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Biodiversity and Ecosystem Services on the African continent – what is changing, and what are our options?

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1 **Biodiversity and Ecosystem Services on the African continent – what is changing, and**
2 **what are our options?**

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7

8 Abstract

9 Throughout the world, biodiversity and nature’s contributions to people are under threat, with
10 clear changes evident. Biodiversity and ecosystem services have particular value in Africa– yet
11 they are negatively impacted by a range of drivers, including land use and climate change. In this
12 communication, we show evidence of changing biodiversity and ecosystem services in Africa, as
13 well as the current most significant drivers of change. We then consider five plausible futures
14 for the African continent, each underlain by differing assumptions. In three out of the five
15 futures under consideration, negative impacts on biodiversity and ecosystem services are likely to
16 persist. Those two plausible futures prioritizing environment and sustainability, however, are
17 shown as the most likely paths to achieving long term development objectives without
18 compromising the continent’s biodiversity and ecosystem services. Such a finding shows clearly
19 that achievement of such objectives cannot be separated from full recognition of the value of
20 such services.

21

22 **1. Introduction**

23 Biodiversity and ecosystem services are facing serious threats globally, impacted by a range of
24 often interacting drivers, including land use and climate change (IPBES 2019). Africa, a
25 continent rich in biocultural diversity, is one of the last places on Earth with a significant, intact
26 large mammal assemblage, and with a unique diversity of indigenous and local knowledge, the
27 majority of which, as yet, remains largely undocumented. The unrealized potential of Africa’s
28 biodiversity, ecosystem services, spirituality, culture and identities places the continent in a
29 unique position globally- it can serve as a source for generating development pathways that are
30 truly sustainable, where people’s wellbeing and needs can be met without negatively infringing on
31 the environment. The continent’s rich biocultural heritage is, however, rapidly being exploited to
32 meet development needs both within and outside of the continent. This has placed Africa in a
33 vulnerable position with regards to building a resilient future for its citizens, and for those people
34 and ecosystems that depend on Africa’s resources outside the continent.

35

36 In this short communication, we draw on the Intergovernmental Science-Policy Platform on
37 Biodiversity and Ecosystem Services (IPBES) Regional Assessment Report on Biodiversity and
38 Ecosystem Services for Africa – worked on by all authors. We show what is changing in
39 biodiversity and ecosystem services on the African continent. We also identify future pathways
40 and options for an African continent where long-term development objectives are recognized as
41 inseparably connected to the conservation of the region’s rich biocultural heritage.

42

43 **2. . Material and approach**

44 The Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services (IPBES)
45 was established in 2012, with the intention of providing the most up to date and independent
46 assessments of the state of biodiversity and ecosystem services (or nature’s contributions to
47 people) to support decision-making around the world. The Regional Assessment Report on
48 Biodiversity and Ecosystem Services for Africa forms one of a suite of regional assessments,
49 alongside those focusing on Asia-Pacific, Europe and Central Asia and the Americas, all of
50 which were undertaken between 2015 and 2018.

51 The Africa Assessment was produced by 127 experts, including seven Fellows (early career
52 scientists brought on at the start of the assessment); with support from 23 contributing authors.
53 Authors were drawn largely from Africa. The report, as well as its Summary for Policymakers,
54 was approved by the Member States of IPBES at the sixth session of the IPBES Plenary, in
55 March 2018, in Medellín, Colombia.

56

57

58 **3. What is changing?**

59 Over the past several decades, biodiversity and ecosystem services in Africa have become
60 increasingly threatened by anthropogenic drivers, some of the most important of which include
61 human migration and political insecurity, climate change, habitat degradation and conversion,
62 unstainable harvesting and illegal trade of wildlife, and invasive alien species (MA, 2005; IPBES,
63 2018). Changes in land use and climate appear to be the most concerning of the drivers (more
64 detail provided below); with land use change the primary driver of change and loss to date.
65 Given current vulnerability to climate change in Africa (IPCC 2018), future changes in
66 biodiversity and ecosystem services are likely to be exacerbated or driven by climate change,
67 whether acting as a direct driver or in the case of multiple stressors. Natural drivers of
68 biodiversity decline have also been increasing over the last two decades, including (but not
69 limited to) diseases, pests and natural disasters (IPBES, 2018), likely as a result of human-driven
70 environmental changes affecting the region (Daszak et al., 2000). Such increasing impacts have
71 clear implications for a range of plants, invertebrates, fish, amphibians, reptiles, birds, mammals
72 and micro-organisms (IPBES 2018).

73

74 Table 1 shows a qualitative assessment of change in intensity of drivers of change in biodiversity
75 in Africa per sub-region and ecosystem type, as reported by parties to the Convention on
76 Biological Diversity (CBD). We see here, for example, that climate change and habitat
77 conversion are increasing in intensity, and may significantly impact both terrestrial/inland waters
78 and coastal/marine biodiversity in all subregions.

79

80

81

82 Table 1: Changes in biodiversity and the role of underlying direct and indirect drivers in Africa
 83 shown per subregion and ecosystem type

84

TABLE 1: CHANGES IN BIODIVERSITY AND THE ROLE OF UNDERLYING DIRECT AND INDIRECT DRIVERS IN AFRICA SHOWN PER SUBREGION AND ECOSYSTEM TYPE

SUBREGIONS	ECOSYSTEM TYPE	DRIVERS OF BIODIVERSITY CHANGE								
		Direct drivers						Indirect drivers		
		Climate change	Habitat conservation	Overharvesting	Pollution	Invasive alien species	Illegal wildlife trade	Demographic change	Protected areas	
CENTRAL AFRICA	Terrestrial/Inland waters	↗	↑	↑	↑	↑	↑	↑	↑	↗
	Coastal/Marine	↗	↑	↑	↗	↗	↑	NI	↔	
EAST AFRICA AND ADJACENT ISLANDS	Terrestrial/Inland waters	↑	↗	↑	↗	↗	↑	↑	↗	
	Coastal/Marine	↑	↔	↗	↗	↗	↑	↑	↔	
NORTH AFRICA	Terrestrial/Inland waters	↑	↗	↗	↗	↑	↔	→	→	
	Coastal/Marine	↗	↗	↗	↗	↑	NI	→	→	
SOUTHERN AFRICA	Terrestrial/Inland waters	↗	↗	↑	↗	↑	↗	↗	↗	
	Coastal/Marine	↗	↗	↗	↗	↑	↗	↗	↗	
WEST AFRICA	Terrestrial/Inland waters	↑	↑	↑	↗	↗	↑	↗	→	
	Coastal/Marine	↑	↗	↗	↗	→	↑	↗	→	

DIRECTION OF ARROW: Trend of the respective impact of the driver

High increase
 Moderate increase
 Low increase
 Decrease
 NI No information available
 Unchanged/Under control

85

86

87 It is well established that Africa is prone to the adverse impacts of climate change (see, for
 88 example, Myhre et al., 2013; Wright et al., 2015; Connolly-Boutin & Smit, 2016; Li et al., 2019).
 89 Temperatures throughout the continent are projected to rise more rapidly than the global rate

90 (IPBES, 2018; IPCC, 2018). In addition, there is a high probability that high intensity extreme
91 rainfall events will increase in frequency (Akumaga & Tarhule, 2018). The most severe
92 projections suggest that distribution, migration and population sizes of African plant species
93 critical for food security (e.g., common bean) are likely to be affected by climate change (see
94 Hummel et al., 2018). By 2100, it is estimated that climate change could result in significant loss
95 of certain bird and mammal species (due to range retraction), and cause a decline in productivity
96 of Africa's lakes by more than 20% (IPBES 2018).

97

98 In addition, climate change impacts on pests and pathogens are likely to significantly affect
99 human health and the livestock sector throughout the continent (e.g., Bett et al., 2019; IPBES
100 2018). Negative climate change impacts on marine and coastal environments (e.g. salinization of
101 water and soil, coastal erosion) pose a substantial risk for fisheries and the regulating and cultural
102 ecosystem services these systems provide. For instance, extreme ocean warming caused massive
103 coral bleaching events in 1998 and 2016, which resulted in reef mortality of more than 50% in
104 certain regions (Obura, 2016), particularly the Western Indian Ocean (Gudka et al., 2018).
105 Climate change and marine heatwaves (Smale et al., 2019), coupled with marine protected areas
106 for which spatial data is available covering only 2.6% of Africa's marine jurisdiction (Belle et al.,
107 2015), increases the impacts of current and future harvesting pressures on marine resources.

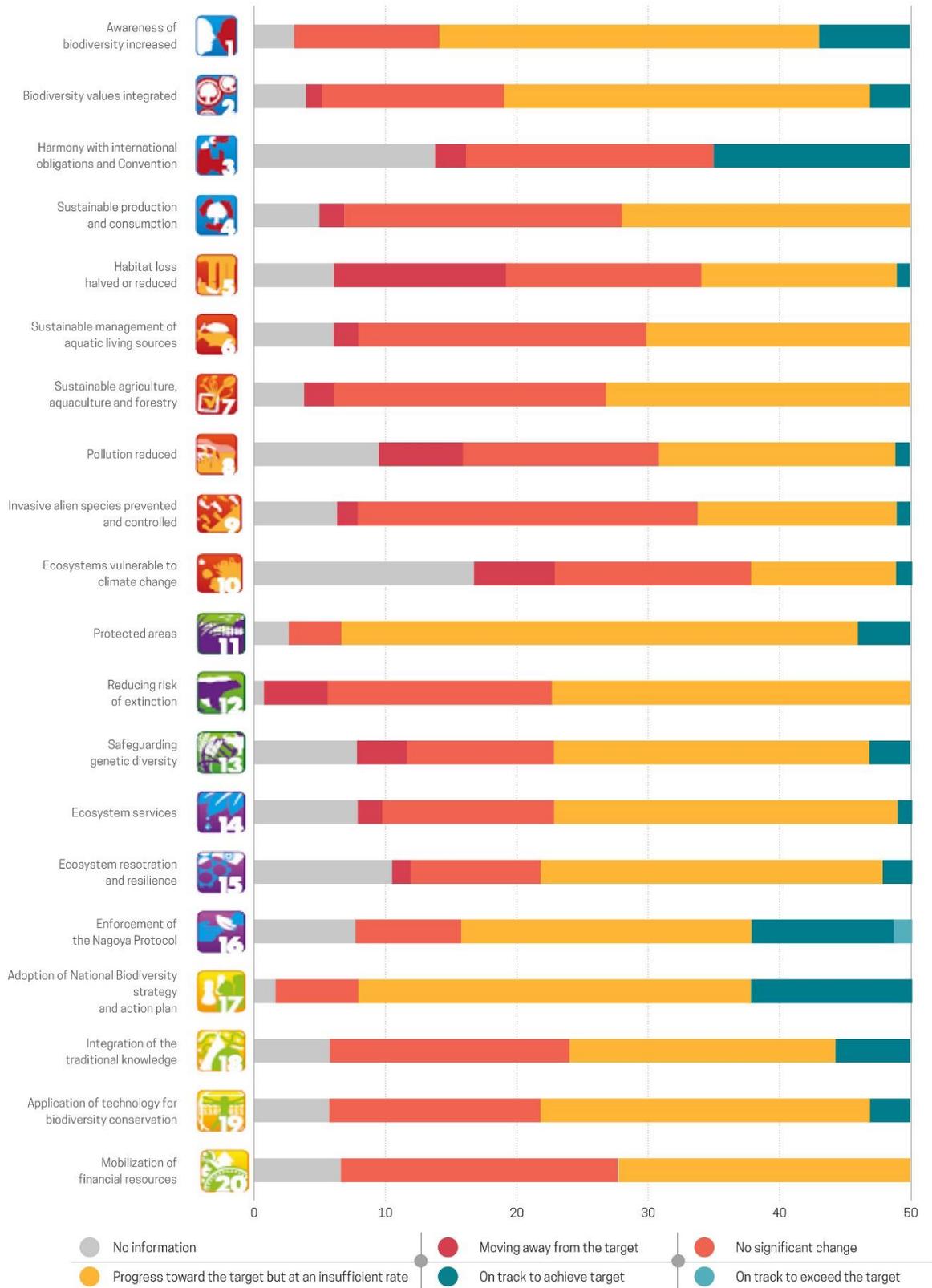
108 Land cover change throughout the continent is already driving a loss of key natural assets and
109 reducing the continent's capacity to support biodiversity. Land cover change includes intensive
110 agriculture, unregulated conversions of intact forest, mining, and use for urban and infrastructure
111 development (IPBES 2018). Effectively, we are seeing the impact of competing demand for land
112 through urban/infrastructure development, extractive industries and agricultural expansion and
113 intensification – an example here would be development and investment choices that strongly
114 emphasize expansion and intensification of primary and extractive industries. An estimate of 20
115 % of Africa's land surface is degraded due to direct drivers of change such as vegetation loss and
116 adverse impacts on soils, including pollution, erosion, decreased fertility and salinization (Nyingi
117 et al., 2018). In a significant finding, agricultural expansion appears as a dominant driver of
118 biodiversity loss with unregulated conversion to agricultural land leading to loss and erosion of
119 soils, habitats and water catchments, thus hampering Africa's long-term sustainable development
120 (IPBES 2018). The interactions between land-use and climate change compound the impacts on
121 biodiversity and ecosystem functioning, with ecosystems in environments that are climatically
122 challenging displaying lowered resistance to land-use change (Peters et al., 2019).

123

124 Tackling the negative impact of these drivers of change is a critical aspect for sustainable
125 development on the continent. Most African countries have committed to achieving particular
126 targets by particular deadlines – including (but not limited to) the Aichi Biodiversity targets and
127 the Sustainable Development Goals; as well as, for the continent specifically, AU Agenda 2063.
128 Some countries are progressing well towards their targets and are on track within the mandated
129 timeframe; others are not (Figure 1). For instance, awareness of biodiversity (Aichi Target 1) has
130 grown, exceeding the target in some countries (Stringer et al 2018). For Aichi Target 10 which
131 calls for reduction of pressures on ecosystems vulnerable to climate change however, evidence of
132 progress is lacking. Information to monitor progress is absent for several countries, while in six
133 nations, the direction of travel is away from the target.

134

FIGURE 1: COUNTRIES' PROGRESS TOWARDS SELECTED AICHI TARGETS



138 Figure 1 also shows some progress in the case of Aichi Target 11 – namely, protected areas
139 (although this finding should be placed in the context that much progress in the case of targets is
140 still only effected on paper – we discuss more in terms of conservation success stories below).
141 Thirty-nine countries are progressing towards the target, albeit at an insufficient rate (Stringer et
142 al., 2018).

143 Opportunities exist to learn from examples of better practice, including how we might be able to
144 scale up approaches and initiatives worthy of replication. One key example here, shown in Box
145 1, is the West African Marine Protected Area Network that supports the growth and
146 maintenance of Marine Protected Areas (MPAs) in West African countries (Failler et al. 2019).

147 Box 1: The West African Marine Protected Area Network

West African MPAs have been set-up initially for the protection of the fish biomass and/or certain emblematic species (turtles, manatees, birds, etc.). With the implementation of the National Determined Contribution in the context of the Paris Agreement on Climate Change, they further play the role of supplying key services for mitigation (blue carbon sequestration mainly) and for adaptation (coastal protection for instance). Overall, their habitats provide about 25% more regulating services than similar ones without special protection (Failler and Binet, 2012). A recent study, for example, showed that the Banc d'Arguin National Park, the largest African coastal MPA, would contribute to 20% of Mauritania's mitigation objective valued at 9 billion euros (with an annual running cost of only 1 million euros). Thus, the government, while recognising the key role of MPA, is taking steps toward the integration of coastal ecosystem services into its NDC (Tregarot et al., 2019). In other words, those measures put in place for the preservation of the biodiversity are now benefiting the society far beyond their initial mandate, with a very high return on public investment.

148

149 Indeed, as shown in Box 1 and elsewhere, protected areas serve as a key example of measures
150 that are already contributing to the recovery of some threatened species. A further example here
151 is the African Wild Dog (*Lycyon pictus*) in southern Africa (Davies-Mostert et al., 2009). Prudent
152 land uses that maintain extensive, well-connected wildlife habitats, and reduce conflict with
153 farmers through careful herding of livestock, have also been shown to facilitate recovery of the
154 African wild dog in East Africa (Woodroffe, 2011), while Dube (2020) working in the Waterberg
155 Biosphere Reserve in South Africa, highlights innovative measures for private landowners to
156 monitor and track wild dogs, helping to reduce human-carnivore conflict. The example of the
157 African Wild Dog is particularly interesting, since it includes land ownership and management
158 that falls outside of, for example, formally designated national and provincial parks.

159 Other measures include control of alien invasive species and restoration of ecosystems (Nyingi
160 et al., 2018), for example as articulated in the Volta Basin Authority's Strategic Action Plan. As at
161 2015, 13.4% of the continent's terrestrial and 2.6 % of the marine realm had been declared as
162 protected areas (Belle et al., 2015); with other sites identified as wetlands of international
163 importance, significant bird and biodiversity areas, community conserved areas, UNESCO
164 World Heritage Sites, and Biosphere reserves, amongst others.

165

166

167 **4. Future pathways and options**

168 Understanding the directions of changes to biodiversity and ecosystem services, and their
 169 contributions to human wellbeing can provide useful insights into how future changes could
 170 impact progress towards key targets, such as those outlined in the African Union Agenda 2063,
 171 the Sustainable Development Goals, and the post-2020 Aichi Biodiversity targets. The Africa
 172 Regional Assessment considered five plausible futures (Table 2) based on an archetype approach
 173 (Sitas and Harmáčková et al. in press) – all underpinned by various assumptions as to what each
 174 future could look like.

175
 176 Table 2: The Global Scenarios Group (GSG) archetypes (at the global level) with their key
 177 characteristics and assumptions. Source: based on van Vuuren *et al.* (2012) (taken with
 178 permission from Biggs et al. 2018)

TABLE 2: THE GLOBAL SCENARIOS GROUP (GSG) ARCHETYPES (AT THE GLOBAL LEVEL) WITH THEIR KEY CHARACTERISTICS AND ASSUMPTIONS

GSG ARCHETYPE CATEGORY	 FORTRESS WORLD	 MARKET FORCES	 POLICY REFORM	 LOCAL SUSTAINABILITY	 REGIONAL SUSTAINABILITY
MAIN OBJECTIVES	Security	Economic growth	Various goals	Local sustainability	Regional and global sustainability
GLOBAL POPULATION GROWTH	High	Low	Low	Medium	Low
GLOBAL TECHNOLOGY DEVELOPMENT	Slow	Rapid	Rapid	Ranging from slow to rapid	Ranging from mid to rapid
GLOBAL ECONOMIC DEVELOPMENT	Slow	Very rapid	Rapid	Ranging from mid to rapid medium	Rangin from slow to rapid
TRADE	Trade barriers	Globalization	Globalization	Trade barriers	Globalization
POLICIES AND INSTITUTIONS	Strong national governments	Policies create open markets	Policies reduce market failures	Local steering: local actors	Strong global governance
ENVIRONMENTAL MANAGEMENT	Reactive	Reactive	Both reactive and proactive	Proactive	Proactive

179

180

181 The analysis showed that drivers of adverse changes in biodiversity and ecosystem services will
 182 increase under all the scenarios (Biggs et al. 2018). In turn, such changes are likely to further
 183 negatively impact on the ability of nature to contribute to human wellbeing and sustainable
 184 development under most cases, except in regional and local sustainability and supportive policy
 185 reform. It was unlikely that the African Union Agenda 2063, the SDGs and the Aichi
 186 Biodiversity would be achieved in three out of the five different futures (see Figure 2). Overall,
 187 only the regional and local sustainability futures offered pathways that offer Africa the greatest
 188 chances to meet its development goals in an economic, social and environmentally friendly way
 189 (Biggs et al 2018).

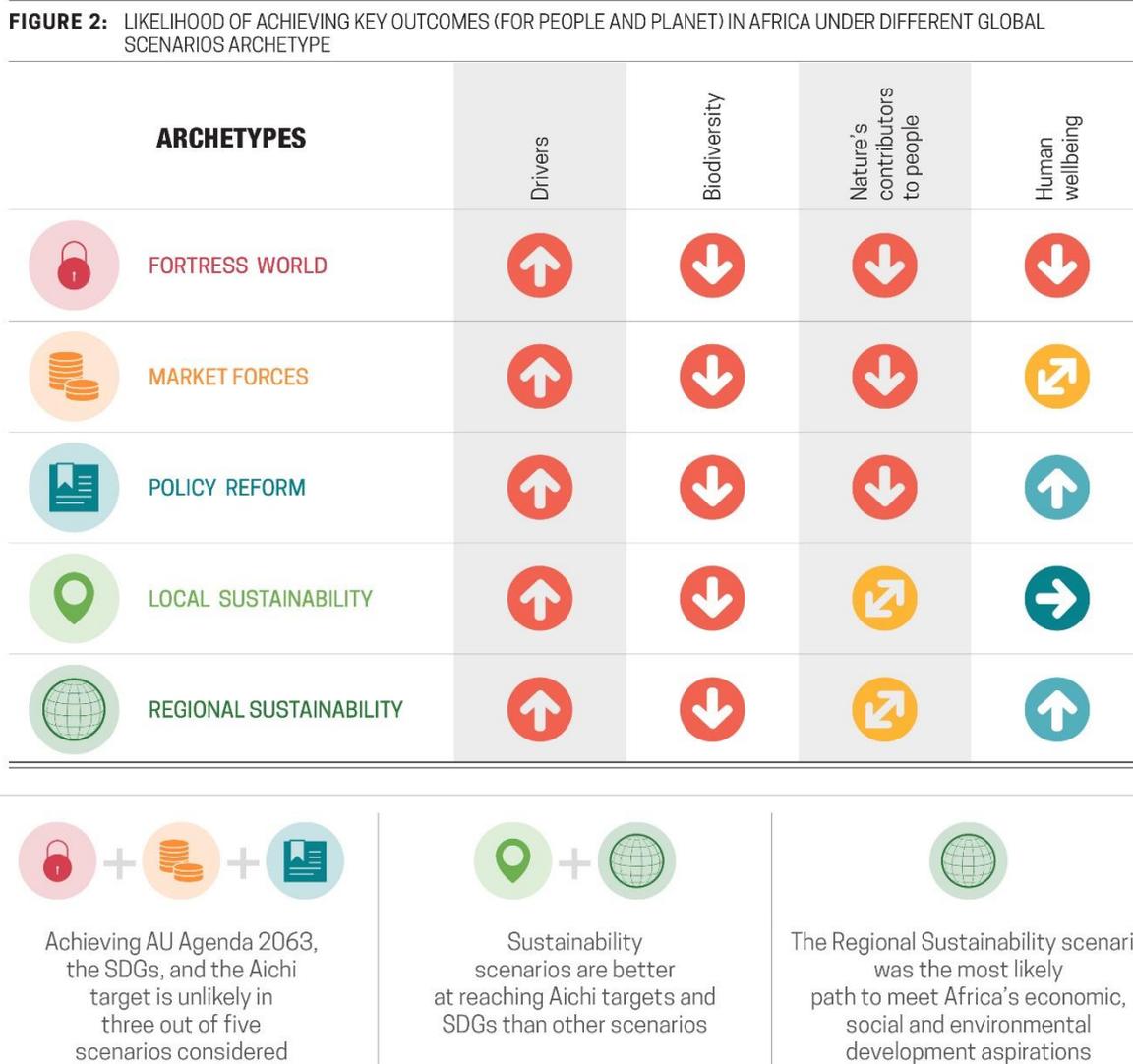
190 All future scenarios present trade-offs but multiple synergies and policy alignments can support
 191 the feasibility of more desirable, equitable and sustainable development options. Our assessment

192 demonstrated that the 'Fortress World' scenario was least likely to support Africa in the
193 achievement of multiple goals and targets. Overall, this future was found to result in failure to
194 achieve important development goals. Market forces (MF) and policy reform (PR) scenarios,
195 representing 'Business-as-usual' approaches, offer some potential for achieving multiple policy
196 goals. Nevertheless, these futures do not adequately support biodiversity conservation, nor the
197 diverse benefits of nature to human well-being. Conditions under a more 'managed
198 transformation' type of future, through policies and practices aligned with regional sustainability
199 and, to a lesser extent, local sustainability, increased the likelihood of reaching a range of
200 sustainable goals.

201 Taking all the goals, targets and aspirations together, no single scenario option allows Africa to
202 achieve them all, despite that some pathways appear more desirable for decision makers. If
203 Africa is to achieve a desirable future (including that envisaged by commitment to targets), it is
204 critical that development of policy and practice be not only based on inclusive and responsible
205 economic tools, but also support the conservation and sustainable use of natural resources and
206 their benefits to people (Figure 2).

207

209 Figure 2: Likelihood of achieving key outcomes in Africa under different global scenarios
 210 archetypes



211

212

213

214 **5. Conclusions: where to from here?**

215 As shown, there are options for Africa to balance development goals with protection of
 216 biodiversity and ecosystem services – in fact, such protection forms the basis for achieving
 217 development goals and improved human well-being. This may only be achieved, however,
 218 through a commitment to transformative change. Progress towards achievement of the Aichi
 219 Biodiversity Targets, SDGs, African Union's Agenda 2063, and the 2°C commitment under the
 220 2015 Paris Agreement on climate change, whilst helping support aspirations for a prosperous
 221 Africa, requires a fundamental shift away from the status quo.

222 Such transformative change towards sustainability, in line with aforementioned targets, will also
223 depend on governance options that are able to harness synergies and deliver multiple benefits
224 (IPBES 2018). By promoting policy coherence with adequate resources and capacity, and
225 encouraging adaptive governance approaches that bring together different perspectives, a more
226 equitable approach to accessing natural resources can ensue, helping to more effectively
227 distribute costs and benefits. In addition, a more enabling environment that embraces Africa's
228 diversity will help to ensure justice and fairness in access to the continent's diverse natural
229 resources. A key finding here is that success stories regarding, for example, species stabilization
230 or recovery, can not only rely on conservation within formal protected areas. This is, of course,
231 a long addressed argument – but it is strongly emphasized in our review of those measures that
232 might be scaled up. Measures that focus, for example, on private landowners or land managers
233 outside of formally designated protected areas are clearly absolutely key (and must be evidence
234 based). Africa has an ambitious development agenda that is critically tied to maintaining and
235 sustainably harnessing its diverse natural systems, biodiversity and ecosystem services – as we
236 have shown, they cannot be decoupled. In order to achieve this transformative agenda, it is
237 necessary for all stakeholders to make use of effective policies that minimise trade-offs and
238 maximise synergies under uncertainty so as to achieve a desirable and prosperous future for
239 Africa.

240 We cannot conclude this paper without addressing COVID19, and the situation within which
241 African conservation finds itself (this paper was first submitted in October 2019, and our context
242 has, of course, changed dramatically). Certain models of conservation in Africa rely, to varying
243 extents, on international tourism – and the recovery of this sector will be key to it's long term
244 ability to achieve, for example, those biodiversity targets where regions and countries currently
245 face difficulties (see, for example, Lindsey et al 2020 and their consideration of how to achieve
246 conservation on the continent during COVID19, and in the post COVID19 period). In turn,
247 conservation of biodiversity and ecosystem services is, of course, key to preventing and
248 controlling zoonotic disease. As stated above, the continent has an ambitious development
249 agenda – one that, along with the world at large, now faces possibly it's greatest economic
250 challenge to date. To quote Lenzen et al in their recent paper in PLOSONe – 'How humanity
251 reacts to this crisis will define the post pandemic world' (Lenzen et al 2020: 1). We can truly say
252 that the post pandemic conservation world will help define our future, as a continent and as a
253 planet.

254

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259

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