Vision’, Norris  
103 2006).

104

105 At this time the PA network managed by ANGAP (subsequently renamed Madagascar  
106 National Parks (MNP)) consisted of 47 sites covering almost 1.7 million ha, and comprising  
107 ‘strict’ PAs in IUCN categories Ia (Strict Nature Reserve), II (National Park) and IV (Special  
108 Reserve) (Randrianandianina et al. 2003). Following the Durban declaration, five working  
109 groups consisting of government officials, foreign donors, NGOs and conservation scientists  
110 were established to advise on implementing the vision, specifically focusing on management  
111 and categorization, biodiversity prioritization, communication, legal frameworks, and funding  
112 (Corson 2014). Systematic conservation planning and gap analyses were carried out to  
113 prioritize where new PAs should be created (Kremen et al. 2008; Rasoavahiny et al. 2008),  
114 and a number of policy changes were implemented in line with IUCN recommendations. This  
115 resulted in the revision of the Protected Area Code (COAP) in 2008, although this legislation  
116 wasn’t ratified until 2015 due to a political crisis in 2009 (see 6. Discussion).

117

118 New PAs are established in a two-step process. First, the organization leading the initiative  
119 (henceforth ‘promoter’) applies for temporary protection which grants sites a two-year  
120 moratorium on mining under the terms of an inter-ministerial decree negotiated between the  
121 Ministry of Environment, Ecology and Forests (MEEF) and the mining ministry. Promoters  
122 must then complete all consultative, administrative and planning procedures to gain definitive  
123 protection within this two-year window, or request an extension.

124

125 By 2016 the PA system had grown to 122 sites covering 7.1 million hectares, a growth of  
126 416% in area (Fig. 1; Table 1). Five new PAs were established by MNP (which also expanded  
127 nine existing national parks), and the remaining new PAs are largely promoted by NGOs and  
128 managed in shared governance arrangements with local communities. Together these two sub-  
129 networks (henceforth MNP and non-MNP) form the Madagascar Protected Area System  
130 (SAPM), administered by the Biodiversity Conservation/Protected Area System Directorate  
131 (DBC/SAP) within MEEF, although marine PAs are administered under the Ministry of  
132 Fisheries.

133

134 [Figure 1]

135

136 [Table 1]

137

#### 138 **4. Evolving protected area policy and practice**

##### 139 4.1 Expanded objectives and categories

140 While the pre-2003 PAs were managed for conservation, research and (in category II sites)  
141 recreation (Randrianandianina et al. 2003), the objectives of SAPM were expanded to include  
142 the conservation of cultural heritage and the promotion of sustainable natural resource use for  
143 poverty alleviation and development, in addition to biodiversity conservation. This parallels  
144 global trends in PA policy (Dudley et al. 2014), and reflects the realization that most priority  
145 sites were home to significant populations of rural people that depended to varying extents on  
146 natural resources for their subsistence and income (e.g. Brown et al. 2011; Urech et al. 2015).  
147 Thus the establishment of strict PAs was seen as inappropriate for many sites, and the  
148 Protected Area Code was revised to permit the establishment of IUCN category III, V and VI

149 protected areas – multiple-use sites in which extractive resource use is permitted (Dudley  
150 2008; Gardner 2011). Almost half of Madagascar’s PAs are now proposed as IUCN category  
151 V<sup>1</sup> or VI (Table 1) and permit sustainable extractive use of natural resources, such as  
152 livestock grazing, fuelwood collection, charcoal production, commercial fishing and the  
153 harvest of wood, non-timber and marine products, according to a zoning plan.

154

#### 155 4.2 Novel governance arrangements

156 Prior to 2003 all PAs in Madagascar were governed by the State through the parastatal  
157 ANGAP/MNP (though in some cases management was delegated to NGOs), but the Durban  
158 Vision saw the rewriting of the Protected Area Code to permit actors other than MNP to  
159 manage PAs within SAPM. All non-MNP PAs have a legally-recognized promoter, typically  
160 international or Malagasy NGOs (although also universities, mining companies and private  
161 individuals), but are generally governed in shared governance arrangements incorporating  
162 regional authorities and local communities (Alvarado et al. 2015; Virah-Sawmy et al. 2014).  
163 These governance structures have evolved iteratively: initial management plans of many sites  
164 proposed community management with promoter NGOs limited to a supporting role (e.g.  
165 Gardner et al. 2008), however this concealed the reality of promoters as de facto  
166 (co)managers, providing funds, technical capacity, direction and drive (Franks & Booker  
167 2015). In response, promoters must now be named as delegated managers of new PAs with  
168 responsibility for management to the State.

169

170 Most non-MNP PAs have multi-tiered governance structures incorporating i) an executive  
171 body/platform comprising the promoter and a community-based management committee, and

---

<sup>1</sup> Category V PAs as implemented in Madagascar differ conceptually from the model envisaged in the IUCN definition, see Gardner (2011).



172 ii) an orientation committee grouping regional authorities, relevant ministries and private  
173 sector representatives (e.g. tourism operators) (Franks & Booker 2015; Virah-Sawmy et al.  
174 2014). Depending on their size, the community-based management committees may be based  
175 around spatially-nested hierarchies with two or three tiers: local management units (LMUs)  
176 are responsible for their own territories but elect representatives to sit on a federation of  
177 LMUs covering a larger area, and this in turn may elect representatives to a central committee  
178 responsible for the whole protected area (Andriamalala & Gardner 2010; Virah-Sawmy et al.  
179 2014) (Fig. 2). In some PAs the LMUs are composed of management transfers enacted under  
180 CBNRM legislation and thus have a legal standing beyond that of the PA. In all cases these  
181 structures remain ‘works in progress’, and will require years of further experimentation and  
182 evolution before they are optimized.

183

184 [Figure 2]

185

186 Beyond new protected areas, the MNP sub-network is also transitioning from State  
187 governance to shared governance between MNP and representatives of local communities  
188 (although some protected areas, such as Bezà Mahafaly, have been under shared governance  
189 since their establishment; Richard & Ratsirarson 2013). Typically, adjacent communities are  
190 integrated into two forms of structure, Local Park Committees (CLP) and a Protected Area  
191 Orientation and Support Committee (COSAP). CLPs are established for each community  
192 around a PA and are responsible for surveillance (and sometimes monitoring) of the  
193 neighboring park sector. They also participate in the prioritization of development  
194 interventions and submit project proposals to the COSAP for approval and funding. The  
195 COSAP, of which MNP is not a member, lobbies for the interests of local communities and  
196 other stakeholders around a PA: it is principally composed of CLP members, as well as

197 traditional leaders, civil society groups, municipal authorities, regional ministerial  
198 representatives (e.g. Environment, Health, Education), and private sector operators (Franks &  
199 Booker 2015; MNP 2014).

200

#### 201 4.3 Management emphasis on livelihoods and social safeguards

202 The evolution of Madagascar's PAs epitomizes global trends of increasing integration of  
203 social and development objectives into PA management. Like mines and infrastructure  
204 projects, all PAs must carry out an environmental and social impact assessment for  
205 submission to the National Environment Office (ONE), and subsequently develop and  
206 implement a social safeguards plan (PSSE). The PSSE requires promoters to identify all  
207 parties likely to be affected by PA establishment, evaluate opportunity costs arising from  
208 access restrictions, and implement mitigation or livelihood improvement initiatives as  
209 compensation. However, the full implementation of these plans is a major challenge for  
210 promoters given the resources required (Virah-Sawmy et al. 2014).

211

212 Many non-MNP PAs go beyond ensuring safeguards to explicitly seek poverty alleviation as a  
213 core objective, and thus focus on livelihood-based interventions rather than 'traditional'  
214 habitat management and threat abatement activities (Gardner et al. 2013). For example, many  
215 new wetland and marine PAs ally conservation with community-based fisheries management,  
216 targeting the recovery of fast-growing species to help fishing-dependent communities derive  
217 meaningful livelihood benefits from resource management (Oliver et al. 2015), complemented  
218 with livelihood-based initiatives such as aquaculture development. In terrestrial sites,  
219 promoters have focused largely on tourism development and agricultural improvement (e.g.  
220 infrastructure rehabilitation, market development, enhanced production methods), in some  
221 cases involving development NGOs or private sector partnerships: for example the Malagasy

222 NGO Fanamby has created a company to broker markets and offer technical support to local  
223 cooperatives producing ginger, rice, vanilla, cashew nuts and essential oils around the Loky-  
224 Manambato and Anjozorobe-Angavo NPAs (Gardner et al. 2013). In other instances,  
225 promoter investments in local communities are channeled through innovative mechanisms  
226 such as community-based payments for ecosystem services (PES) schemes involving  
227 conservation agreements and inter-village competitions (Brimont & Bidaud 2014;  
228 Sommerville et al. 2010). In addition, Madagascar is a global leader in the expansion of  
229 ‘population-health-environment’ (PHE) initiatives associated with PAs, helping meet demand  
230 for healthcare services that is unmet by the State (Robson & Rakotozafy 2015). However  
231 while many PAs have made notable investments, the challenge of scaling up these  
232 interventions across the expanded network remains formidable.

233

## 234 **5. Principal challenges**

### 235 5.1 Enhancing participation

236 Despite the transition to shared governance of all Madagascar’s PAs, the effective level of  
237 local community participation in decision-making may vary between sites. Negotiation  
238 processes during the establishment of new PAs may be skewed by power imbalances resulting  
239 from the strong mandate of MNP and NGO promoters to establish new PAs (Ferguson et al.  
240 2014; Freudemberger 2010): as a result, field agents tasked with leading participatory planning  
241 exercises may in some cases have been incentivized to persuade rural communities to agree to  
242 pre-established plans rather than encourage participatory planning (Corson 2014; Marie et al.  
243 2009). However, in other cases ongoing negotiations with communities have led to PA limits  
244 and zoning being considerably altered between the temporary and definitive protection stages,  
245 highlighting the effectiveness of consultation processes. Furthermore, village-level  
246 consultations take the traditional form and are dominated by older men, marginalizing groups

247 such as women, young people and migrants (Virah-Sawmy et al. 2014), while participation in  
248 PA governance may become a tool in intra-community struggles for power and access to  
249 resources. For example educated community members, often newcomers, may be better  
250 placed to participate and thus empower themselves at the expense of traditional leaders and  
251 other interest groups (Pollini et al. 2014). Beyond participation in governance, local  
252 communities are expected to play an active management role in many PAs, for example in  
253 surveillance and monitoring: however, the incentive for them to do so is not always apparent.

254

## 255 5.2 Ensuring financial sustainability

256 Of PAs with definitive protection, 13 currently lack active management and can be considered  
257 ‘paper parks’, while a further 29 ‘orphan’ sites were adopted by NGO promoters but – for  
258 various reasons including rural insecurity, international donor withdrawal during the 2009-  
259 2014 political crisis (see 6. Discussion) and changing strategic priorities – never received PA  
260 status. This is a concern because the launch of a PA establishment process may encourage  
261 some people to claim land through deforestation, while abandonment partway through  
262 establishment may preclude future conservation initiatives due to diminished trust with local  
263 communities and authorities.

264

265 The future of established PAs depends on their financial sustainability, since PA effectiveness  
266 is dependent on investment in management (Geldmann et al. 2015; Gill et al. 2017). However  
267 traditional funding sources (multi- and bilateral donors, NGOs and private foundations) are  
268 unreliable due to changing donor priorities and periodic political crises resulting in  
269 international sanctions and major donor withdrawal (Nicoll & Ratsifandrihamanana 2014). In  
270 addition the unpredictable nature and short timescales (3-5 years) of grant-based funding are  
271 inappropriate and unrealistic for addressing the scale and complexity of contemporary PA

272 management challenges, while frequent changes in donor fashions can cut off support to  
273 established programs and thus encourage risk-averse management. Recognizing the need for  
274 financial stability and sustainability, a trust fund – the Madagascar Biodiversity and Protected  
275 Areas Foundation – was established in 2005 by the government, MNP and several NGOs to  
276 cover recurrent protected area management costs (MNP 2014). In 2014 capitalization of the  
277 fund reached US\$52 million, generating revenues of US\$2.16 million, used to fund the  
278 management of 27 PAs of which 70% managed by MNP. Nevertheless, the projected annual  
279 funding deficit of MNP protected areas for 2011–2015 was estimated at 7–8 million US  
280 dollars, while the cumulative funding deficit for a sample of 70 non-MNP sites was estimated  
281 to reach 25 million USD by 2015 (AGRECO 2012). Available funding has not kept pace with  
282 PA expansion, thus reducing per-unit resource availability: hence, the development and  
283 implementation of a sustainable financing strategy for SAPM remains a critical priority.

284

285 In recognition of this shortfall PA managers are adopting an entrepreneurial approach to  
286 diversify revenue streams. For example, many non-MNP sites are developing private sector  
287 partnerships and market-based mechanisms including PES, to support both livelihood  
288 interventions and management costs (Brimont & Bidaud 2014; Gardner et al 2013), while  
289 MNP is targeting strategic markets such as corporate social responsibility, mining offsets,  
290 ecotourism and tourism concessions, film and photography, research and carbon markets  
291 (MNP 2014). However, while funders increasingly demand the development of market-based  
292 approaches to promote financial sustainability, conservationists cannot always be  
293 reprogrammed successfully as entrepreneurs and there are no examples in Madagascar of PAs  
294 able to support themselves fully through such mechanisms. Since it remains highly unlikely  
295 that even the most well visited or entrepreneurial PAs will achieve full financial independence  
296 in the near future, the network’s reliance on donor funding will probably grow further.

297

### 298 5.3 Applying rules

299 Law enforcement is a major challenge for PAs worldwide, particularly in developing  
300 countries with limited resources for surveillance and enforcement and widely-dispersed,  
301 resource-dependent rural populations and/or organized criminals seeking to illicitly extract  
302 natural resources (Nolte 2016). The problem is exacerbated in Madagascar because neither  
303 MNP nor new PA promoters have authority to apply the law: instead serious infractions  
304 require managers to organize and fund field missions by a ‘mixed brigade’, comprising  
305 members of the gendarmerie, MEEF agents, local and municipal authorities and members of  
306 the PA management committee. The system is slow, costly and inefficient, and hampered by a  
307 lack of capacity since PA expansion has not been accompanied by growth in the human  
308 resources of the ministries responsible. Enforcement is further hampered by poor knowledge  
309 of PA-related legislation, a lack of political will, and an ineffective judiciary that rarely  
310 enforces penalties.

311

312 Partly in order to overcome this enforcement vacuum, protected areas legislation permits a  
313 second form of regulation – dina – to be developed and applied by local community  
314 managers. Traditionally referring to social norms that exist outside the formal legal system  
315 (Henkels 1999), dina have been used to govern management transfers since the 1990s and  
316 comprise locally-developed and applicable laws regulating resource use within any designated  
317 area. Enforceable at the local level without recourse to any higher authority, dina may also be  
318 ratified by a regional court to become legally-recognized by-laws, allowing recourse to the  
319 judicial system when infractions cannot be resolved (Andriamalala & Gardner 2010). Despite  
320 the nominally community-based development of dina, however, the articles often reflect the  
321 interests of PA promoters rather than the communities: accordingly, community members

322 may be reluctant to apply rules against members of their own community, as well as  
323 powerless to do so against outsiders (Brimont & Bidaud 2014; Rabesahala Horning 2003). In  
324 response, dina application committees are now widely integrated into local governance  
325 structures.

326

#### 327 5.4 Achieving ecological sustainability

328 The authorization of extractive resource uses within PA sustainable use zones means that new  
329 PAs will undergo continued ecosystem change and biodiversity loss (Gardner et al. 2016a;  
330 Nicoll & Ratsifandrihamanana 2014), even if managers are successful in preventing illicit  
331 threats<sup>2</sup>. This is a particular concern in terrestrial sites as most endemic vertebrates are  
332 obligate forest dwellers (Goodman & Benstead 2005) and forest degradation triggers  
333 community turnover from endemic to non-endemic species (Gardner 2009; Gardner et al.  
334 2016a; Irwin et al. 2010).

335

336 In addition to reducing the natural resource dependence of local communities through  
337 livelihood-based interventions, minimizing the impacts of permitted activities will require the  
338 spatial configuration of sustainable use zones to ensure metapopulation persistence (Carroll et  
339 al. 2004), and applied ecological research into harvested species/systems to inform the  
340 development of low-impact extraction methods and quota setting. However few, if any, PAs  
341 are currently enabling science-based sustainable resource use. Participatory research into  
342 resource stocks and monitoring of their dynamics would help to overcome the low research  
343 capacity of many PAs, and provide a means to engage resource users in discussions over  
344 future use: however, appropriate resources to guide managers are not available. The absence

---

<sup>2</sup> Beyond permitted and illicit threats, many forest protected areas are extremely small and therefore also threatened in the long term by their small size and isolation.

345 of an evidence base increases the importance of effective monitoring programs, carried out as  
346 part of an adaptive management cycle, so that negative impacts can be identified and  
347 management adjusted accordingly. Given that ecological sustainability will not be the only  
348 management objective, particularly for resource users whose short-term interests may be best  
349 served by overharvesting, mechanisms for stakeholders to negotiate trade-offs will also need  
350 to be developed (McShane et al. 2010; Sayer et al. 2017).

351

### 352 5.5 Achieving transformative livelihood change

353 The objectives of SAPM state that PAs should support poverty alleviation and development  
354 through the sustainable use of natural resources. However, while such resources provide a  
355 valuable safety net for rural communities, dependence on them may form a poverty trap  
356 (Barrett et al. 2011). The management of new PAs tends to be landscape focused, but depends  
357 on the types of resource underpinning local livelihoods: wetland and coastal PAs focus on  
358 improving the productivity and sustainability of existing natural resource use (e.g. Oliver et  
359 al. 2015) since fisheries respond rapidly to management, while forest PAs seek to reduce  
360 natural resource use through interventions based on agriculture and tourism (Gardner et al.  
361 2013; Pollini et al. 2014). There is no one-size-fits-all approach, and the participatory design  
362 of productive landscapes that meet the needs of all stakeholders should be considered a  
363 critical step in management planning, as well as fertile ground for research. Mobilizing  
364 sufficient resources to achieve transformative change at the necessary scale will be an  
365 enormous challenge for promoters, particularly in isolated landscapes comprising tens of  
366 thousands of households. Moreover, economic development around PAs may lead to  
367 increased demand for natural resources (e.g. Scales et al. 2017): in response, some NGO  
368 promoters are experimenting with conservation contracts whereby investments are conditional  
369 on behavior change or threat reduction.



370

## 371 5.6 Stakeholder motivations and long-term vision

372 While most new PAs involve local community structures, regional/municipal authorities and  
373 in some cases the private sector in their governance, it would be naive to assume that all  
374 stakeholders retain similar motivations for PA management: while promoters may champion  
375 biodiversity conservation, other stakeholders (e.g. local communities) may prioritize revenue  
376 generation and retain little interest in the PA other than for the opportunities they perceive  
377 may arise from it. This raises concerns for the long-term governance of these sites given the  
378 uncertain ability of NGOs to continue providing leadership, drive and resources indefinitely.  
379 The long-term vision for non-MNP sites has not been clearly articulated in policy, but some  
380 NGO promoters talk of exit strategies once co-managers have the necessary capacity.  
381 However capacity does not equal motivation, so the transition from NGO-driven to truly  
382 locally-managed PAs will require careful planning and implementation. One option may be to  
383 convert the site-based teams of international NGOs into autonomous Malagasy NGOs.

384

## 385 **6. Discussion**

386 In 2003 the government of Madagascar made a major commitment to global biodiversity  
387 conservation through the expansion of its PA system. The intervening period has seen rapid  
388 change in the country's conception of PAs and the development of new protected area policy  
389 and practice. The PA system has quadrupled in size, and the country's new PAs have led the  
390 development of new management approaches and governance systems. These achievements  
391 provide a model for other tropical developing countries seeking to expand their protected area  
392 coverage to meet CBD goals.

393

394 The country's success in so rapidly quadrupling its protected area coverage is particularly  
395 notable given the general lack of State capacity in rural areas, widespread corruption, the  
396 absence of adequate land tenure systems (Ferguson et al. 2014), the extreme isolation of many  
397 sites and the impacts of the 2009-2014 political crisis, amongst other factors. This period saw  
398 central government functioning come to a virtual standstill, the suspension of funding from  
399 numerous multilateral and bilateral donors, the decreasing rule of law, and consequent  
400 increases in deforestation and other illegal activities both within and outside protected areas  
401 (Barrett et al. 2010; Nicoll & Ratsifandrihamanana 2014; Schwitzer et al. 2014; Waeber et al.  
402 2016). Nevertheless, NGO promoters were largely able to maintain funding and continued  
403 their efforts in the field (where security permitted), the cohort of technicians within DSAP and  
404 relevant ministries remained stable, and the Durban Vision continued to be implemented  
405 despite a loss of momentum and the absence of governmental leadership.

406

407 While national progress towards CBD targets is measured by PA coverage, the convention  
408 also stipulates that PAs should be effectively managed, and in this regard the performance of  
409 SAPM remains a serious concern. While PAs have reduced deforestation at a system-wide  
410 level (Eklund et al. 2016, though see Waeber et al. 2016), the effects are small and uneven,  
411 and some regions and sites show no significant decline in deforestation rates despite PA  
412 establishment. Forest clearance continues in both MNP and non-MNP sites (Allnutt et al.  
413 2013; Grinand et al. 2013), while activities such as illegal logging (Randriamamala & Liu  
414 2010), artisanal mining (Cook & Healy 2012) and bushmeat hunting (Razafimanahaka et al.  
415 2012) remain widespread. Similarly, marine PAs have had limited effectiveness in reducing  
416 overfishing, curbing the use of destructive fishing methods, deterring illegal foreign fleets, or  
417 controlling the trade in threatened species (Cripps & Gardner 2016; Le Manach et al. 2012).  
418 Across all biomes, evidence for the stabilization or recovery of key ecological or biodiversity

419 indicators within the new generation of PAs remains scarce. This reflects a growing body of  
420 recent research which finds little evidence for the effectiveness of community-based,  
421 extractive resource management in conserving biodiversity in terrestrial, developing world  
422 contexts, primarily due to the differences in objectives between local resource users and  
423 conservationists, and the inability of resource users to satisfy their needs through permitted  
424 sustainable uses (Rao et al. 2016; Sayer et al. 2017; Terborgh & Peres 2017). Likewise, there  
425 is mixed evidence for the effectiveness of multiple use (category V) protected areas in  
426 conserving biodiversity (Dudley et al. 2016).

427

428 While the limited effectiveness of PAs to date may not be surprising given the challenging  
429 social-ecological contexts in which they have been established, it may also have been  
430 influenced by the rapidity with which the system has been expanded. The time-bound nature  
431 of the Durban Vision (a “conservation emergency”, Marie et al. 2009) meant that many PA  
432 establishment projects were launched without sufficient understanding of the socio-ecological  
433 contexts in which they are embedded, and have continued to be managed without an evidence  
434 base or adequate monitoring systems to ensure that implemented actions are effective. Indeed  
435 we often don’t even know which species occur in newly established sites, and very little of the  
436 research conducted on Madagascar is relevant to management decision-making (Gardner  
437 2012). The rush to establish new PAs also stretched the resources of promoter NGOs,  
438 undoubtedly compromising the rigor of participatory planning processes and potentially  
439 undermining the robustness and legitimacy of new institutions, which depend on the  
440 establishment of trustful and cooperative relationships between partners. While the Durban  
441 Vision provided an unprecedented opportunity to create new PAs, it may inadvertently have  
442 incentivized quantity over quality in PA establishment processes.

443

444 Alternatively, the limited success of many PAs may be the result of them attempting to do too  
445 much with insufficient expertise and resources, and thus spreading their efforts too thinly.  
446 Protected area promoters now seek not only to prevent environmental change but also reverse  
447 the socio-economic trajectories of impoverished communities living over vast, isolated  
448 landscapes. To do so successfully requires substantial resources, but promoters instead  
449 compete for donor funds in a scramble that may see the same site simultaneously  
450 characterized as a climate adaptation, food security, poverty alleviation, sustainable  
451 livelihoods, gender empowerment, carbon sequestration or biodiversity conservation  
452 initiative. While financially expedient, rebranding PAs in this way has brought new  
453 challenges for the sector, not least in meeting expectations of a new generation of donors for  
454 development outcomes which PA managers have little experience of delivering or measuring.

455

456 The establishment of protected areas is a complex and lengthy process, and it is still early to  
457 be judging the success of the Durban Vision in terms of its conservation and development  
458 objectives. What is clear is that the challenge continues to grow, as Madagascar has changed  
459 greatly since the Vision was launched – the economy has weakened further, the rule of law  
460 has decreased, the human population has grown by a third, and climate change continues to  
461 undermine rural livelihoods and increase dependence on the safety net provided by natural  
462 resources (Gardner et al. 2016b; Harvey et al. 2014). As land and resources continue to be set  
463 aside within PAs and degradation outside them continues, physical and political pressure on  
464 the country's PAs is likely to grow, so the challenge faced by the government, NGOs and  
465 their rural community partners is greater than ever. However the conservation sector's  
466 achievements since 2003 provide a robust platform from which to build.

467

468 In conclusion, Madagascar's experiences show that tropical developing countries can rapidly  
469 expand their protected area networks to meet CBD targets, and that this can be achieved  
470 primarily by non-State actors. Multiple-use PA categories and shared governance  
471 arrangements have an important role to play in such expansion because they help minimise  
472 conflict with other stakeholders and reduce the management burden on the State. However,  
473 such institutions are necessarily complex, and the simultaneous pursuit of development and  
474 conservation goals is an enormous (and ambitious) challenge if promoters lack sufficient  
475 resources to adequately address the root causes of biodiversity loss. Given this, it is important  
476 that equal attention is paid to PA effectiveness as it is to PA coverage, in post-2020 CBD  
477 targets and more generally.

478

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482

#### 483 **Conflicts of interest**

484 All authors currently or previously worked with organisations involved in the expansion and  
485 management of Madagascar's protected areas, and these experiences provide the bulk of the  
486 data on which the paper is built. However there are no conflicts of interest influencing the  
487 paper.

488

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492

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764 **Tables**

765

766 Table 1. Number and area of protected areas in Madagascar in March 2017, by IUCN  
 767 category. The Madagascar Protected Area System (SAPM) comprises sites managed by  
 768 Madagascar National Parks (MNP) and the non-MNP network of new protected areas.  
 769 Numbers in brackets refer to protected areas that currently lack active management and are  
 770 considered ‘paper parks’.

	<b>All SAPM</b>		<b>MNP network</b>		<b>Non-MNP network</b>	
	<b>No.</b>	<b>Area (ha)</b>	<b>No.</b>	<b>Area (ha)</b>	<b>No.</b>	<b>Area (ha)</b>
	<b>Sites</b>		<b>Sites</b>		<b>Sites</b>	
Cat I	1	2228	1	2228		
Cat II	28	2,617,847	27	2,245,377	1	372,470
Cat III	2	4807			2	4807
Cat IV	23(3)	408,231.9 (53,470)	22 (3)	407,461.9 (53,470)	1	770
Cat V	39	2,617,638.4			39	2,617,638.4
Cat VI	17	865,549.5			17	865,549.5
No category	12 (10)	566, 224 (484,517)			12 (10)	566, 224 (484,517)
<b>Total</b>	<b>122 (13)</b>	<b>7,082,525.8</b> <b>(537,987)</b>	<b>50 (3)</b>	<b>2,655,066.9</b> <b>(53,470)</b>	<b>72 (10)</b>	<b>4,427,458.9</b> <b>(484,517)</b>

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773

774 **Figure legends**

775

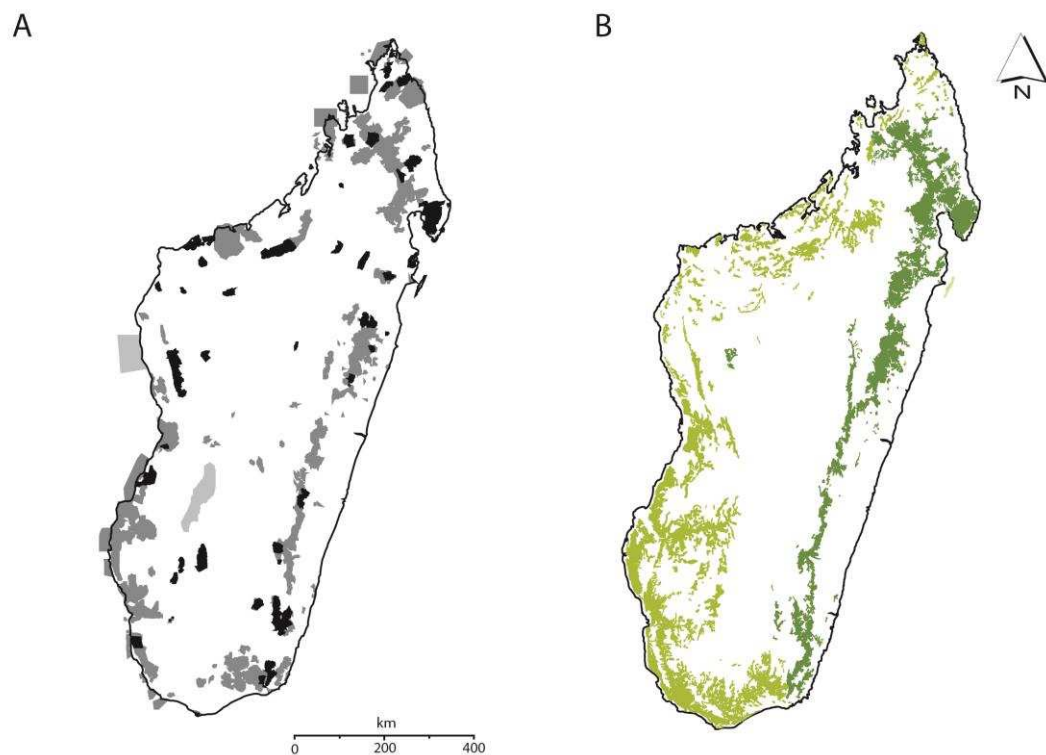
776 Figure 1. Maps of Madagascar showing A) the protected area network, with the pre-2003  
777 network in black, new protected areas established since 2003 in dark grey, and protected areas  
778 partway through establishment in light grey (Source: REBIOMA, March 2016); B) forest  
779 cover, with humid forests in dark green and dry and spiny forests in olive green (Source: Moat  
780 and Smith 2007).

781

782 Figure 2. Model shared governance schematic for new, non-MNP protected areas in the  
783 Madagascar Protected Area System.

784

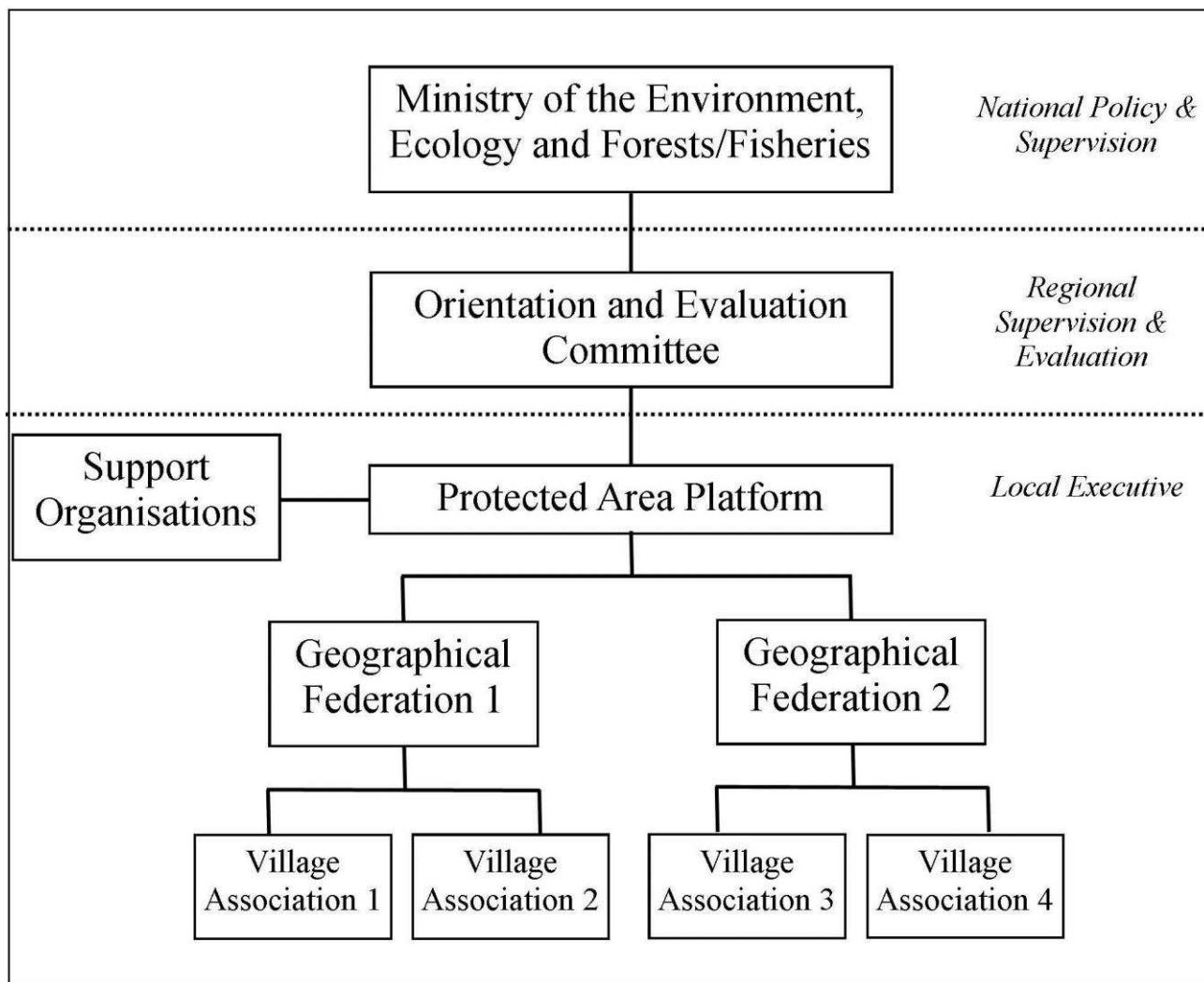
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 796 Madagascar Protected Area System.

797