

1 **An analysis of Species Conservation Action Plans in Guinea**  
2 **CHARLOTTE COUCH<sup>1</sup> · DENISE MOLMOU<sup>2</sup> · SÉKOU MAGASSOUBA<sup>2</sup> · SAÏDOU**  
3 **DOUMBOUYA<sup>3</sup> · MAMADOU DIAWARA<sup>4</sup> · MUHAMMAD YAYA DIALLO<sup>4</sup> ·**  
4 **SÉKOU MOUSSA KEITA<sup>5</sup> · FALAYE KONÉ<sup>3</sup> · MAHAMADOU CELLOU DIALLO<sup>6</sup> ·**  
5 **SÉKOU KOUROUMA<sup>3</sup> · MAMADOU BELLA DIALLO<sup>3</sup> · MAMADY SAYBA**  
6 **KEITA<sup>3</sup> · ABOUBACAR OULARE<sup>3</sup> · IAIN DARBYSHIRE<sup>1</sup> · EIMEAR NIC**  
7 **LUGHADHA<sup>1</sup> · XANDER VAN DER BURGT<sup>1</sup> · ISABEL LARRIDON<sup>1,7</sup> · and**  
8 **MARTIN CHEEK<sup>1</sup>**

9

10 <sup>1</sup> Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3AE, UK.

11 <sup>2</sup> Herbarium National de Guinée, Université Gamal Abdel Nasser de Conakry, Guinea

12 <sup>3</sup> Ministère de l'Environnement, Eaux et Forêts, République de Guinée, Conakry, Guinea

13 <sup>4</sup> Guinée Ecologie, Dixinn, Conakry, Guinea

14 <sup>5</sup> Centre d'Etudes de Recherche en Environnement (CERE), Université Gamal Abdel Nasser  
15 de Conakry, Guinea

16 <sup>6</sup> Protection et Gestion de l'Environnement (PEG) (Environmental NGO), Conakry, Guinea.

17 <sup>7</sup> Ghent University, Department of Biology, Systematic and Evolutionary Botany Lab, K.L.  
18 Ledeganckstraat 35, 9000 Gent, Belgium

19

20 CHARLOTTE COUCH (Corresponding Author) Royal Botanic Gardens, Kew, Richmond,  
21 Surrey, TW9 3AE, UK. [c.couch@kew.org](mailto:c.couch@kew.org). ORCID: 0000-0002-5707-9253

22

23 Isabel Larridon ORCID: 0000-0003-0285-722X

24 Martin Cheek ORCID: 0000-0003-4343-3124

25

26 **Abstract**

27 To achieve conservation success, we need to support the recovery of threatened species. Yet,  
28 <5% of plant species listed as threatened on the IUCN Red List have Species Conservation  
29 Action Plans (CAPs). If we are to move from a Red List to a Green List for threatened plant  
30 species, CAPs need to be devised and implemented. Guinea is one of the most botanically  
31 diverse countries in West Africa. Recent research found that nearly 4000 vascular plants  
32 occur in Guinea, a 30% increase from previous estimates. 273 of these plant species are now  
33 assessed as threatened with global extinction. There is increasing pressure on the  
34 environment from the extractive industry and a growing population. In parallel with  
35 implementation of an Important Plant Area programme in Guinea, CAPs were developed for  
36 20 threatened plant species. These plans elaborate conservation efforts needed first to  
37 safeguard threatened species both *in situ* and *ex situ* and then to support their recovery. We  
38 document the approach used to assemble the Species Conservation Action Plans, and we  
39 discuss the importance of having up to date field information, IUCN Red List assessments,  
40 and use of a collaborative approach. The need for these plans is increasingly important with  
41 recent calculations suggesting a third of African plants are threatened with extinction. This  
42 paper outlines initial detailed plant conservation planning in Guinea and offers a template for  
43 conservation practitioners in other tropical African countries to follow.

44

45 **Key words:** Important Plant Areas, IUCN Red List, Species Conservation Action Plans,  
46 Guinea, threatened species.

## 47 **Introduction**

48 The goal of conservationists is to protect globally threatened species and achieve success  
49 through species recovery, eventually recording this on the Green List (Akcakaya et al. 2018).  
50 Yet, of the 15,774 threatened plant species treated on the global Red List, only 753 (4.78 %)  
51 are reported to have Species Conservation Action Plans (CAPs) in place (IUCN 2019). To  
52 help address this massive deficit, we offer an approach to developing CAPs for threatened  
53 plant species which has succeeded in Guinea (West Africa), as a template for conservation  
54 practitioners in other Tropical African countries.

55 Guinea is one of the most botanically diverse countries in West Africa. It has nearly  
56 4000 vascular plant species (G. Gosline et al. unpubl. data), a significant increase from the c.  
57 3000 listed in the *Flore (Angiospermes) de la République de Guinée* by Lisowski (2009).  
58 This increase reflects an extensive searches over the last five years to inventory the flora of  
59 Guinea through the digitisation and georeferencing of historical herbarium records  
60 (Magassouba et al. 2014, GBIF 2019) complemented by targeted field expeditions to  
61 understudied areas of Guinea by the National Herbarium of Guinea (HNG) and the Royal  
62 Botanic Gardens, Kew (RBGK) (Cheek et al. 2018a). As a result of efforts to find additional  
63 localities for rare species, we determined at least one likely extinction (*Inversodicraea*  
64 *pygmaea* G.Taylor) due to a hydroelectric dam (Cheek 2018c). A total of 74 published  
65 endemic species have been recorded for Guinea, all of which are threatened (G. Gosline et al.  
66 unpubl. data, Rokni 2017, 2018, Larridon 2018). Recent estimates of endemism for Guinea  
67 ranged from 2.6% (Lisowski, based on a species list) to 4.7% (Sosef et al. 2017 inferred from  
68 the RAINBIO dataset. The number of endemic species is set to increase with recent  
69 discoveries; several descriptions of new species to science are in progress. The comparatively  
70 high plant diversity in Guinea is in part due to the highland areas found in the central and  
71 eastern parts of the country. The central Fouta Djallon highlands have many endemic plant

72 species found in a variety of habitats such as sandstone cliffs, sandstone and lateritic bowal  
73 (treeless hardpan), and submontane forest (Couch et al. 2019a). However, over past centuries  
74 this area has undergone a dramatic change with the expansion of cattle ranging and  
75 development of agricultural systems. The submontane forest has become extremely degraded  
76 and intact submontane forest has practically disappeared over all of the Fouta Djallon. A  
77 recent three year project to identify Tropical Important Plant Areas in Guinea (Couch et al.  
78 2019a) showed that of 35 threatened species not seen for 60 years or more, and not  
79 rediscovered during the project, 25 are globally endemic to Guinea and the majority occur in  
80 the Fouta Djallon. The Fouta Djallon historically shared some species with the mountain  
81 chains of Simandou and Nimba in eastern Guinea, such as *Habenaria jaegeri* Summerh. and  
82 *Kotschya lutea* (Portères) Hepper. Both species are likely to be locally extinct in the Fouta  
83 Djallon, as they have not been seen despite targeted searches there for 57 and 82 years  
84 respectively.

85         The Tropical Important Plant Areas (TIPAs) of Guinea project recently identified nine  
86 threatened habitats and 22 TIPAs (Couch et al. 2019a, Couch et al, 2017). TIPAs are assessed  
87 using three criteria: the presence of (1) Threatened species, (2) Botanical richness (including  
88 socio-economic species), and (3) Threatened habitats (Darbyshire et al. 2017). Each TIPA  
89 assessment also documents past, present and future threats as well as the current protection  
90 given to the proposed TIPA site. A variety of threats imperil the flora of Guinea, not least  
91 from the mining sector. Guinea is one of the leading exporters of bauxite, producing 95% of  
92 African bauxite and 15% of the global share, based on tonnes exported (Alcircle, 2018). It  
93 also has considerable reserves of iron ore, gold and diamonds, with smaller reserves of other  
94 minerals including nickel, copper, cobalt, manganese and uranium (Guinean Ministry of  
95 Mines and Geology, 2016). However, for many of the habitats, in particular the lowland  
96 evergreen forest and submontane forest (including gallery forest), the main threats are the

97 unsustainable slash and burn agricultural practices and the cutting of wood for charcoal. A  
98 study by Sayer et al. (1992) documented that 96% of original forest had already disappeared  
99 from Guinea. In the bowal areas, the main threats are from cattle-ranging and linked  
100 management practices causing increases in fire frequency, and from housing development.

101 New large-scale projects, for example in the mining sector and for hydroelectric  
102 power, require companies to carry out detailed Social and Environmental Impact  
103 Assessments (SEIAs). These studies should highlight threatened plant species in their  
104 concessions. Until now, only 7% of all plant species have been assessed globally for the  
105 IUCN Red List (Bachman et al. 2019), including c. 5% of the Guinean flora, making it  
106 difficult for environmentalists to demonstrate that protection or mitigation is needed. A  
107 GBIF-BID funded project (reference number AF2015-0042-NAC) entitled ‘Towards a Red  
108 Data Book for Guinea’ in collaboration with the Darwin Initiative funded TIPAs project  
109 (Darwin Project 23-002), has assessed c. 200 plant species from Guinea (using the IUCN  
110 2012 guidelines). This is a considerable achievement. However, the review and publishing  
111 process of IUCN Red List assessments are time-consuming. These delays were accentuated  
112 because until recently there was no IUCN specialist group available to review most West  
113 African plant assessments. In June 2019, the West Africa Plant Red List Authority  
114 (WAPRLA) was accepted by the IUCN Species Survival Commission. It is expected that the  
115 new RLA will reduce the delays in publication of IUCN Red List assessments of West  
116 African plants and will also unite plant conservation efforts and promote red listing across the  
117 West African region. A preliminary list of threatened plant species for Guinea was published  
118 in PeerJ Preprints in 2017, and updated over the course of the projects described above  
119 (Couch et al. 2019b) to keep conservation practitioners up to date ahead of the publication of  
120 a full plant Red Data Book for Guinea 2020. This will also feed into updating the  
121 *Monographie Nationale* (Guinea’s National Biodiversity Management Action Plan) which

122 has not been revised since 1997. As part of the red listing process, ongoing and required  
123 conservation actions are recorded. However, these are high level actions with little or no  
124 detail generally given.

125 As part of the GBIF-BID ‘Towards a Red Data Book for Guinea’ project, and as a  
126 first step towards detailed plant conservation planning in Guinea, individual Species  
127 Conservation Action Plans were developed for 20 plant species assessed as Critically  
128 Endangered (CR), Endangered (EN) or Vulnerable (VU). These plans document the  
129 conservation efforts needed to safeguard each of these threatened species both *in situ* and *ex*  
130 *situ*.

131 In this paper, we outline the approach used to assemble the Species Conservation  
132 Action Plans, and we discuss the importance of having up to date species field information  
133 and IUCN Red List assessments. We also discuss the advantages of a collaborative approach  
134 and outline the next stages for implementing these species action plans on the ground in  
135 Guinea.

136

## 137 **Materials and Methods**

138 Several points need to be considered before a Species Conservation Action Plan can be  
139 written. Firstly, who should be involved in this process? To address this and the assessment  
140 of the Tropical Important Plant Areas, a joint working group on TIPAs and Conservation  
141 Action Plans (CAPs) was formed in May 2018. The working group consists of  
142 representatives from the National Herbarium of Guinea (HNG), the Royal Botanic Gardens,  
143 Kew, UK (RBGK), the Guinean Ministry of Environment, Water and Forests (MEEF), the  
144 National Parks and Reserves office (MEEF-OGuiPAR), the Centre for Biological  
145 Observations and Monitoring (MEEF-COSIE), environmental NGOs Guinée Ecologie (GE)  
146 and Protection et Gestion de l’Environnement (PEG), the Centre for Environmental Research

147 Studies at the Université Gamal Abdel Nasser de Conakry (UGANC-CERE), and the Sereidou  
148 Herbarium (Institut de Recherche Agronomique de Guinée (IRAG) acronym SERG). This  
149 was the first time that these organisations had united to support the prioritisation of  
150 threatened plant conservation in Guinea. The working language of the group is French. The  
151 working group meets every 2 months and conducts business over email inbetween meetings,  
152 discusses and agrees what should be included in the CAPs and which designated members are  
153 to be charged with collating the information and writing the plans.

154 The protocol for preparing the conservation action plans was developed and approved  
155 by the working group (available on the National Herbarium of Guinea website) and was  
156 based in part on the *Conservation Action Planning Handbook* by The Nature Conservancy  
157 (TNC 2007). The format and style of the Conservation Action Plans drew upon previously  
158 drafted species recovery plans for non-Guinean taxa (e.g. JNCC UK priority species pages  
159 2010a, 2010b, Panjabi et al. 2011) together with constant from conservation actions  
160 identified in the IUCN Red List process.

161 A shortlist was drawn up by the HNG and RBGK members of the group from the preliminary  
162 list of threatened species of Guinea (Couch et al. 2019b). Twenty species were chosen that  
163 meet the following selection criteria: 1) listed as CR, EN or VU in the preliminary checklist,  
164 2) have a published or reviewed IUCN Red List assessment, 3) cover a range of life forms,  
165 and 4) are found over a range of threatened habitats. The decision to prepare CAPs only for  
166 species with formal IUCN assessments was made in part because there is more information  
167 available for these species, but also because their assessed conservation status was unlikely to  
168 change in the near future. With species that have yet to be formally assessed or reviewed  
169 there is the risk that the IUCN Red List status may change. The species chosen included a  
170 mixture of life forms i.e. trees, shrubs, lianas and herbs (Table 1).

171 With the protocol drafted and the short list of species agreed, two members of the group took  
172 the lead on collating species information and drafting the plans. All members of the group  
173 contributed to review and refinement of the plans. This work took place over a period of 9  
174 months and involved an estimated 152 person working days.

175 The first part of each CAP sets out the context for each species. It is imperative that  
176 each species is properly researched and clearly circumscribed based on sound taxonomy. This  
177 is especially necessary since any existing documentation, particularly in Guinea, is often out  
178 of date. Until recently, there was little published on the Guinean flora. The *Flore*  
179 (*Angiospermes*) *de la Guinée* by Lisowski, was published posthumously in 2009, with  
180 taxonomy not updated since Lisowski submitted it for publication in 2000. As a result, many  
181 names in Lisowski's *Flore de la Guinée* are out of date (Cheek et al. 2015), and since its  
182 publication about 20 newly discovered species (e.g. Cheek & Haba 2016, Cheek et al. 2018b)  
183 and many new range extensions have been recorded in Guinea. Where a recently discovered  
184 species was chosen for a CAP, the protologue (original scientific publication) has been used  
185 as the source for the taxonomic information. Names have been checked against the African  
186 Plant Database (2019), the International Plant Names Index (2019) and Plants of the World  
187 Online (2019). Descriptions of the plant species were taken from either Lisowski (2009), the  
188 *Flora of West Tropical Africa* (Keay & Hepper 1954-72) or the protologue. Details about the  
189 ecology, phenology and habitat where known, have also been documented.

190 The working group decided that each CAP should include as much information as is  
191 available for the species including i) past and present collection data, this information has  
192 largely been collated from herbarium specimen label data and species accounts in the works  
193 cited above. If the species is known to be used by people, these uses are also documented; ii)  
194 geographical distribution, particularly within Guinea to focus conservation efforts and, iii)  
195 where known, the number of individuals in the population. Specimen-based distribution maps



196 for each species have been produced based on records collected for the Red Listing  
197 programme, examples can be seen in Fig. 1. Distribution maps were made using ArcGIS Pro  
198 software with simple XY coordinates uploaded and mapped onto a world basemap.

199 Information on threats both past and present, direct and indirect, is listed. This  
200 information was gathered partly through literature but also during recent fieldwork. As part of  
201 the Darwin Initiative funded project on Tropical Important Plant Areas in Guinea 2016-2019,  
202 over 20 field expeditions were carried out targeting rare species and priority threatened  
203 habitats. These field expeditions were invaluable to gather current information on rare  
204 species, their distribution and uses, and on the current threats.

205 The second part of the CAP document sets out a summary plan for the management  
206 and conservation of the species based on current knowledge. The first section, of the second  
207 part, details all known research or suggests what research is required. *In situ* and *ex situ*  
208 conservation actions are then proposed for the protection of the species.

209 *In situ* conservation actions detail any protected areas in which the species is currently  
210 found, and whether the species is found within any of the newly designated Tropical  
211 Important Plant Areas (Couch et al. 2019a). The total size of the population and details of the  
212 sites where the species is found are recorded so that these data can be presented to the local  
213 authorities and ultimately support the legal protection of the sites and species. The CAP also  
214 emphasises that this documentation process must always be undertaken with support from  
215 local communities especially when a species (sub)population occurs within a community  
216 forest or sacred forest or in an area outlined for housing development, e.g. as is the case for  
217 *Vernonia djalonensis* A.Chev. Without community support, conservation efforts will have  
218 little long-term effect on the survival of species on the ground.

219 *Ex situ* conservation actions focus on the propagation of the species outside its range,  
220 seed collection and banking where applicable, and the potential for translocation to another

221 protected area or botanical garden. The results of any experiments previously completed are  
222 also documented. Each CAP also recommends sensitization of the local population to the  
223 importance of plant species conservation and to the protection of the national plant heritage  
224 of Guinea.

225

## 226 **Results**

227 Of the twenty CAPs produced (see Online Resources 1-20), 11 are for species endemic to  
228 Guinea; this represents 15% of the total 74 published endemic plant species of Guinea. The  
229 threats to the CAP species vary. All species have one or more associated threats. Fig. 2 shows  
230 the percentage of species per threat type. The threats affecting most CAP species are  
231 uncontrolled fires (75%), mining or quarrying (60%) and infrastructure / urbanisation (50%).  
232 Two of the species are directly threatened by pollution and all of the woody species (9) are  
233 threatened by deforestation or clearance of habitat through slash and burn agriculture, which  
234 is also a threat to 40% of the CAP species overall.

235         Nine of the twenty CAP species are found in a current protected area and all of the  
236 species are found within one or more of the newly designated TIPAs (Couch et al. 2019a).  
237 However, these protected areas either lack management plans or have management plans  
238 which are outdated. Within these management plans, specific species conservation actions,  
239 especially for plants, are usually absent.

240         Eight of the CAP species have seed collections made and banked at the Simfer base in  
241 the Simandou mountains or Herbiere National de Guinee, and the Millennium Seed Bank at  
242 RBGK, UK, though none have reached the recommended seed banking target threshold of  
243 10,000 seeds (Way & Gold 2014). Some seed collections are small because there are few  
244 known individuals or individuals do not produce many seeds each season. Some species have  
245 large seeds, expected to be recalcitrant, i.e. they are unsuitable for conventional seed banking,

246 the seeds dying when dried. *Talbotiella cheekii* Burgt is one such species (Burgt et al, 2018).  
247 Some Rubiaceae species are also known to be recalcitrant so *Tarenna hutchinsonii* Bremek.  
248 and *Keetia susu* Cheek may also prove to be unsuitable for conventional seed banking, but as  
249 yet they remain untested.

250 For the majority of the CAP species no propagation information is available and so  
251 experimentation will be required to fill this knowledge gap. However, for a quarter of the  
252 species propagation protocols are available, due to their association with a mining project.  
253 These protocols were researched at RBGK using a variety of methods, e.g. micropropagation  
254 for *Habenaria jaegeri* (Cheek 2017), and cuttings for *Tarenna hutchinsonii* (Cheek et al  
255 2015) and *Marsdenia exellii* C.Norman (Cheek 2013).

256 Currently, only five of the 20 species have been identified as suitable for potential  
257 reintroduction. Two transplant experiments have already been carried out with *Eriosema*  
258 *triformum* Burgt. Transplantation of tubers, from the Simandou mountains to Mt Béro in May  
259 2012, was unsuccessful as the tubers were mostly eaten by squirrels and rock hyrax, and  
260 ultimately, all died (Cheek et al, 2017). Translocation of *Eriosema triformum* seed to the Mts  
261 Nimba Strict Nature Reserve and also to Mt Tibe was attempted in April 2019. Results of  
262 these transplants are to be evaluated in 2020 (X. van der Burgt, pers. comm.). Rhizomes of  
263 *Stylochaeton pilosus* Bogner were successfully translocated in 2013 (C. Couch, pers. obs.).

264

## 265 **Discussion**

266 The BID-GBIF funded project “Towards a Red Data book for Guinea” and the Darwin  
267 Initiative funded project identifying “Tropical Important Plant Areas of Guinea” have the  
268 attracted attention of both national and international audiences to the threatened and unique  
269 plant species of Guinea. The Species Conservation Action Plans resulting from these projects  
270 are the first to be written for threatened plant species in Guinea and are a result of the

271 collaboration between the HNG, RBGK, Guinean government departments and NGOs  
272 focussed on plant conservation. The partnerships and expertise on plant conservation built  
273 during these projects did not previously exist. Conservation of endemic and near-endemic  
274 plant species had not been on the national agenda. In contrast, the conservation of large  
275 mammals such as the chimpanzee have had high levels of attention (Sugiyama & Soumah  
276 1988, Brugière et al. 2005, Fleury-Brugière & Brugière 2010, Humle et al. 2011). Following  
277 the conclusion of the Darwin and GBIF-BID projects in March 2019, the working group has  
278 continued to collaborate to address, review and update 1) Guinea's CITES list and 2) the  
279 second edition of the Guinean National Biodiversity Action Plan. The collaboration has  
280 gained support from all sectors concerned with plant conservation and together with the  
281 recently identified Tropical Important Plant Areas (Couch et al. 2019a), it is pushing plant  
282 conservation in Guinea further up the national agenda. To the best of our knowledge this is  
283 the first time that a programme of plant conservation action plans for globally threatened  
284 plant species has been devised and acted upon in a West African country.

285 The 20 Species Conservation Action Plans have highlighted the importance of fieldwork to  
286 provide up to date information on the target species. IUCN Red List assessments can be  
287 written based on literature and herbarium records, but knowing the current status of a  
288 population and the real threats that they face is invaluable when writing a CAP. The CAPs  
289 draw on fieldwork undertaken over the past 10 years, largely by HNG and RBGK.

290 Implementation of these plans will need further action. One of the plans, for *Vernonia*  
291 *djalonensis* (Online Resource 19), was the basis of a successful funding bid to the  
292 Mohammed bin Zayed Species Conservation Fund and is being used to guide on-the-ground  
293 conservation actions for this species, which was recently elected as the national flower of  
294 Guinea (Couch 2018). We have engaged with the local authorities and local plant nurseries to

295 protect and propagate this species. In early 2020, we are planning to engage with students and  
296 youth groups.

297 There is a growing need for documentation on the plants of Guinea, not only because there  
298 has been so little published, but also because much of the documentation is out of date. The  
299 need for national scale CAPs for individual priority species is ever more important as original  
300 habitat is lost due to human activities. One in five of the world's plant species were reported  
301 as threatened (RBG Kew 2016), and Stévant et al. (2019) infer that one in three African plant  
302 species are at risk of extinction. With 96% loss of original forest reported in 1992 (Sayer et  
303 al. 1992), many of Guinea's most threatened plant species need tailored CAPs if they are not  
304 to follow *Inversodicraea pygmaea* into global extinction.

305 Guinea has over 270 threatened species of which 74 are endemic. Given the person  
306 hours required to write 20 CAPs for threatened species, some endemic species might be more  
307 effectively treated by local area action plans, for example based on the 22 identified TIPAs,  
308 provided they adequately cover the species encompassed (Monteiro et al. 2018). Broader  
309 action plans for example a comprehensive action plan that treats all Guinean threatened tree  
310 species might be more effective than individual CAPs. This would reduce the timeframe  
311 needed to develop conservation action plans enabling efficient implementation.

312 Increased development in Guinea is resulting in an increase in environmentally damaging  
313 projects e.g. mining, hydroelectric dams and quarrying. However, development does not have  
314 to mean wholesale destruction of the environment and global extinction of species. Good  
315 management based on solid data and analysis can lead to much better industry practices.

316 Guinea's mining projects are implicated in the conservation of the plant species found in their  
317 concessions, but they do not always make this data available. There is a vital need to have up  
318 to date information freely available for those assessing the environmental impact of such  
319 projects and the possible mitigation that can be achieved. Most of the existing conservation

320 efforts in Guinea are focussed on mammals, birds, ecosystem services, commercial trade or  
321 large-scale landscape protection e.g. trans-boundary areas such as the Nimba Mountains  
322 (STEWART 2008, Nganje et al. 2014, Brugière & Kormos 2008, Brugière 2012, Brugière et  
323 al. 2005, Correia et al. 2010, Samoura et al. 2007). TIPAs aside, most of the currently  
324 protected areas in Guinea do not overlap with concentrations of threatened plant species  
325 (Couch et al. 2019a). The majority of the Classified Forests (CF) were designated for forestry  
326 services, are not protected within the National Parks and Reserves network, and are  
327 considered as unprotected by the Guinea Government. In those few cases where a CF is  
328 considered protected, it will have a second designation e.g. ‘Reserve Intégrale’ or National  
329 Park. Where management plans are in place for protected areas, these do not include  
330 protection of individual threatened plant species or their specific habitats for example the  
331 1995-2014 Management plan for the forest of Ziama (PROGERFOR, 1994).

332         The 20 species CAPs will be used to target plant conservation and funding, not just in  
333 protected areas. They also have the potential to form the basis of conservation planning and  
334 mitigation strategies for the extractive industries in those cases where project footprints  
335 intersect with those of the threatened plant species. With 20 species CAPs written of 273  
336 threatened species in Guinea, this is merely the beginning. On the ground implementation of  
337 the 20 CAPs will assist in updating and modifying the CAP protocol to make it a useful and  
338 relevant tool in future conservation planning in Guinea.

339

#### 340 **Author Contributions**

341 Writing and compilation of supplementary materials: CC and DM; Contribution and revision  
342 of CAPs: all members of the working group; Revision of content and supplementary  
343 materials: XvdB, IL, MC, EL. Writing of BID funding proposal: ID, MC.

344

## 345 **Acknowledgements**

346 This work was funded through a grant from Global Biodiversity Information Facility (GBIF)  
347 Biodiversity Information for Development (BID) programme. Isabel Larridon is supported by  
348 the B.A. Krukoff Fund for the Study of African Botany. The authors would like to thank all  
349 those involved with field work in Guinea over the past 10 years who have gathered data,  
350 notably P  p   Haba, Gbamon Konomou, Pierre Haba, Fatoumata Fofana Mad  , Almamy  
351 Diallo, Natalie Konig, Oliver Hooper and Abdoulaye Bald  . Nagnouma Conde, Tokpa Seny  
352 Dore, Albert Guilavogui, Boubacar Sow, and Saba Rokni. We also thank Royal Botanic  
353 Gardens Kew volunteers Margaret Joachim and Rosemary Lomer who georeferenced  
354 herbarium specimens for the GBIF-BID and Darwin Initiative Tropical Important Plant Areas  
355 Guinea projects. Our thanks also to Catia Canteiro and Emma Williams for their work on  
356 writing IUCN Red List assessments for Guinean plant species. This work has been enabled  
357 by the Memorandum of Understanding between RBG Kew and National Herbar de Guinee  
358 since 2008.

359

## 360 **Conflicts of interest**

361 None.

362

## 363 **Ethical standards**

364 This research was carried out in accordance with the *Oryx* code of conduct.

365

## 366 **References**

367 Akcakaya H.R., et al. (2018) Quantifying species recovery and conservation success to  
368 develop an IUCN Green List of Species. *Conservation Biology* 32(5) :1128-1138  
369 <https://doi.org/10.1111/cobi.13112>

- 370 African Plant Database (version 3.4.0) (2019). Conservatoire et Jardin botaniques de la Ville  
371 de Genève and South African National Biodiversity Institute, Pretoria.  
372 <http://www.ville-ge.ch/musinfo/bd/cjb/africa/>. Accessed 20 August 2019
- 373 Alcircle (2019) [https://www.alcircle.com/news/bauxite-export-by-guinea-estimated-to-grow-](https://www.alcircle.com/news/bauxite-export-by-guinea-estimated-to-grow-13-yoy-in-2019-china-to-remain-the-top-importer-44444)  
374 [13-yoy-in-2019-china-to-remain-the-top-importer-44444](https://www.alcircle.com/news/bauxite-export-by-guinea-estimated-to-grow-13-yoy-in-2019-china-to-remain-the-top-importer-44444)
- 375 Bachman SP, Field R, Reader T, Raimondo D, Donaldson J, Schatz GE, Nic Lughadha E  
376 (2019) Progress, challenges and opportunities for Red Listing. *Biol Conserv* 43:45–55
- 377 Brugière D (2012) Identifying priority areas for the conservation of antelopes in the Republic  
378 of Guinea, West Africa, using the complementarity approach. *Oryx*: 46 pp. 253-259
- 379 Brugière D, Kormos R (2008) Review of the protected area network in Guinea,  
380 West Africa, and recommendations for new sites for biodiversity conservation.  
381 *Biodivers Conserv* 18: 847. <https://doi.org/10.1007/s10531-008-9508-z>
- 382 Brugière D, Dia M, Diakité S. et al. (2005) Large- and medium-sized ungulates in the Haut  
383 Niger National Park, Republic of Guinea: Population changes 1997–2002. *Oryx*  
384 39:50–55
- 385 Burgt XM van der, Molmou D, Diallo A. et al. (2018) *Talbotiella cheekii* (Leguminosae:  
386 Detarioideae), a new tree species from Guinea. *Kew Bull* 73:26
- 387 Cheek, M. (2013). *Marsdenia exellii*. The IUCN Red List of Threatened Species 2013:  
388 e.T21480972A21481025. [http://dx.doi.org/10.2305/IUCN.UK.2013-](http://dx.doi.org/10.2305/IUCN.UK.2013-1.RLTS.T21480972A21481025.en)  
389 [1.RLTS.T21480972A21481025.en](http://dx.doi.org/10.2305/IUCN.UK.2013-1.RLTS.T21480972A21481025.en). Downloaded on 03 December 2019.
- 390 Cheek M. (2017). *Habenaria jaegeri*. The IUCN Red List of Threatened Species 2017:  
391 e.T15368405A15368408. [http://dx.doi.org/10.2305/IUCN.UK.2017-](http://dx.doi.org/10.2305/IUCN.UK.2017-2.RLTS.T15368405A15368408.en)  
392 [2.RLTS.T15368405A15368408.en](http://dx.doi.org/10.2305/IUCN.UK.2017-2.RLTS.T15368405A15368408.en). Downloaded on 03 December 2019.



- 393 Cheek M (2018c) *Inversodicraea pygmaea*. The IUCN Red List of Threatened Species 2018:  
394 e.T98569037A100439967. [http://dx.doi.org/10.2305/IUCN.UK.2018-](http://dx.doi.org/10.2305/IUCN.UK.2018-1.RLTS.T98569037A100439967.en)  
395 [1.RLTS.T98569037A100439967.en](http://dx.doi.org/10.2305/IUCN.UK.2018-1.RLTS.T98569037A100439967.en). Accessed 21 October 2019
- 396 Cheek M, Haba PM (2016) *Inversodicraea* Engl. resurrected and *I. pepehabai* sp. nov.  
397 (Podostemaceae), a submontane forest species from the Republic of Guinea. Kew Bull  
398 71:55
- 399 Cheek M, Poveda LL, Molmou D (2015) *Tarennia hutchinsonii* (Rubiaceae) redelimited, and  
400 *T. agnata* described from W. Africa. Kew Bull 70:12
- 401 Cheek M, van der Burgt X. & Rokni S. (2017). *Eriosema triformum*. The IUCN Red List of  
402 Threatened Species 2017: e.T15368367A15368370.  
403 <http://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T15368367A15368370.en>.  
404 Downloaded on 03 December 2019.
- 405 Cheek M, Magassouba S, Howes MR. et al. (2018a) *Kindia* (Pavetteae, Rubiaceae), a new  
406 cliff-dwelling genus with chemically profiled colleter exudate from Mt Gangan,  
407 Republic of Guinea. PeerJ 6:e4666
- 408 Cheek M, Magassouba S, Molmou D. et al. (2018b) A key to the species of *Keetia*  
409 (Rubiaceae - Vanguerieae) in West Africa, with three new, threatened species from  
410 Guinea and Ivory Coast. Kew Bull 73:56
- 411 Correia M, Diabaté M, Beavogui P. et al. (2010) Conserving forest tree diversity in Guinée  
412 Forestière (Guinea, West Africa): the role of coffee-based agroforests. Biodivers  
413 Conserv 19: 1725. <https://doi.org/10.1007/s10531-010-9800-6>
- 414 Couch CA (2018) Guinea: The Campaign for a National Flower. [https://www.kew.org/read-](https://www.kew.org/read-and-watch/guinea-the-campaign-national-flower)  
415 [and-watch/guinea-the-campaign-national-flower](https://www.kew.org/read-and-watch/guinea-the-campaign-national-flower) Accessed 20 August 2019
- 416 Couch C, Cheek M, Haba P. et al. (2019a) Threatened Habitats and Tropical Important Plant  
417 Areas of Guinea, West Africa. Solopress, UK.

- 418 Couch C, Magassouba S, Molmou D, et al. (2017) Tropical Important Plant Areas-A case  
419 study from Guinea. European Conference of Tropical Ecology: 388.
- 420 Couch C, Magassouba S, Rokni S. et al. (2019b) Threatened plants species of Guinea-  
421 Conakry: A preliminary checklist. PeerJ Preprints 5:e3451v4.
- 422 Darbyshire I, Anderson S, Asatryan A, Byfield A, Cheek M, Clubbe C, Ghrabi Z, Harris T,  
423 Heatubun CD, Kalema J, Magassouba S, McCarthy B, Milliken W, de Montmollin B,  
424 Nic Lughadha E, Onana J-M, Saïdou D, Sârbu A, Shrestha K, Radford EA (2017)  
425 Important Plant Areas: revised selection criteria for a global approach to plant  
426 conservation. Biodivers Conserv 26:1767–1800
- 427 Fleury-Brugière MC, Brugière D (2010) High Population Density of *Pan troglodytes verus* in  
428 the Haut Niger National Park, Republic of Guinea: Implications for Local and  
429 Regional Conservation. Int J Primatol 31:383–392
- 430 GBIF (2019) Global Biodiversity Information Facility.  
431 <https://www.gbif.org/publisher/751cb816-53a6-46e6-9e37-6ac2c43f10fd> Accessed 21  
432 October 2019
- 433 Guinean Ministry of Mines and Geology (2016) <https://mines.gov.gn/en/resources/bauxite/>  
434 Accessed 21 October 2019
- 435 Herbiier National de Guinée (2019) Protocole des PACs.  
436 <http://www.herbiierguinee.org/documents-du-projet-bid.html>. Accessed December  
437 2019.
- 438 Humle T, Colin C, Laurans M, Raballand E (2011) Group Release of Sanctuary Chimpanzees  
439 (*Pan troglodytes*) in the Haut Niger National Park, Guinea, West Africa: Ranging  
440 Patterns and Lessons So Far. Int J Primatol 32: 456–473
- 441 International Plant Names Index (2019). Published online. Board of Trustees of the Royal  
442 Botanic Gardens, Kew. <https://www.ipni.org/>. Accessed 20 August 2019

- 443 IUCN (2019) The IUCN Red List of Threatened Species. Version 2019-3.  
444 <http://www.iucnredlist.org>. Downloaded on 10 December 2019.
- 445 JNCC UK priority species pages: *Aceras anthropophorum* (L.) W.T. Aiton Version 2 updated  
446 on 15 December 2010 (a). <http://archive.jncc.gov.uk/speciespages/2470.pdf>.  
447 Accessed 1 May 2018
- 448 JNCC UK priority species pages: *Astragalus alpinus* L. Version 2 updated on 15 December  
449 2010 (b). <http://archive.jncc.gov.uk/speciespages/2068.pdf> Accessed May 2018
- 450 Keay RWJ, Hepper N (Eds) 1954–1972. Flora of West Tropical Africa. Royal Botanic  
451 Gardens Kew. Crown Agents, London
- 452 Larridon, I. 2018. *Pitcairnia feliciana*. The IUCN Red List of Threatened Species 2018:  
453 e.T87753965A87753976. [http://dx.doi.org/10.2305/IUCN.UK.2018-  
454 z1.RLTS.T87753965A87753976.en](http://dx.doi.org/10.2305/IUCN.UK.2018-z1.RLTS.T87753965A87753976.en).
- 455 Lisowski, S. (2009) Flore (Angiospermes) de la République de Guinée. Scripta Botanica  
456 Belgica Vol. 41.
- 457 Magassouba S, Camara B, Guilavogui K. et al. (2014) Hunting Threatened taxa of Guinea.  
458 Abstracts of the XXth AETFAT Congress, South Africa, 2014. Scripta Bot Belg  
459 52:255
- 460 Monteiro L. et al. (2018) Conservation priorities for the threatened flora of mountaintop  
461 grasslands in Brazil. Flora 238: 234–243.
- 462 Nganje M, Lebbie A, Sambollah R. et al (2014). Mid-Term Performance Evaluation of the  
463 Sustainable and Thriving Environments for West Africa Regional Development  
464 (STEWARD III) Project. DOI:10.13140/RG.2.1.1243.6966.
- 465 Panjabi S, Neely B, Lyon P (2011) Rare Plant Conservation Action Plan: Big Gypsum Valley  
466 and Dry Creek Basin, Colorado. Unpublished report prepared by The Nature

- 467 Conservancy and the Colorado Natural Heritage Program for the National Fish and  
468 Wildlife Foundation. 25 pp. Accessed May 2018
- 469 Plants of the World Online (2019) Published online. Board of Trustees of the Royal Botanic  
470 Gardens, Kew. <http://www.plantsoftheworldonline.org/> Accessed 20 August 2019
- 471 PROGERFOR (1994) Plan d'Aménagement de la Forêt de Zياما 1995-2014. Groupement  
472 ingénieur conseil CIRAD-forêt Deutsche Forst Consult.
- 473 RBG Kew (2016) The State of the Worlds Plants Report – 2016. Royal Botanic Gardens  
474 Kew.
- 475 Rokni S (2017) *Anisotes guineensis*. The IUCN Red List of Threatened Species 2017:  
476 e.T85719057A85719060. [http://dx.doi.org/10.2305/IUCN.UK.2017-](http://dx.doi.org/10.2305/IUCN.UK.2017-2.RLTS.T85719057A85719060.en)  
477 [2.RLTS.T85719057A85719060.en](http://dx.doi.org/10.2305/IUCN.UK.2017-2.RLTS.T85719057A85719060.en)
- 478 Rokni S (2018) *Vernonia djalonensis*. The IUCN Red List of Threatened Species 2018:  
479 e.T87753868A87753873. [http://dx.doi.org/10.2305/IUCN.UK.2018-](http://dx.doi.org/10.2305/IUCN.UK.2018-1.RLTS.T87753868A87753873.en)  
480 [1.RLTS.T87753868A87753873.en](http://dx.doi.org/10.2305/IUCN.UK.2018-1.RLTS.T87753868A87753873.en).
- 481 Samoura K, Bouvier AL & Waaub, JP. (2007) Strategic environmental assessment for  
482 planning mangrove ecosystems in Guinea. Know Techn Pol. 19: 77.  
483 <https://doi.org/10.1007/BF02914892>
- 484 Sayer JA, Harcourt CS, Collins NM (1992) The Conservation Atlas of Tropical Forests:  
485 Africa. IUCN and Simon and Schuster, Cambridge, UK
- 486 Sosef MS, Dauby G, Blach-Overgaard A. et al. (2017) Exploring the floristic diversity of  
487 tropical Africa. BMC Biol 15:15.
- 488 Stévar T, Dauby G, Lowry II PP. et al. (2019) A third of the tropical African flora is  
489 potentially threatened with extinction. Sci. Adv. 5, eaax9444 (2019).
- 490 STEWARD (2008) Sustainable and Thriving Environment for West African Regional  
491 Development Program. An Assessment of Environmental Threats and Transboundary

492           Development Opportunities in the Upper Guinean Forest Region. USAID and US  
493           Forest Service. Retrieved from [www.land-links.org](http://www.land-links.org).  
494   Sugiyama Y, Soumah AG (1988) Preliminary survey of the distribution and population of  
495           chimpanzees in the Republic of Guinea. *Primates* 29:569–574  
496   TNC, 2007. Conservation Action Planning Handbook: Developing Strategies, Taking Action  
497           and Measuring Success at Any Scale. The Nature Conservancy, Arlington, VA.  
498   Way M, Gold K (2014) Assessing a population for seed collection. Millennium Seed Bank  
499           Partnership Technical Information Sheet 02.  
500           [http://brahmsonline.kew.org/Content/Projects/msbp/resources/Training/02-Assessing-](http://brahmsonline.kew.org/Content/Projects/msbp/resources/Training/02-Assessing-population.pdf)  
501           [population.pdf](http://brahmsonline.kew.org/Content/Projects/msbp/resources/Training/02-Assessing-population.pdf) Accessed September 2019

## Tables

**Table 1.** List of species chosen for Conservation Action Plans. IUCN status: CR = Critically Endangered, EN = Endangered, VU = Vulnerable.

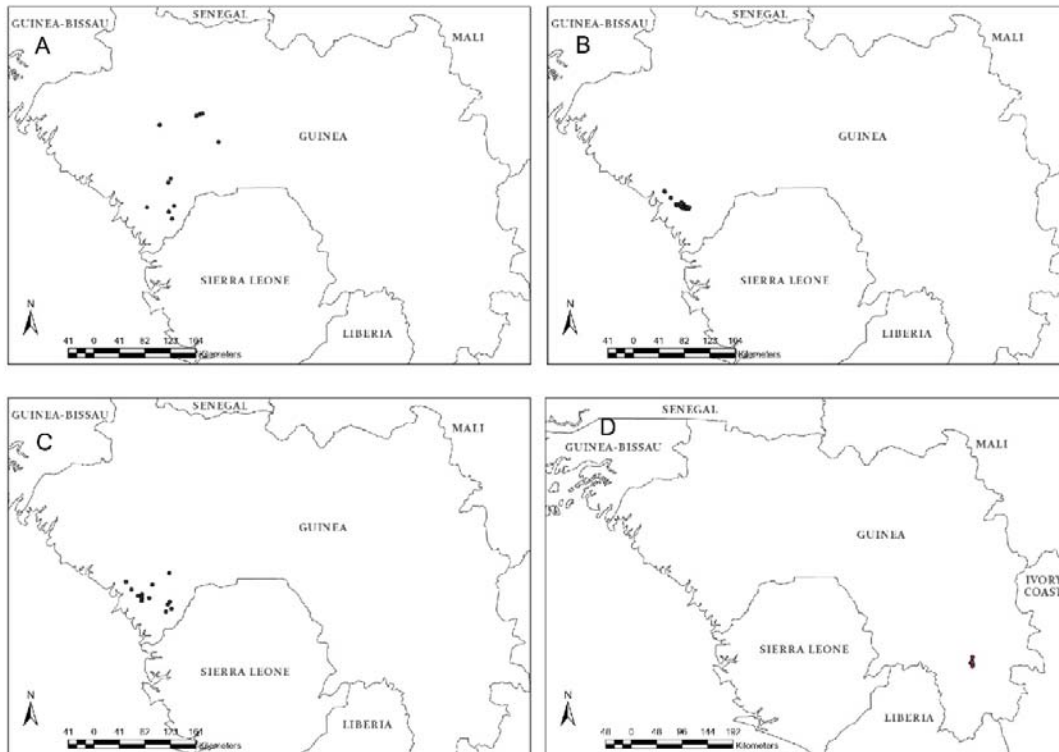
| Family                     | Species  | IUCN status | Growth form |
|----------------------------|--|-------------|-------------|
| Acanthaceae                | <i>Anisotes guineensis</i> Lindau                                      | EN          | Shrub       |
| Apocynaceae                | <i>Marsdenia exellii</i> C.Norman                                      | EN          | Liana       |
| Apocynaceae                | <i>Xysmalobium samoritourei</i> Goyder                                 | EN          | Herb        |
| Araceae                    | <i>Stylochaeton pilosus</i> Bogner                                     | EN          | Herb        |
| Asteraceae                 | <i>Vernonia djalonensis</i> A.Chev.                                    | CR          | Herb        |
| Bromeliaceae               | <i>Pitcairnia feliciana</i> (A.Chev.) Harms & Mildbr.                  | CR          | Herb        |
| Cyperaceae                 | <i>Scleria guineensis</i> J.Raynal                                     | CR          | Herb        |
| Ebenaceae                  | <i>Diospyros feliciana</i> Letouzey & F.White                          | EN          | Tree        |
| Euphorbiaceae              | <i>Acalypha guineensis</i> J.K.Morton & G.A.Levin                      | VU          | Herb        |
| Lamiaceae                  | <i>Plectranthus linearifolius</i> (J.K.Morton) B.J.Pollard & A.J.Paton | EN          | Herb        |
| Leguminosae-Detarioideae   | <i>Talbotiella cheekii</i> Burgt                                       | EN          | Tree        |
| Leguminosae-Papilionoideae | <i>Pterocarpus erinaceus</i> (DC.) Polhill & Wiens                     | EN          | Tree        |
| Leguminosae-Papilionoideae | <i>Eriosema triformum</i> Burgt  | CR          | Herb        |

|                 |  |    |            |
|-----------------|--|----|------------|
| Melastomataceae | <i>Cailliella praerupticola</i> Jacq.-Fél.             | EN | Shrub      |
| Orchidaceae     | <i>Habenaria jaegeri</i> Summerh.                      | EN | Herb       |
| Podostemaceae   | <i>Inversodicraea pepehabai</i> Cheek                  | EN | Herb       |
| Rubiaceae       | <i>Keetia susu</i> Cheek                               | EN | Shrub/Tree |
| Rubiaceae       | <i>Tarenna hutchinsonii</i> Bremek.                    | CR | Shrub/Tree |
| Rutaceae        | <i>Vepris felicis</i> Breteler                         | CR | Shrub      |
| Sapotaceae      | <i>Tieghemella heckelii</i> (A.Chev.) Pierre ex Dubard | EN | Tree       |

---

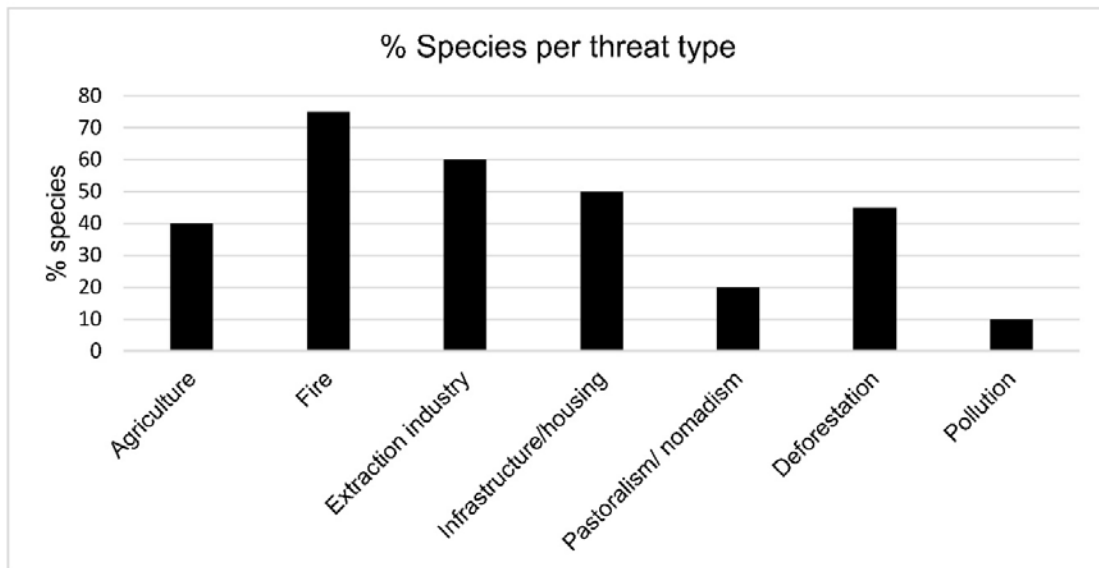
## Figure legends

**Fig. 1** Species distribution maps for four endemic Guinean species. **A** *Anisotes guineensis*, **B** *Talbotiella cheekii*, **C** *Diospyros felicianae*, and **D** *Eriosema triformum*.





**Fig. 2** Graph showing the percentage of the 20 Conservation Action Plan species per threat type.



## Supplementary files

### Conservation Action Plans for 20 threatened Guinean plant species can be found

following the links below:

CAP 1. *Acalypha guineensis* J.K.Morton & G.A.Levin DOI: [10.13140/RG.2.2.34363.36648](https://doi.org/10.13140/RG.2.2.34363.36648)

CAP 2. *Anisotes guineensis* Lindau DOI: [10.13140/RG.2.2.25974.75845](https://doi.org/10.13140/RG.2.2.25974.75845)

CAP 3. *Cailliella praerupticola* Jacq.-Fél. DOI: [10.13140/RG.2.2.34363.36648](https://doi.org/10.13140/RG.2.2.34363.36648)

CAP 4. *Diospyros feliciana* Letouzey & F.White DOI: [10.13140/RG.2.2.15824.87047](https://doi.org/10.13140/RG.2.2.15824.87047)

CAP 5. *Eriosema triformum* Burgt DOI: [10.13140/RG.2.2.35957.5296](https://doi.org/10.13140/RG.2.2.35957.5296)

CAP 6. *Habenaria jaegeri* Summerh. DOI: [10.13140/RG.2.2.11630.56644](https://doi.org/10.13140/RG.2.2.11630.56644)

CAP 7. *Inversodicraea pepehabai* Cheek DOI: [10.13140/RG.2.2.25052.33925](https://doi.org/10.13140/RG.2.2.25052.33925)

CAP 8. *Keetia susu* Cheek DOI: [10.13140/RG.2.2.18341.45280](https://doi.org/10.13140/RG.2.2.18341.45280)

CAP 9. *Marsdenia exellii* C.Norman DOI: [10.13140/RG.2.2.28407.78244](https://doi.org/10.13140/RG.2.2.28407.78244)

CAP 10. *Pitcairnia feliciana* (A.Chev.) Harms & Mildbr.

DOI: [10.13140/RG.2.2.21696.89609](https://doi.org/10.13140/RG.2.2.21696.89609)

CAP 11. *Plectranthus linearifolius* (J.K.Morton) B.J.Pollard & A.J.Paton

DOI: [10.13140/RG.2.2.35118.66880](https://doi.org/10.13140/RG.2.2.35118.66880)

CAP 12. *Pterocarpus erinaceus* (DC.) Polhill & Wiens DOI: [10.13140/RG.2.2.30085.50401](https://doi.org/10.13140/RG.2.2.30085.50401)

CAP 13. *Scleria guineensis* J.Raynal DOI: [10.13140/RG.2.2.23374.61767](https://doi.org/10.13140/RG.2.2.23374.61767)

CAP 14. *Stylochaeton pilosus* Bogner DOI: [10.13140/RG.2.2.36796.39049](https://doi.org/10.13140/RG.2.2.36796.39049)

CAP 15. *Talbotiella cheekii* Burgt DOI: [10.13140/RG.2.2.30164.14728](https://doi.org/10.13140/RG.2.2.30164.14728)

CAP 16. *Tarenna hutchinsonii* Bremek. DOI: [10.13140/RG.2.2.20097.81766](https://doi.org/10.13140/RG.2.2.20097.81766)

CAP 17. *Tieghemella heckelii* (A.Chev.) Pierre ex Dubard

DOI: [10.13140/RG.2.2.33519.59047](https://doi.org/10.13140/RG.2.2.33519.59047)

CAP 18. *Vepris felicis* Breteler DOI: [10.13140/RG.2.2.18420.09606](https://doi.org/10.13140/RG.2.2.18420.09606)

CAP 19. *Vernonia djalonensis* A.Chev. DOI: [10.13140/RG.2.2.15064.65289](https://doi.org/10.13140/RG.2.2.15064.65289)

CAP 20. *Xysmalobium samoritourei* Goyder DOI: [10.13140/RG.2.2.28486.42561](https://doi.org/10.13140/RG.2.2.28486.42561)