

Introducing and evaluating a knowledge transfer approach to support problem solving in and around protected areas

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1 Introducing and evaluating a knowledge transfer approach to support problem solving in and around  
2 protected areas

### 3 **Abstract**

4 Protected areas (PAs) can generate many benefits inside and outside their borders, and achieving  
5 objectives for diverse stakeholders raises many challenges. There are many examples of successful  
6 PA management around the globe, although a systematic and comprehensive approach to developing  
7 and sharing these solutions has been lacking. We present “solutioning” as a structured process of  
8 peer-learning, which can inform management strategies in and around protected areas. We explain  
9 how the PANORAMA - Solutions for a Healthy Planet initiative has put solutioning into practice  
10 through an interactive community and web portal to learn about protected area solutions around the  
11 globe. Unlike other web platforms and initiatives reviewed, PANORAMA facilitates adaptation of  
12 solution elements (i.e., building blocks) for novel implementation. Supported by theories of resilience  
13 and peer-learning, PANORAMA appears to have potential to promote efficiency and equitable  
14 benefits for PAs and associated stakeholders focused on nature conservation and sustainable  
15 development, although further research is needed to assess whether this learning leads to better  
16 solutions or more effective PA management.

### 17 **Key words**

18 nature conservation; PANORAMA Solutions for a Healthy Planet; protected area management; peer  
19 learning; sustainable development; web platform

20

### 21 **INTRODUCTION**

22 Protected areas (PAs) around the world cover 15% of terrestrial and freshwater areas and 4% of  
23 marine areas within national jurisdiction (Bhola et al. 2016), playing an essential role for maintaining  
24 biodiversity, ecosystem integrity, and the diverse services and cultural values these landscapes and  
25 ecosystems provide to society (Watson et al. 2014). Objectives of individual protected areas (PAs)

26 can vary greatly (Dudley 2008), and through diverse management practices PAs generate many  
27 benefits including climate change mitigation and adaptation, regulating erosion and flooding,  
28 protecting watersheds for water quality, providing habitat for wild species, protecting sacred grounds  
29 for indigenous peoples and other communities, and supporting regional development (Watson et al.  
30 2014, Stolton et al. 2015). Through participatory approaches, stakeholder groups engaged in PA  
31 management (e.g., PA managers, local communities, and non-government organizations; henceforth  
32 PA stakeholders) have the potential to affect conservation and natural resource management beyond  
33 borders of PAs (Wells and McShane 2004, Schick et al. 2017). As such, PAs can serve as nodes or  
34 hubs that enable flows of ecosystem services in green infrastructure networks at broader scales  
35 (Benedict and McMahon 2012, Mattsson 2017).

36 Enabling equitable provision of ecosystem services and associated benefits for diverse stakeholders  
37 over the long term (henceforth, socioecological sustainability; Broto 2013) is an ambition drawn from  
38 global policy documents by the United Nations (i.e., Sustainable Development Goals; UN General  
39 Assembly 2015) and the International Union for Conservation of Nature (IUCN; Dudley 2008) and is  
40 relevant for many protected areas around the planet. Achieving objectives across the socioecological  
41 spectrum (e.g., species protection and recreation opportunity) even at local to regional scales raises  
42 many challenges for management of individual PAs. Among others, these challenges include gaps in  
43 knowledge to develop and implement effective management plans that balance competing objectives,  
44 and insufficient communication and engagement among stakeholders (Ferraro and Hanauer 2015). In  
45 addition to these internal challenges, external pressures well beyond the control of PA stakeholders are  
46 influencing decision making, including political shifts, pressures for economic development, PADDD  
47 (PA downgrading, downsizing, degazettement), climate change impacts, and invasive species (Watson  
48 et al. 2014, Watson et al. 2016). Efficient solutions are needed urgently to overcome these challenges  
49 to ensure the long-term benefits of PAs for nature and society.

50 Many knowledge resources exist to help PA stakeholders address the key challenges, and they exist  
51 primarily in the form of general guides, training and tutorials, and as individually published case  
52 studies (Table 1). Case studies that describe the implementation of a particular approach in a local or

53 regional context are particularly valuable, because they highlight the challenges and benefits  
54 associated with particular solutions (i.e., successfully implemented management strategies) in a  
55 specific area. PA managers in Europe have expressed interest in sharing more detailed descriptions of  
56 such case studies that have been implemented for individual PAs or PA networks, in a format that they  
57 can easily understand and interpret. This presents a challenge, as each solution is tailored to the focal  
58 PA(s), and solutions are reported in various formats that may preclude easy sharing and consistent  
59 interpretation by other PA stakeholders.

60 Based on theories drawn from learning sciences (Bloom 1956, Krathwohl 2002), psychology  
61 (Anderson), and environmental conservation (Biggs et al. 2012), we propose that structuring a solution  
62 by breaking it into potentially replicable component parts (i.e., building blocks) will facilitate  
63 communication, learning, and adoption of one or more building blocks by other PA stakeholders. We  
64 further anticipate that providing PA stakeholders with a systematic approach to share structured  
65 solutions will inform, connect, and motivate PA stakeholders, and thus help overcome key challenges  
66 in PA management (IUCN 2015). Learning from peers about specific examples of successful  
67 management practices and governance arrangements provides an important means toward innovation  
68 and implementation of increasingly effective management strategies (Fish and Walton 2013).

69 Our general aim is to present a “solutioning” approach for sharing knowledge among conservation  
70 practitioners regarding examples of successful management in and around PAs. The term was  
71 borrowed from the fields of counseling (Webb 1999) and information technology (Malik 2013) to  
72 describe a process that engages peers and social discourse to seek answers to questions about behavior  
73 change and innovation. Although solutioning can be applied by a diverse range of actors, we focus  
74 here on the application of solutioning by PA stakeholders addressing issues within and beyond their  
75 protected area. We will begin by describing theories to support this approach followed by a  
76 description of the PANORAMA – *Solutions for a Healthy Planet* initiative (henceforth,  
77 PANORAMA; Fig. 2), which has pioneered and implemented this approach in the context of PA  
78 management. In particular we illustrate the design of PANORAMA, including its online and offline  
79 community of users who engage through four phases that comprise solutioning. We also highlight

80 solutions that have been published and have inspired others to enact parts of them in their own regions.  
81 In closing, we outline the future vision for PANORAMA and how this approach could inform other  
82 parallel efforts to support socioecological sustainability within and beyond PAs.

### 83 **SOLUTIONING: DEFINITION & THEORETICAL FOUNDATIONS**

84 We introduce solutioning as a four-phase process to address one or more challenges facing protected  
85 area stakeholders aiming to support objectives for nature and people (Fig. 1). Although we focus on  
86 the application of the approach by PA stakeholders, solutioning may be enacted by any conservation  
87 and sustainable development practitioner. This approach is supported by theories of knowledge  
88 transfer, peer learning, and social-ecological resilience. We briefly describe each of these main  
89 theoretical foundations.

90 The well-known Bloom's Taxonomy of Learning (Bloom 1956) acknowledged that learning from  
91 dissimilar examples can be difficult. Extrapolation from a single example was identified as the highest  
92 form of comprehension, and synthesis of multiple examples to produce a new idea and apply to a  
93 novel situation was identified as one of the most difficult learning tasks of all. More recently  
94 Krathwohl's (2002) revision of the taxonomy proposed that knowledge about when and how to apply  
95 principles was the highest form of procedural knowledge. To help PA managers apply lessons from  
96 seemingly disparate case studies, it may therefore be useful to seek ways to simplify the learning task.

97 Psychologists have long embraced Bandura's (1985) theory of social learning, which posits that  
98 humans learn best by replicating the behaviors, norms, and beliefs of valued "others." However, as the  
99 behaviors become more complex, imitation grows more difficult. Anderson's (1996) Adaptive  
100 Character of Thought Theory argues that humans learn new approaches to complex problems through  
101 the acquisition and interaction of procedural and declarative knowledge. Declarative knowledge is  
102 obtained in units called "chunks" that are simple enough to be processed, while procedural knowledge  
103 describes how things are connected together in one's environment. By breaking management problems  
104 into potentially replicable component parts and providing clear guidance on how to carry out a

105 solution in a stepwise fashion, solutioning provides a way to help PA managers recognize and process  
106 the chunks from which learning can be achieved.

107 Sharing knowledge among peers through communities of practice can be especially effective for  
108 learning, innovation, and implementation of novel management strategies (Reed et al. 2014). By  
109 breaking down and documenting a solution according to its component building blocks, tacit (i.e.,  
110 undocumented) knowledge is converted to explicit (i.e., documented) knowledge (Nonaka and  
111 Takeuchi 1995) that can then be transferred between PA stakeholders. Within a conservation  
112 organization or natural resource management agency, the solutioning approach encourages knowledge  
113 creation through development of new solutions and building blocks along with knowledge and  
114 retention through the documentation and storage of these solutions and building blocks (Argote and  
115 Miron-Spektor 2011). Through the transfer and uptake of building blocks in a novel application  
116 domain or administration, practitioners consider a broader range of management approaches in  
117 different contexts. This process should therefore generate improved understanding and enhanced  
118 capabilities for adapting and improving the solutioning process within a particular community of  
119 practice.

120 Biggs et al. (2012) proposed seven principles (P1-7) for enhancing resilience of ecosystem services in  
121 the face of disturbances and dynamics of social-ecological systems (SES), and we argue that the  
122 solutioning approach is useful for realizing at least some of these principles across diverse ecosystems  
123 and multiple spatial and temporal scales. First, it encourages learning and experimentation (P5)  
124 through sharing lessons learned among PA stakeholders regarding the challenges and successes of  
125 implementing solutions (and their component building blocks) in diverse contexts. Below, we expand  
126 further on the theory of organizational learning and how this relates to the solutioning approach.  
127 Second, maintaining diversity and redundancy (P1) in SES can be achieved through ensuring  
128 heterogeneity of biological communities and management approaches. Although methods for  
129 maintaining biological diversity must be tailored to the particular areas where they are applied (Ferraro  
130 and Hanauer 2015), the fields of natural and social sciences offer general theories, and conservation  
131 organizations have prepared general guides (e.g., IUCN 2016) that can be used as a basis to formulate

132 building blocks that are transferable. Lastly, when applied to protected area management, solutioning  
133 broadens participation (P6) by engaging networks of PA stakeholders in developing, implementing,  
134 documenting, and sharing their solutions and building blocks.

## 135 **PANORAMA INITIATIVE: OVERVIEW**

136 The PANORAMA – Solutions for a Healthy Planet initiative began in 2014 (henceforth,  
137 PANORAMA; Appendix S1; Fig. 2). It addresses the need to understand and analyze what constitutes  
138 success in PA management through the four phases of solutioning (Fig. 1). PANORAMA serves a  
139 wide variety of institutions and individuals, and it serves as a mechanism for sharing solutions and  
140 their component building blocks along with lessons learned. PANORAMA is coordinated by German  
141 International Cooperation Agency (GIZ) and International Union for the Conservation of Nature  
142 (IUCN), and it is being implemented in partnership with United Nations Environment Programme,  
143 GRID-Arendal, and Rare (a non-governmental conservation organization). Although PANORAMA  
144 facilitates solutioning within and beyond the thematic realm of protected area related issues, the  
145 purpose of our study is to describe the solutioning process as it applies to solutions that include PAs.

### 146 **Web platform**

147 PA stakeholders publish their solutions and view others' solutions on the PANORAMA web platform,  
148 particularly the thematic portal on "Protected Areas". The PANORAMA platform currently has 3  
149 further thematic portals: "Ecosystem-based Adaptation", "Marine and Coastal" and "Agriculture and  
150 Biodiversity", with further themes foreseen to be added in the future. Each theme is coordinated by an  
151 organization, sub-unit of an organization, or a consortium (e.g., IUCN Global Protected Areas  
152 Programme for the "Protected Areas" community). All thematic portals are part of a single database  
153 storing all solutions and building blocks. In addition to viewing solutions by entering through any of  
154 the thematic portals, users can view all solutions within that database on the "Explorer" page  
155 (PANORAMA 2018). The platform provides diverse means of search and filtering, e.g. by ecosystem  
156 or region. It is built on the web content management platform Drupal.

### 157 **Describing and refining a solution for publication**



158 Solutions, as defined in the context of PANORAMA, are specific, applied examples of successful  
159 processes or approaches to protected area management and governance. They can represent entire  
160 projects or only aspects of a project, and they typically encompass several phases of activities.  
161 Recognizing the global scope of PANORAMA, solutions can be published in any of 3 languages (EN,  
162 FR, or ES). They are documented in a way that is understandable for audiences from diverse cultures,  
163 to enhance the opportunity for building blocks to be adapted for new contexts. Documenting a solution  
164 is the second step in the solutioning process, following the initial step of self-reflection and  
165 summarizing key factors that made their work successful (Fig. 1).

166 Before being published on the PANORAMA web platform, each solution is subjected to a review  
167 process, conducted by IUCN staff members and in some cases an external reviewer designated by  
168 IUCN (e.g. member of the IUCN World Commission on Protected Areas). The reviewer provides  
169 comments to support the solution provider in meeting the required quality standard, particularly with  
170 regards to general logic, clear description of the core idea, selection and description of building blocks,  
171 clarity of expression and grammar, and adherence to the format.

172 Any PA solution to be considered must meet the following criteria : 1) thematically relevant:  
173 solutions respond to challenges for sustainable development and human wellbeing and contribute to  
174 maintaining or improving biodiversity and ecosystem services in one or more protected areas; 2)  
175 impactful: solutions are effective and their implementation shows strong potential for improvements in  
176 ecological, social, and economic conditions; and 3) replicable and/or scalable: building blocks of the  
177 solution have the potential for adaptation, replication or upscaling in other geographic, social or  
178 sectorial contexts.

179 Solutions on the PANORAMA web platform are documented in a standard format as either a “full  
180 solution” or as a “snapshot solution” (Appendix S2). Here, we focus on the full-solution template as  
181 the snapshot solution template is a subset. The full-solution template starts with a general information  
182 including the solution title, names of the contributors, world region, specific location(s) where the  
183 solution was implemented, summary, positive social, ecological and/or economic impacts, images  
184 illustrating the solution, and links to related resources.

185 The remaining sections of the template are required for full but not snapshot solutions, and these  
186 sections include challenges addressed, list of beneficiaries, ecosystem types, themes covered, scale of  
187 implementation, organizations involved, and a personalized story to highlight certain aspects of the  
188 solution (Table 2; Appendix S2). Entries for the relevant world regions (n=16), ecosystems (n=40),  
189 and themes (n=67) represent the primary dimensions of the solution and provide the basis for a guided  
190 filter mechanism on the web platform. In addition to the introductory sections, up to 6 building blocks  
191 need to be described by completing the following sections for each building block: title, summary  
192 description, enabling factors, lessons learned, classification of building block, scale and phase of  
193 implementation in the context of the overall solution, images, and links to relevant resources. The  
194 final section of the template is a description of how these building blocks interact to produce the  
195 solution as a whole. Solutions are therefore formatted to achieve the overarching goals of the  
196 PANORAMA initiative, as they summarize impacts on socioecological sustainability within a  
197 particular context including individuals and organizations involved along with the lessons learned  
198 from implementing the building blocks.

### 199 **Communicating solutions and building blocks**

200 In addition to visiting the PANORAMA web portal, PA stakeholders communicate about published  
201 solutions and building blocks through several pathways, including webinars, workshops, publications,  
202 newsletters, and social media. These modes of communication are designed to help practitioners  
203 share their stories in a consistent way, get recognized for successful work by other PA stakeholders,  
204 learn how others have tackled problems across the globe, and reflect and consider implementing new  
205 management approaches in their own context (Fig. 2). For example the PANORAMA webinar series  
206 focuses on particular themes, seeking to provide a useful means to promote existing solutions,  
207 stimulate discussion about uptake of building blocks, and inspire PA stakeholders to reflect and submit  
208 new solutions of their own. One of the webinars was supported by an accompanying IUCN publication  
209 on that theme (i.e., transboundary conservation; Rodrigues and Fischborn 2016). The webinar  
210 recordings and individual solutions are further highlighted via newsletters and social media.

211 As another form of live interaction through PANORAMA, IUCN and partners have hosted solutioning  
212 workshops to discuss existing PA solutions and building blocks to promote learning and to initiate  
213 adaptation and uptake of building blocks (Appendix S3). In-person workshops offer benefits for both  
214 solution providers and for solution seekers. For solution providers, the workshop provides a vehicle to  
215 potentially transfer and adapt their solutions to new application domains. For solution seekers, the  
216 solutions and building blocks discussed during the workshop provide inspiration for finding ways to  
217 address their own challenges. Beyond the exchange of knowledge, solutioning workshops also have  
218 clear networking benefits resulting from the diverse expertise and knowledge of the participants.

219 PANORAMA solutions and building blocks are integrated into training modules. The use of solutions  
220 in a training event supports the learning process, as they serve as examples from practice that  
221 complement the theory of training content. The specific theme of the training provides the audience  
222 with an overall framework, while the case studies within that theme address context and detailed  
223 consideration of local needs, and/or can enrich the discussions by illustrating relevant lessons from  
224 similar or other geographic contexts.

225

### 226 **Transfer and uptake of building blocks**

227 As predicted by learning theories (Krathwohl 2002, Anderson 1996), the last and most time-intensive  
228 phase in the solutioning process involves adapting one or more building blocks from existing solutions  
229 for implementation in another situation (Fig. 1). A PA stakeholder reflects on existing solutions or  
230 building blocks to determine whether these can be adapted for implementation in their own context,  
231 and following consultation and deliberation, applies these ideas in practice. By learning about  
232 solutions and building blocks through the PANORAMA web platform, the webinars and the  
233 discussion at the workshops, PA stakeholders gain insights into how individual building blocks have  
234 been applied in the original context. Through further reflection, the building blocks can be adapted to a  
235 new local context, taking advantage of the knowledge shared from colleagues in the PANORAMA  
236 community of practice. Implementing the adapted building blocks has potential positive outcomes for

237 biodiversity and human livelihoods, and these outcomes should be monitored to support learning and  
238 future improvements.

239

#### 240 **PANORAMA INITIATIVE IN ACTION**

241 Although PANORAMA has only recently been developed, there has been a large degree of  
242 participation in the initiative. As of February 2018, 369 solutions had been published on the web  
243 platform across the currently 4 thematic portals, including 270 full solutions (i.e., solution summary  
244 plus at least two building blocks) and 99 Snapshot Solutions (i.e., solution summary) describing  
245 conservation and natural resource management solutions distributed across all continents except  
246 Antarctica. Of these, the “Protected Areas” portal currently features 200 solutions, 118 of which are  
247 full solutions, and 82 are snapshot solutions (Fig. 3). On average, 1 full solution and 2 snapshot  
248 solutions are submitted each month for publishing on the “Protected Areas” portal. In addition to the  
249 publishing activities, starting in 2016, there have been 9 bi- to tri-monthly “protected area solutions”  
250 webinars averaging 115 registrants and 44 attendees, who then receive recordings of the presentations  
251 (Table 3). On average, 71 people viewed the recording of each session.

252 Several solutioning workshops have been conducted. The largest of these was a series of workshops  
253 entitled “Blue Solutions Regional Fora” that spanned several days and brought together over 100  
254 practitioners in marine and coastal conservation. The focus was on local to regional-scale marine  
255 conservation efforts across a certain region, and the workshops included sessions for knowledge  
256 sharing on solutions relating to management of marine protected areas and other issues. Other  
257 workshops have been smaller-scale. For example a half-day workshop with staff from IUCN, GIZ,  
258 and KfW (Kreditanstalt für Wiederaufbau) banking group focused on identifying 1) building blocks  
259 from protected area related projects around equitable governance being implemented by local actors;  
260 2) lessons learned from existing applications of the solutioning approach; and 3) ways of improving  
261 the solutioning approach in light of these lessons learned.

262 Although more challenging to document, multiple instances of building-block adaptation and uptake  
263 have already occurred during the first years of the initiative. To illustrate the process, we describe two  
264 examples where one or more building blocks of a solution were adapted and implemented in another  
265 context. In the first example, multiple building blocks were adapted to several locations in Laos.  
266 Appendix S4 describes a building block implemented near the west coast of southern Africa inspired  
267 thinking about potential building blocks to implement in another country along to the opposite coast of  
268 the continent. The second example illustrates how solutions can be transferred between countries.

### 269 **Case study: Building block adaptation between PAs of Laos**

270 The management of Hin Nam No National Protected Area (HNPA), located along the Lao-Vietnamese  
271 border, had been facing many challenges, including lack of human and fiscal resources along with  
272 insufficient engagement of stakeholders in the surrounding communities regarding day-to-day  
273 management and decision-making (de Koning et al. 2016). One of the goals of protected area  
274 managers is to maintain biodiversity in the region, which requires managing hunting and poaching  
275 activities. Given that these activities occur within the local villages embedded within the protected  
276 area, effective management is only possible with strong participation and cooperation of stakeholders  
277 in the local communities. To address this need, staff of the German International Cooperation Agency  
278 (GIZ) worked with park authorities and local community members to enact the solutioning process  
279 (Fig. 1). Each step of the process was followed and in step 2 several building blocks were documented  
280 to comprise the solution: participatory mapping and zoning of the area, villager ranger training to  
281 enforce harvest and poaching policies, a monitoring system to track data related to poaching activities,  
282 and systematic wildlife observations (HNPA 2010, de Koning et al. 2016, Dobbelsteijn 2017). In step  
283 3, building blocks within the HNPA solution were then shared with nine other PAs in Laos. To date  
284 three of these PAs have adapted these building blocks (step 4) to approve 21 village co-management  
285 agreements (Phommasane 2017), illustrating another case of building block adaptation between  
286 regions.

287

## 288 **DISCUSSION AND CONCLUSIONS**

289 We have presented solutioning as a process of reflection, documentation, communication, followed by  
290 adaptation and uptake of successful management in and around protected areas. The process is  
291 supported by theories from psychology, education, ecology, and conservation biology, and has a  
292 general aim to support the achievement of objectives of protected area authorities at a local scale and  
293 socioecological sustainability at broader scales. Recognizing the diverse objectives and contexts  
294 among regions, the process is designed to document tailored solutions and building blocks that are  
295 then adapted to other areas facing similar issues and challenges. The 2 examples facilitated by the  
296 solutioning methodology support the idea that, through the deconstruction of a solution into its  
297 adaptable components, solutioning can facilitate adaptation and delivery of existing successful  
298 approaches leading to improved ecological and social conditions.

### 299 **Successes**

300 The PANORAMA Solutions for a Healthy Planet initiative has pioneered development of the  
301 solutioning process in the context of PA management, and has put it into practice through an  
302 interactive community and protected areas solutions web portal hosting over 200 PA solutions that  
303 have been implemented on every continent except Antarctica. This initiative is expected to persist and  
304 expand well into the future, with a general aim of expanding its network of influence to an  
305 increasingly diverse suite of site managers, NGO staffs, researchers and government agencies.  
306 PANORAMA partner organizations (e.g., Global Environment Facility and Germany's Federal  
307 Ministry for the Environment, Nature Conservation, Building and Nuclear Safety) have committed  
308 financial support and encouraged their members to participate in the initiative (e.g., contributing  
309 solutions, joining webinars, and hosting workshops) in exchange for dedicated portal of solutions (on  
310 the PANORAMA website) related to the respective missions of the organizations. With this diverse  
311 support, the PANORAMA initiative is expected to expand and persist within the mandates of existing  
312 and future partner institutions (Appendix S5). In return for the external support, PANORAMA  
313 supports participating organizations and individuals in sharing knowledge on how to achieve goals for  
314 conservation and sustainability.

315 Looking more specifically beyond PANORAMA, other initiatives use standardized templates to  
316 collect and publish on-line case study descriptions of successful management in the fields of nature  
317 conservation and socioecological sustainability (Table 1). Our review finds that PANORAMA is the  
318 only such initiative that uses the solutioning process to develop a large portfolio of case studies on  
319 protected area management and governance around the globe. The solutions collectively describe very  
320 diverse approaches operating at multiple levels of implementation (from individual PAs to continental-  
321 scale efforts), which have been led by a wide variety of actors and institutions. PANORAMA is also  
322 the only one of these initiatives that uses a modular case study format, offering building blocks within  
323 solutions. This presents a challenge and an opportunity for PANORAMA to collaborate with these  
324 related web platforms and to share case studies despite the diverse templates among platforms.

325 Solutions, while context-specific, are seen as toolboxes that demonstrate successful application of a  
326 suite of building blocks and can be adapted across geographies and themes. The solutions within  
327 PANORAMA address diverse issues relating to biodiversity conservation in the context of sustainable  
328 development and human well-being. Solutions document building blocks that can be used to address  
329 Sustainable Development Goals (International Council for Science and International Social Science  
330 Council 2015), and such documentation can serve a basis for parallel certification processes (Boiral  
331 and Gendron 2011, Jaung et al. 2016) that acknowledge the progress that is being made on the ground  
332 by PA staff and stakeholders.

### 333 **Challenges for the future**

334 In reviewing PANORAMA, we identified potential areas for improvement. One concern is the lack of  
335 quality indicators in the database of solutions. Currently, solutions are reviewed by a small group of  
336 IUCN staff members, and since August 2017, some solutions receive an external review by experts  
337 from the IUCN World Commission of Protected Areas' membership. Having external review for every  
338 published solution would improve the quality of the database. Although registered users may post  
339 comments to individual solutions, there is currently no means to provide anonymous feedback (e.g., by  
340 clicking a "like" button). Displaying the level of external review and allowing for anonymous  
341 feedback on the solutions will provide indicators of quality. Another concern for the future is the

342 webinar series, which is one of the main mechanisms (other than in-person workshops) to maintain  
343 live interaction with the user community. Although there were 6 webinars in 2016, there were only 3  
344 in 2017 and so far none in 2018 (as of February; IUCN 2018a), which may be too infrequent to  
345 maintain or increase the set of participants. A third area for improvement is the linkage between the  
346 database of solutions and other elements of the initiative. Of the 8 webinars there have been only 2  
347 that have had associated publications summarizing the relevant solutions (IUCN 2018b), which are an  
348 effective means of linking the webinars and database of solutions. The newsletters along with the list  
349 of webinars and associate publications are hosted on a separate IUCN website (IUCN 2018b), and  
350 there is no link to this website from the solutions explorer (PANORAMA 2018).

351 Beyond issues related to the solution-review process and webinars, mechanisms for stakeholder  
352 engagement should also be made clear for the PANORAMA initiative to achieve its ambitions of  
353 ensuring sustainable and equitable management in and around PAs. The solutioning approach offers  
354 ways to enhance stakeholder engagement, but stakeholder participation in PA solution-building and  
355 solution-transfer is not made explicit in the solutioning process. It is all too common in PA  
356 management for stakeholder outreach to be insufficiently broad, or for stakeholders to be engaged too  
357 late in the process (Agardy et al. 2011). The solutioning process is likely to work best when  
358 participation strategies are built into the framework from the start, and extra efforts are made to  
359 broaden participation beyond the most obvious stakeholders (Sayce et al. 2013). Further work is  
360 needed to identify optimal mechanisms for stakeholder engagement in the solutioning process under  
361 particular management contexts.

### 362 **Research opportunities**

363 Nonetheless, the broad coverage and standardized template for solutions being published on  
364 PANORAMA offers research opportunities. In particular, researchers can use the on-line solutions and  
365 building blocks to examine hypotheses about whether the PANORAMA initiative is improving  
366 efficiency and equitability of PA management. Such investigations would be possible through  
367 increasing sophistication of tools for quantifying information flows via the internet (Lei et al. 2015).  
368 Two general kinds of investigations could be conducted. First, researchers can address questions



369 about what determines knowledge transfer via the PANORAMA portal using web analytics to monitor  
370 visits to particular solutions and building blocks (Soriano-Redondo et al. 2017). Certain attributes  
371 (e.g., location of implementation, themes addressed) may attract more viewers to read about particular  
372 solutions or building blocks, which could guide future research on the design of supportive solutions.  
373 Second, researchers can examine spatial and temporal patterns in the objectives and actions being  
374 taken by protected areas and associated stakeholders by using formal content analysis (Bhatia et al.  
375 2013, Jiménez et al. 2015). Such an analysis could reveal insights into contrasting goals and strategies  
376 among regions and how these relate to targets under the Sustainable Development Goals (International  
377 Council for Science and International Social Science Council 2015), Aichi Biodiversity Targets of the  
378 Convention on Biological Diversity (CBD 2013), and other relevant global to national-scale policy  
379 commitments. Such an endeavor could complement parallel efforts examining protected area  
380 management effectiveness using standardized databases and approaches (Brooks et al. 2015, Coad et  
381 al. 2015).

382 Although social science theory suggests the solutioning approach creates a better process for finding  
383 solutions and engages stakeholders in a way that should lead to more effective solutions (Jamal and  
384 Stronza 2009, Sayce et al. 2013), this assumption has not been tested. Such evaluation is outside the  
385 scope of this paper. However, we suggest that the framework for management effectiveness developed  
386 by the IUCN World Commission for Protected Areas (Hockings et al. 2006) would provide an  
387 appropriate lens through which to assess contributions of the solutioning approach for addressing  
388 challenges in protected area management. For example, one might draw a random sample of  
389 protected-area cases from the PANORAMA database, pair each one with a similar protected area  
390 where the solutioning approach had not been used, and compare outcomes between each pair for the  
391 six assessment categories identified by Hockings et al. (2006): context, planning, inputs, management  
392 processes, outputs and outcomes.

### 393 **Learning, adaptive management, and transformation**

394 Our analysis suggests that the solutioning approach, operationalized through PANORAMA, can be  
395 useful to government agencies responsible for protected area management. Assessing, understanding

396 and summarizing “what works” in protected area management and governance will promote learning  
397 while providing valuable information to inform future policies and reporting on progress to  
398 international targets, such as the CBD’s Aichi Target 11. An example of adapting building blocks  
399 within a governmental conservation agency has occurred in the upper midwestern US, where a  
400 network of 22 national wildlife refuges managed by the U.S. Fish and Wildlife Service has worked  
401 with scientists in the U.S. Geological Survey to develop and implement a joint adaptive management  
402 program that has enhanced their effectiveness at managing invasive plant species to maintain  
403 biodiverse prairie habitat across an ecoregion (Moore et al. 2013).

404 Learning and adaptive management can promote effective conservation planning and natural resource  
405 management in diverse contexts (Grantham et al. 2010, Williams and Brown 2012). Non-  
406 governmental conservation organizations (NGOs) such as Rare have developed approaches to achieve  
407 transformational behaviour change by borrowing from psychology, marketing theory and other social  
408 sciences disciplines in identifying so-called “bright spots”, i.e. locally-led solutions, and repeat them  
409 in communities around the world (Rare 2015). These approaches are expected to bring about voluntary  
410 behaviour changes inspired by specific, locally-owned solutions. This example illustrates that  
411 conservation agencies and organizations can move beyond repeating traditional conservation and  
412 natural resource management practices that have been locally established.

413 Ideally, the collaborations and stakeholder engagement fostered by the solutioning process would not  
414 only benefit individual protected areas and associated stakeholders, but lead to improvements in socio-  
415 ecological sustainability at broader scales. The initiative’s creators envision that it can be a catalyst for  
416 change and transformative governance toward socioecological sustainability (Chaffin et al. 2016). The  
417 text published in the standardized template for solutions and building blocks on the web platform  
418 along with on-ground verification procedures can be used to evaluate this hypothesis. If so,  
419 solutioning could therefore create positive impacts for science and society at the local level and  
420 broader political levels, by encouraging and motivating individuals, communities and institutions to  
421 take positive and documentable action for socioecological sustainability.

422

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587

## 588 TABLES

Table 1. Examples of knowledge resources highlighting best practices for management of individual protected areas around the globe.

Author(s) <sup>a</sup> , Year, Title
<b>General guides and publications</b>
IUCN (2016), Protected areas: best practice guidelines.
Douvere (2017 ) World Heritage marine sites: best practice guide.
<b>Web portals with collections of resources on protected area management<sup>b</sup></b>
Equator Initiative (2017) Case study database, 37
EUROPARC Federation (2017a) Toolbox, 73
Global Transboundary Conservation Network (2017) Case studies, 14
National Biodiversity Strategies and Action Plans Forum (2015) Best practices, 124
Oppla (2017) Case study finder, 22
PANORAMA (2017) Solutions for a Healthy Planet: Protected Areas portal, 151
#NatureForAll (#NatureForAll) Success stories
<b>Trainings and tutorials, including in-person courses and resources available online</b>
Conservation Measures Partnership (2017)
The Nature Conservancy (2017). ConservationTraining.
Warner College of Natural Resources (2012) Center for Protected Area Management and Training.
National Conservation Training Center (2017) The National Conservation Training Center.
<b>Peer-reviewed journal articles including multiple case studies on <math>\geq 1</math> PA in an ecoregion or country<sup>c</sup></b>
Crabbe et al. (2014), Capacity building and policy development in Belize marine protected areas, an example for Caribbean integrated coastal management.

Havard et al. (2015), Stakeholder participation in decision-making processes for marine and coastal protected areas: Case studies of the south-western Gulf of California, Mexico.

Stringer and Paavola (2013), Participation in environmental conservation and protected area management in Romania: A review of three case studies.

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<sup>a</sup> Acronyms: IUCN = International Union for the Conservation of Nature; BIOPAMA = Biodiversity and Protected Areas Management Programme

<sup>b</sup> Numbers of case studies on PA management as of 8 November 2017, when known, are given.

<sup>c</sup> Based on literature search in Web of Science using the following search keywords: protected area\* and ("case studies" or examples). Papers published before 2013 or lacking descriptions of strategies to achieve socioecological sustainability of PAs are not included in the table.

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Table 2. Hypothetical selections of solution dimensions by a solution seeker and corresponding examples of protected area solutions published on the PANORAMA - Solutions for a Healthy Planet web platform.

Hypothetical selections of solution dimensions <sup>a</sup>				Example solution matching each hypothetical set of dimensions	
Region	Ecosystem	Theme	Type	Title	Citation
Southeast Asia	Tropical deciduous forest	Outreach	Full	Integration of local knowledge in park management	Dobbelsteijn (2017)
East and South Africa	Mangrove	Indigenous people	Full	Improving relationships between local communities and Saadani National Park management	Downie (2017)
East and South Africa	Desert ecosystems	Protected area governance	Full	Making protected area concessions work for communities	Snyman (2017)
West and Central Africa	Temperate evergreen forest	Sustainable livelihoods	Full	Conflict resolution strategy for Kahuzi-Biega National Park	Kujirakwinja (2017)
Europe	Temperate deciduous forest	Connectivity / transboundary conservation	Full	Promoting transboundary co-existence of large carnivores	Mattsson (2017)

<sup>a</sup> The full range of selections for each dimension are given in Appendix S2.

593 Table 3. Overview of protected areas (PAs) webinar series organized by PANORAMA – Solutions for  
 594 a Healthy Planet.

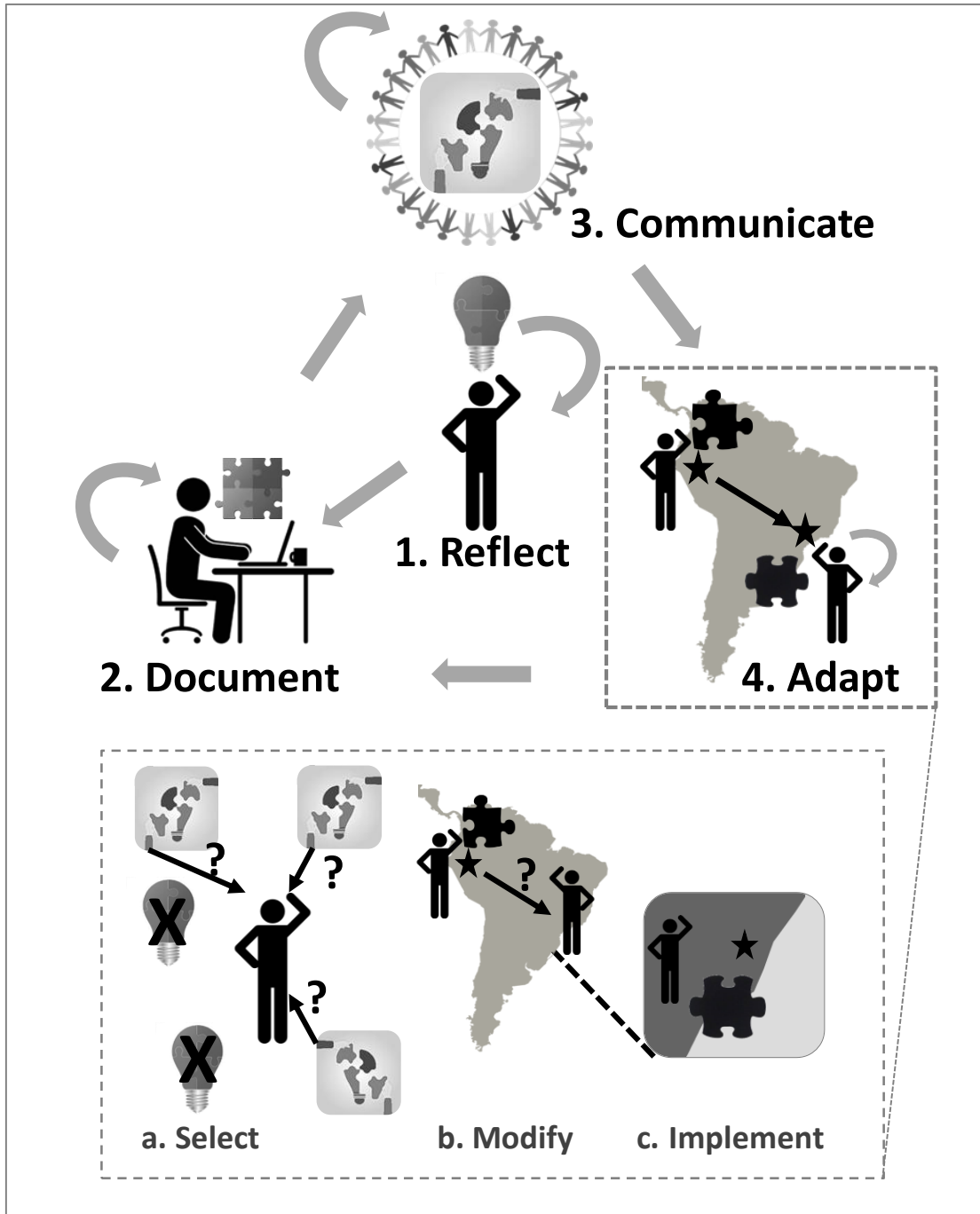
Topic	Date	Registrants who received the webinar recording	Attendees	Turnout ratio	Number of users who viewed webinar recording (as of 06 November 2017)
African PA solutions to climate change	Jan 2016	72	34	47%	56
PA tourism (session 1)	Mar 2016	77	55	71%	103
PA tourism (session 2)	Apr 2016	88	39	44%	59
Island solutions	Aug 2016	126	41	33%	17
Engaging young people in PAs	June 2016	103	31	30%	121
Transboundary PA solutions	Dec 2016	141	43	30%	102
Gender mainstreaming solutions for PAs	Mar 2017	195	68	35%	166
Scaling up community-led MPA management	June 2017	253	92	36%	80
Solutions on lessons learned in the management of Amazon Protected Areas (Soluciones sobre lecciones aprendidas en la gestión de Áreas Protegidas Amazónicas)	Oct 2017	220	47	21%	40

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597

598 **FIGURES**



599

600 Fig. 1. The solutioning process as applied to protected area (PA) management. One or more PA  
 601 stakeholders carry out the four phases of solutioning as follows: 1) reflect on a particular solution that  
 602 they have implemented to address a problem in one or more regions; 2) document the problem,  
 603 solution, and publish including the component building blocks; 3) communicate the solution with  
 604 peers via publications, webinars, and workshops; and 4) Adapt building blocks of an original solution  
 605 and implement them in other region(s) where they work. The last phase involves three steps for a PA

606 stakeholder: a) select among existing solutions or individual building blocks that are relevant to the  
607 issues they are facing; b) modify the selected building blocks as needed for proper implementation in  
608 the new context; and c) implement the adapted building block, often requiring a participatory  
609 approach that involves the relevant stakeholders.



Fig. 2. Schematic illustrating the PANORAMA – Solutions for a Healthy Planet initiative, which implements a solutioning approach via an online web portal, workshops, webinars, and trainings to support protected area management.

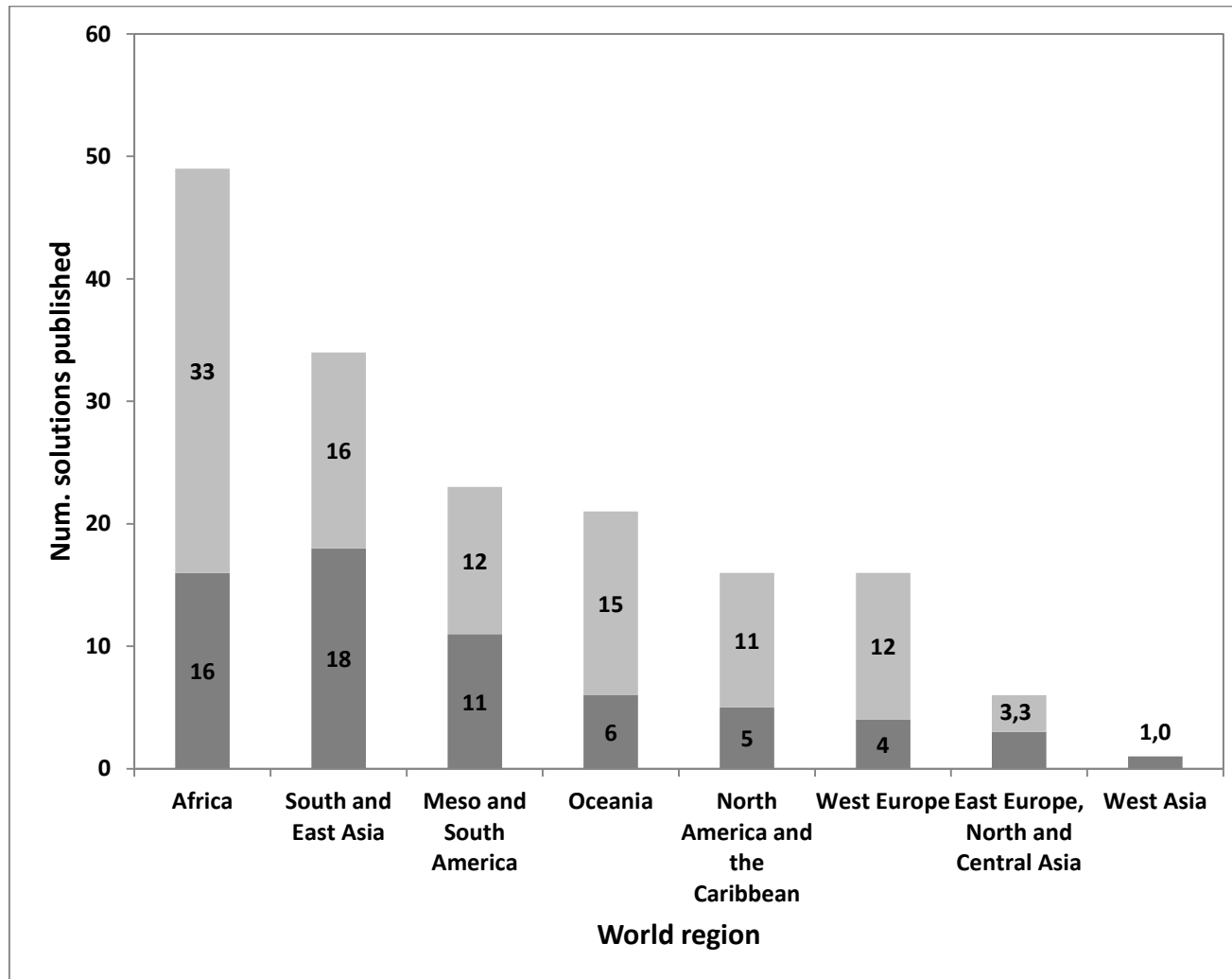


Fig. 3. Geographic distribution of solutions published on the PANORAMA – Solutions for a Healthy Planet protected areas web portal as of March 2017. Dark-shaded bars represent full solutions, and gray-shaded bars represent snapshot solutions.