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Threatened plants of New Caledonia: Is the system of protected areas adequate?

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With 76 % of its 3063 native species of flora endemic, the New Caledonia biodiversity hotspot has long been recognized as having a high potential for conservation. Under the new IUCN Red List categories, 25 % of the endemic plants are at risk (Conservation Dependent, Vulnerable, Endangered, Critically Endangered), and five species are already extinct. A review of their distribution demonstrates that 83 % of the threatened species do not occur at all in a conservation area, and only 11 % have their conservation status improved by a protected area. The protected area network is geographically and floristically very unbalanced, with the rainforest and high altitude maquis in the south concentrating most of the conservation effort. Conversely, the middle and northern segments of the island, as well as all of the dry west coast, are left without adequate conservation area. Two vegetation types, the sclerophyll forest and the unique low/middle altitude maquis, are virtually totally unprotected. We conclude that the current network of protected areas needs to be considerably expanded, in terms of both geographical/floristic subregions within New Caledonia and vegetation type covered. With only 54 % of the conservation area covered by strict mining restrictions, existing reserves need to have their conservation efficiency improved by a more vigorous enforcement of their status, and by extending mining bans to all of them.

Keywords: New Caledonia; endemism; plants; conservation; protected areas.

Introduction

The island of New Caledonia is both ancient and isolated and its terrestrial biota are characterized by an unusual overall composition and a very high degree of endemism (Morat *et al.*, 1995). Despite a depauperate vertebrate fauna, faunal endemism is high at the species and generic levels. It ranges from 100 % in the less mobile groups (e.g., land snails, Psocoptera, pselaphid beetles) to 20–40 % in the more vagile groups (birds, butterflies) (Chazeau, 1993). Of the ca. 3063 indigenous species of flowering plants, as many as 76 % are endemic, and the composition of the flora is so unusual that New Caledonia has traditionally been regarded as a floristic region of its own. At higher taxonomic levels, five families and 105 genera of phanerogams are endemic (Morat *et al.*, 1994).

Despite a low density of human population (currently 10 per km^2), the terrestrial ecosystems of New Caledonia have not been spared the ravages suffered by insular ecosystems all over the world. Indeed, New Caledonia is one of 10 hotspots in tropical forests recognized by Myers (1988), and one of six countries in the Indo-Pacific Region with high potential for conservation efforts (Dinerstein and Wikramanayake, 1993). The first nature reserves and parks were established in New Caledonia as early as 1950 with the purpose of

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preserving areas with exceptionally remarkable plant diversity. The whole country now officially claims 25 reserves, covering a total of 52 654 ha, or 2.7 % of land area. The purpose of the present paper is to evaluate the adequacy of the existing protected area system for the conservation of the biodiversity of New Caledonia. Our target group are the phanerogams, because they are probably the best known segment of the terrestrial biota of New Caledonia. Massive collecting efforts have been made by resident botanists in the last 30 years, resulting in a collection density index of more than 600, a figure higher than for any other tropical forested country (Campbell, 1989). State-of-the-art knowledge on the taxonomy and distribution is published in the ongoing series *Flore de Nouvelle-Calédonie* (Aubréville *et al.*, 1967–1995). The 19 volumes published so far cover 1550 species, or 60 % of the total phanerogam flora. Our study focuses on the endemic species of this recently revised section of the flora, with additional selected data from other families when adequate knowledge, published or unpublished, permits so.

The native vegetation

Four vegetation types can be recognized in an ecological and conservation perspective: (i) rain forests and (ii) sclerophyll (or dry) forests, both of them unquestionably climacic; (iii) low- and middle-altitude (from the shore to 850–900 m) maquis and (iv) high-altitude maquis, on exposed summit areas above 850–900 m. Both maquis types comprise climacic as well as secondary formations. For convenience, savannas and secondary thickets, all of them secondary vegetation, are grouped together as a fifth (v) category. The diversity in vascular plant species, level of endemism, and extension of the main vegetation types are summarized in Table 1.

As elsewhere in the Pacific, the vegetation of New Caledonia has been considerably modified since the arrival of man, ca. 3500 years ago, with over 50 % of the original vegetation cover already gone (Fig. 1). The climacic vegetation has suffered from clearing and fires, probably since pre-European times. Rainforest and sclerophyll forest, as well as low altitude maquis from dry areas and high altitude maquis, have been affected. Since the late 19th century, mining has added its impact, affecting mainly maquis and dense forest (Jaffré, 1980; Morat *et al.*, 1981). The distribution of native species, many of them endemic, is now reduced and fragmented, to the benefit of alien or fire-resistant plants.

Now covering roughly one-fourth of mainland New Caledonia, low- and mid-altitude maquis are the most common native vegetation type, slightly in excess of the extent of rain forests. Secondary maquis on ultrabasic rocks is composed mostly of fire-resistant en-

Table 1. Current extent, floristic richness and percentage of endemism of the main native vegetation formations (after Jaffré *et al.*, 1994 with revision)

	Area ($\times 10^3$ ha)	Number of vascular species	Endemism (%)
Rainforest	400	2011	82.4
Sclerophyll forest	35	409	56.9
Low and middle altitude maquis	440	1100	89
High altitude maquis	10	200	91
Savanna and thickets	600	129	6.2

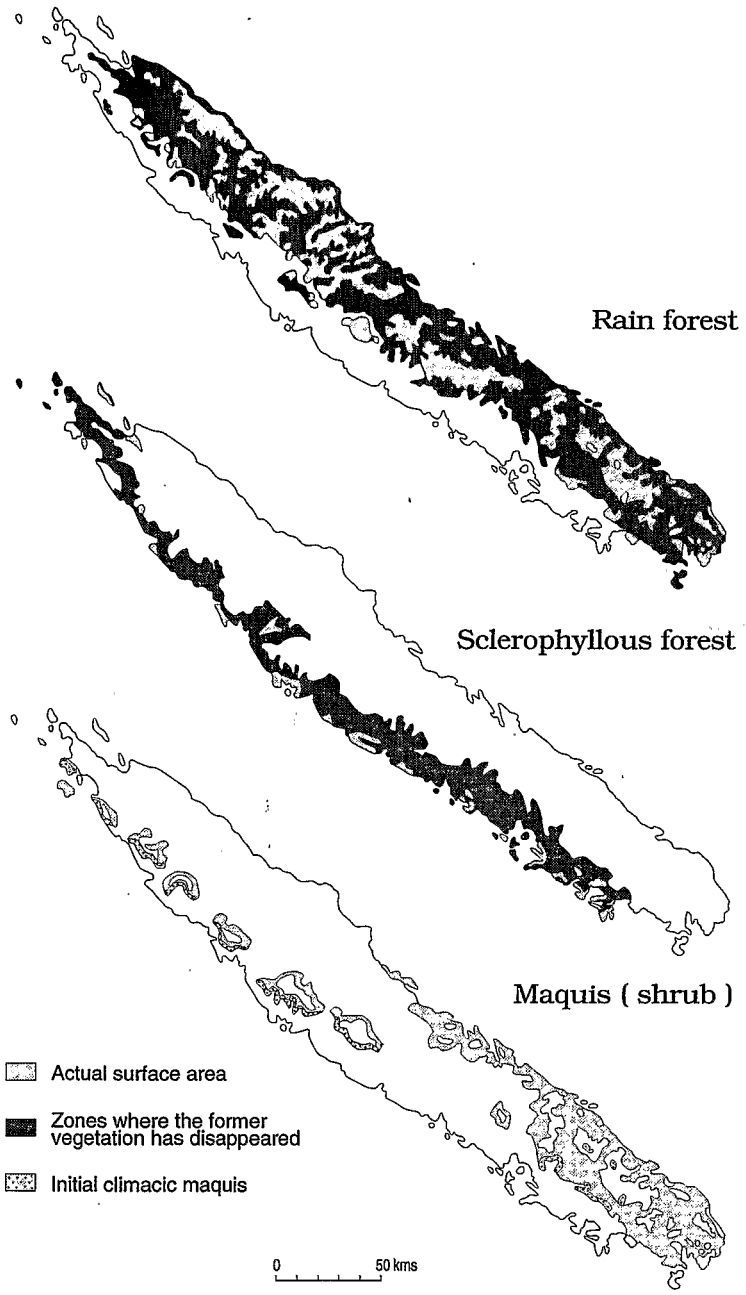

Figure 1. Original and current extension of the main native vegetation types in New Caledonia.

demics and forms unique plant communities (Morat *et al.*, 1986), with individual plant species closely adapted to local soil types (Jaffré, 1980). Such communities may be difficult to tell apart from undisturbed climacic maquis. High altitude maquis is a formation of very limited extent, mostly restricted to a few mountain tops in the Southern Massif, and is

remarkable for an unparalleled level of endemism which reaches 91 %. Rainforest has the most diverse flora, but its level of endemism is slightly less than that of low- and middle-altitude maquis (82.4 % versus 89 % endemics). Sclerophyll forest is now reduced to fragmented patches and is the most vulnerable in terms of conservation (Jaffré *et al.*, 1994; Bouchet *et al.*, 1995). By contrast, exotics constitute the main, and sometimes only, component of the flora of the now very extensive savannas and thickets, with suites of tropical tramps similar to those of other islands in the tropics.

A review of the protected areas of New Caledonia

Different compilations have produced widely different figures on the number and extent of protected areas in New Caledonia (Table 2). Much of the discrepancies between the different sources apparently result from different interpretations of what constitutes a 'protected area'. These differences may in turn result from the language barrier of English-speaking compilers when using French documents produced by the local authorities of New Caledonia. To understand the background of many regulations that apply locally, it must be borne in mind that mainland New Caledonia is unusually rich in rare metals, mainly nickel and chromium, but also cobalt and gold, and mining constitutes the economic base of the country. Many of the documents relating to 'protection' from mining should be understood as being aimed at safeguarding settled areas, agriculture and water catchments from the worst negative consequences of mining. Such areas may be 'protected areas' from a miner's perspective; they are not however protected areas in the context of conservation.

Based on the official documents that mandate different types of protection over selected reserves in New Caledonia, we present below a summary of the terminology used locally. It should be noted that the different categories (a), (b), (c) and (d) are not mutually exclusive, i.e. a water catchment protection area (a) may lie within the limits of a mining restriction area (b), or a conservation area (d) may be included within a forest production area (c). Four major categories are distinguished:

(a) *Périmètres de protection des eaux* (water catchment protection areas). In these areas, which are designated for the protection of drinking water quality, it is prohibited to dump material, in particular industrial waste, liable to affect public health. Apart from this restriction, these areas can be developed. There are currently 147 such areas, covering a total of 94 093 ha.

Table 2. Number and extent of protected areas in New Caledonia in recent compilations

Source	Number of terrestrial protected areas	Total area (ha)
IUCN, 1991	44	651 543
IUCN, 1992	35	99 715
WCMC, 1992	14	61 676
Dinerstein and Wikramanayake, 1993	12	48 400
This paper	25	52 654

(b) *Périmètres de protection minière*: *activités minières réglementées* (mining restriction areas: regulated mining activities) and *Zones fermées à la prospection et à la recherche minière* (areas closed to prospecting and mining exploration). In such areas, mining exploration is regulated or forbidden, but exploitation may be granted following an application by a mining company. Any other form of development is unrestricted. Five closed areas and eight restricted areas total 563 098 ha. In addition, mining activities are forbidden in 13 conservation areas (see below) covering a total of 19 429 ha.

(c) *Terrains affectés* (allocated areas). These areas are allocated to the various forest departments (terminology varies with province and time period considered) and can be used for planted production forest (mainly exotic *Pinus caribaea*), experimental agroforestry, or other purposes, as seen fit by the administration. The expression *réserve forestière* used in connection with such *terrains affectés* simply means that this public land is put aside for the forest departments; it does not mean that they are forests put aside for conservation. Thus, the terminology 'forest reserve' used by IUCN (1991, 1992) is inappropriate and misleading. Nine currently allocated areas cover a total of 54 415 ha.

(d) *Réserve naturelle intégrale* (strict nature reserve), *Parc territorial/provincial* (territorial/provincial park), *Réserve spéciale marine* (special marine reserve), *Réserve spéciale de faune* (special fauna reserve) and *Réserve spéciale botanique* (special botanical reserve) are all areas that, to a smaller or larger extent, have been set aside for the conservation of plants and animals. The category affording least protection is the special fauna reserve, which is no more than a reserve where hunting is prohibited, with logging still permitted. Conversely, hunting is permitted in the botanical reserves. Mining is forbidden in some reserves, but in principle still possible in others.

The high number of protected areas in IUCN (1991) results from the listing of 'périmètres de protection minière' (items 43–44, 46–48, 50–52 in the list), 'périmètres de protection des eaux' (item 45), and 'terrains affectés' (items 33–41), along with areas that have been degazetted as protected areas (item 49). In our opinion, only the areas in paragraph (d) above should be considered as conservation areas, and this view is shared by the local authorities (Boulet, 1993). The 25 terrestrial conservation areas are reviewed in Table 3. They cover altogether 52 654 hectares, i.e. 2.7 % of the territory of New Caledonia. Of these, reserves set aside for the conservation of plants, or animals *and* plants cover 39 126 ha. The difference (13 528 ha) is made up of reserves set aside for the conservation of fauna only.

The conservation value of any given area depends not only on its formal protection status, but also to a larger extent on the enforcement of this status. We have personally visited several times all the protected areas and based on this experience we have classified each one according to a number of criteria (Table 4):

(i) Percentage of reserve covered by undisturbed or relatively undisturbed native flora. Native vegetation cover has been rounded and allocated to one of five categories: 0, less than 15 %, 40 %, 60–85 %, 90 % or more.

(ii) Accessibility. We have taken into consideration the existence of roads and the actual penetration of the reserve by the public. 1 = remote, access by foot track only; 2 =

Table 3. Categorization and extent of terrestrial conservation areas in New Caledonia

Name	Category	Area (ha)
1 Montagne des Sources	strict nature reserve	5878
2 Rivière Bleue	provincial park [a]	9045
3 Thy	provincial park [a]	1133
4 Ouen-Toro	provincial park [a]	44
5 Parc M. Corbasson	provincial park [a]	35
6 Mt Mou	special botanical reserve	675
7 Mt Humboldt	special botanical reserve	3200
8 Yaté Barrage	special botanical reserve	546
9 Fausse Yaté	special botanical reserve	386
10 Mts Nengoné	special botanical reserve	307
11 Forêt Nord	special botanical reserve	280
12 Cap N'Dua	special botanical reserve	830
13 Pic du Pin	special botanical reserve	1482
14 Forêt Cachée	special botanical reserve	635
15 Forêt de Saille	special botanical reserve	1100
16 Pic Ningua	special botanical reserve	350
17 Chute de la Madeleine	special botanical reserve	400
18 Mt Panié	special botanical reserve	5000
19 Mt Do	special fauna and flora reserve	300
20 Mt Kouakoué [b]	special fauna and flora reserve	7500
21 Haute Yaté [c]	special fauna reserve	15900
22 Leprédour	special fauna reserve	760
23 Pam	special fauna reserve	460
24 Aoupinié	special fauna reserve	5400
25 Etang de Koumac	special fauna reserve	53

[a] created as Parc territorial, and renamed Parc provincial when the provinces have been granted authority over the conservation areas in 1988.
[b] gazetted 24.11.1995.
[c] includes the Parc provincial de la Rivière Bleue.

moderately difficult, access by four-wheel drive and/or road closed by gate; 3 = very easy access by ordinary car.

(iii) Ban on mining activities. Yes = all forms of mining exploration and exploitation prohibited; no = some mining activities permitted.

(iv) Staff. Refers to the presence of staff for the enforcement of protection status.

(v) Under 'remarks', we have noted side effects or other uses that impact on the conservation value of the area. To some extent, the presence of feral dogs and cats, orchid and palm collecting, and hunting affect most natural areas of New Caledonia. These aspects of human impact have not been repeated under every reserve.

The most comprehensive protected area is formed by the contiguous Montagne des Sources (strict nature reserve), Rivière Bleue (park) and Haute-Yaté (fauna reserve), which together occupy 21 778 ha, or 48 % of the protected areas of New Caledonia (Fig. 2). Rivière Bleue is also the only permanently staffed protected area which, in addition, has a single, controlled access road. Because it is so close to Nouméa, where over half the population of New Caledonia is concentrated, this area is increasingly used for recreation.

Table 4. Assets and drawbacks of the terrestrial conservation areas of New Caledonia

Name	% Natural vegetation	Access	Ban on mining activities	Staff	Remarks
1 Montagne des Sources	≥ 90	1	yes	no	orchid picking, 4-wheel drive, limited hunting, endurance rallies
2 Rivière Bleue	≥ 90	3	yes	yes, permanent	high recreative use, endurance rallies, logging until 1970s
3 Thy	60–85	3	no	no	logging in 1950s
4 Ouen-Toro	≤ 15	3	yes	yes	urban park, fire
5 Parc Corbasson	≤ 15	3	yes	yes, permanent	urban park, zoo
6 Mt Mou	≥ 90	2	no	no	some littering and tramping from trekkers
7 Mt Panié	≥ 90	1	no	no	
8 Mt Humboldt	≥ 90	1	no	no	littering and tramping from trekkers
9 Yaté barrage	60–85	2	yes	no	maintenance road of high power line, old and recent fires
10 Fausse Yaté	≥ 90	2	yes	no	mining exploration tracks in 1970s
11 Mt Nengoné	60–85	2	yes	no	encroachment from fires in 1991, illegal tree felling
12 Forêt Nord	≥ 90	2	yes	no	maintenance of TV antenna, fire induced erosion, logging earlier this century
13 Cap N'Dua	60–85	2	yes	no	littering from yachters, fire induced erosion
14 Pic du Pin	60–85	2	yes	no	fire induced erosion, logging and mining earlier this century
15 Forêt Cachée	≥ 90	2	yes	no	logging earlier this century
16 Forêt de Saille	≥ 90	1	yes	no	very limited hunting
17 Pic Ningua	≥ 90	2	yes	no	access road controlled by mining company
18 Chute de la Madeleine	60–85	3	no	yes, occasional	excessive recreative use, excessive area occupied by roads and tourist installations

Table 4. (*Continued*)

Name	% Natural vegetation	Access	Ban on mining activities	Staff	Remarks
19 Mt Do	60–85	2	yes	no	access road and maintenance of TV antenna controlled by police, fire and other vandalism
20 Massif Kouakoué	60–85	1	no	no	logging in 1990s, fire
21 Haute Yaté	40	3	no	yes, permanent	fire, plantation of exotic species, input of chemical fertilizers, mining exploratory roads in 1970s
22 Lepredour	≤ 15	2	no	yes, occasional	deers, rabbits, other alien species, erosion
23 Pam	≤ 15	2	no	no	not visited (by us) recently
24 Aoupinié	60–85	2	no	no	fire, ongoing logging, maintenance of TV antenna
25 Etang de Koumac	0	3	no	no	barren land around brackish water swamp

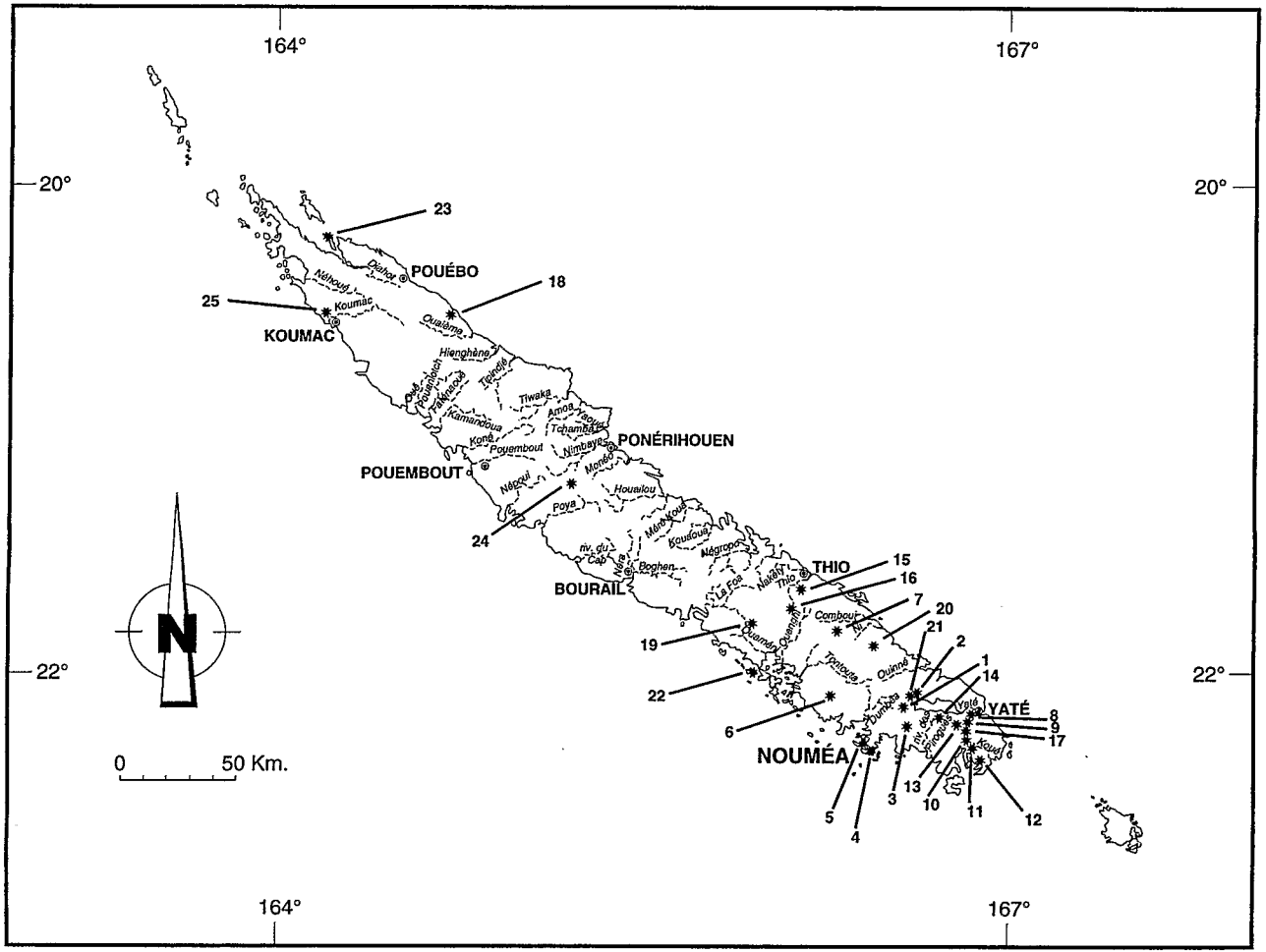

Figure 2. Location of conservation areas in New Caledonia. For status, extension and comments, see text.

Categorization of the phanerogam flora of New Caledonia under Red List criteria

The new IUCN criteria (IUCN, 1994) have been used to categorize the native flora under different levels of extinction risk. In this paper, which focuses mostly on the endemic flora, only full species (as opposed to subspecies and varieties) are considered. Our view is that extinction risks of many native non-endemic species, as well as of the numerous endemic and native non-endemic varieties named from New Caledonia, cannot currently be properly assessed.

Knowledge about the 2317 endemic species is uneven: data are adequate to classify 1784 of them under the IUCN categories, but a further 533 endemic species have not been evaluated because of lack of sufficient data. Table 5 summarizes the results of our evaluation. A total of 392 species are categorized as vulnerable (VU), endangered (EN) or critically endangered (CR), i.e. 22 % of the species evaluated are at risk, and a further five species are extinct (EX) (Bouchet *et al.*, 1995). We list these species in the appendix, and indicate how the IUCN criteria are met for every species. Fifty species that would have met the criteria for VU or higher have only been listed as Conservation Dependent (LR cd) because we have considered that their occurrence within protected areas actually improves their conservation status.

Despite the high proportion of species at risk, we want to emphasize that the proportion of threatened species would have been still higher under the 'old' (pre-1994) IUCN criteria. An earlier evaluation of world conifer species under those criteria (Farjon *et al.*, 1993) had classified 23 of the 43 New Caledonia species as threatened (i.e. categories 1–4 in that publication, or 53 %), whereas our own evaluation under the new criteria recognizes just 11 (26 %, i.e. close to the average for the whole native flora).

We have further researched how the species at risk are distributed in the main vegetation types (Table 6). Our results show that low and middle altitude maquis have a higher number of threatened or extinct species than rainforests (178 versus 148 species). Not surprisingly, high altitude maquis have the lowest number of species at risk (12 species), with dry forests species occupying an intermediate position. However, when these numbers are compared with the actual number of evaluated species in the different vegetation types, a different pattern emerges (Fig. 3). As many as 49.6 % of the evaluated dry forest species face a VU or higher extinction risk. This is hardly surprising in view of the considerable loss of dry forest habitat and extreme fragmentation of remnant patches (Bouchet *et al.*,

Table 5. Classification of endemic phanerogams of the main autochtonous vegetation formations using the different danger categories of IUCN

Vegetation types	Evaluated species	Low risk species		Threatened species				Total
		LR nt/lc	LR cd	VU	EN	CR	EX	
Rainforest	1093	909	36	97	33	15	3	148
Sclerophyll forest	117	58	0	28	9	21	1	59
Low and middle altitude maquis	546	366	2	88	74	15	1	178
High altitude maquis	40	16	12	2	9	1	0	12
Total	1796	1349	50	215	125	52	5	397

Table 6. Occurrence of the conservation dependent species in different types of protected areas. Figures indicate the number of species concerned. S = strict nature reserve; B = special botanical reserve; P = provincial park

	Rainforest	Sclerophyll forest	Low and middle altitude maquis	High altitude maquis	Total
S+B+P	1				1
S+B	3		1	9	13
S+P					
S	2			3	5
B+P	6		1		7
B	27		2	9	38
P	6	6			12
Total	45	6	4	21	76

1995). The maquis flora (both low/middle and high altitude maquis) has 32.4 % of its species facing a VU or higher extinction risk. Rainforest is the vegetation type least at risk, with 13.3 % of its evaluated species in the VU or higher category.

Threatened plants in protected areas

Seventy-six species that would have met the criteria for VU or higher occur within protected areas (Table 6). Of course, occurrence within a protected area is not *per se* a guarantee of long-term survival, especially when it is realized that 17 908 ha, or 45.8 % of the 39 126 ha of plant conservation areas, are not protected against mining activities. Even if no mining is taking place today, some species are already facing a critical situation within the perimeter of reserves. Efficiency of protected areas in terms of conservation is a function of accessibility (hence level of human disturbance), staffing (hence enforcement of conservation status) and competition from alien species. As examples of inappropriate management of protected areas, we want to cite two cases. At the Chute de la Madeleine botanical reserve, shrub cover has considerably regressed with the increasing number of visitors since about 1990 (see e.g. Farjon, 1994). At Michel Corbasson provincial park, the dry forest species *Homalium deplanchei* has completely disappeared since a deer enclosure has been built in the park. *Homalium deplanchei* is now rare in the Nouméa area, although it is not globally threatened. Occurrence in a protected area is therefore not sufficient to consider a species safe, and certain species occurring in reserves have to be categorized under VU, EN or CR. First and foremost, there are six dry forest species that are globally threatened (VU 4, EN 2), despite their occurrence in two provincial parks (Michel Corbasson and Ouen Toro parks), where they are insufficiently protected. Also threatened are two narrow-range endemic species of podocarp conifers (*Dacrydium guillauminii* [CR] and *Retrophyllum minor* [EN]), with a distribution restricted to low altitude marshy maquis in the Chute de la Madeleine reserve, and two rainforest palms. *Pritchardiopsis jeanneneyi*, long thought to be extinct, is known from a single population with a single adult plant (Jaffré and Veillon, 1989). The site is in the Mts Nengoné botanical reserve, which is unstaffed and unfenced, and where we have noticed numerous traces of trespassing as well

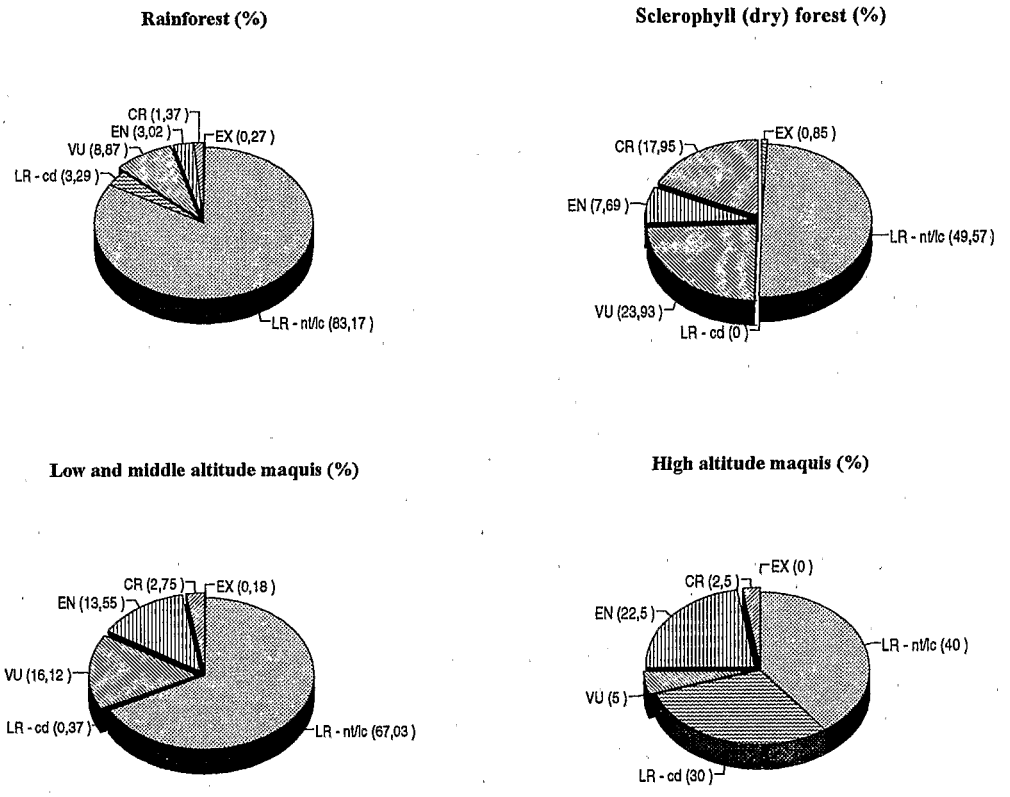

Figure 3. Partitioning of the species from different vegetation types in the IUCN threat categories. EX = Extinct; CR = Critically Endangered; EN = Endangered; VU = Vulnerable; LR = Lower Risk; cd = conservation dependent; nt = near threatened; lc = least concern. Figures in parentheses are percentages.

as recent tree felling. Although the single known population of *Lavoixia macrocarpa* is within the Mt Panié reserve, it has only 30 adult plants and artifical propagation has so far been unsuccessful. We categorize both palm species as CR, and suggest that increased supervision of the sites concerned would improve the odds of successful recovery through monitoring of the seeds produced.

Second, several species in the flora of high altitude maquis have total distributions narrowly restricted to Mt Humboldt and to the summit of Mt Kouakoué. Currently, the only threat to their survival comes from accidental fires, but we nevertheless categorize nine of the more rare species as EN. This is because wild fires that routinely come with increased human occupation are a potential threat to some of these exceedingly localized and rare species.

In conclusion, for 50 of the 76 species occurring in protected areas that would meet the criteria for VU, EN or CR, we consider that their presence within a protected area does afford sufficient protection and we thus rank them as LR cd. A further 26 species deserve categorization as VU, EN or CR despite their occurrence in a protected area.

Discussion: adequacy of the protected area network

Our results demonstrate that, of a total of 447 species of plants that are LR cd, VU, EN or CR, 83.0 % do not occur at all in a protected area and only 11.2 % have their conservation status improved by a protected area. In a very coarse estimate, one might thus predict that at least 5–9 times the current protected area would be necessary to reduce the extinction risk of the threatened endemic flora of New Caledonia.

We have then examined the results of the protected area network in terms of vegetation types. We have calculated a 'conservation efficiency index' by dividing the number of species in the LR cd category by the total number of species in the LR cd, VU, EN and CR categories. Our results (Table 7) show that sclerophyll forests are left totally without adequate protection. The two parks that contain some sclerophyll forest cover together 79 ha, i.e. 0.23 % of the remaining area occupied by that vegetation type. Only six threatened species occur within these parks, and this does not afford them actual protection (therefore they have been categorized under VU and EN, as appropriate; see above). Roughly 5–6 % of remaining low or middle altitude maquis vegetation is within protected areas, and most special botanical reserves and special fauna and flora reserves contain maquis. However, all of these protected areas are concentrated in the southern third of the main island, south of a Thio-Boulouparis line. Of 178 low or middle altitude maquis species needing protection, only four threatened species are encountered in protected areas, and two of these owe their LR cd status to their occurrence in conservation areas. High altitude maquis is well represented in the Montagne des Sources (strict nature reserve), Mt Humboldt and Mt Kouakoué reserves, and this is undoubtedly the best protected vegetation type. Over half the species of conservation concern grow in a conservation area, but only 30 % can be considered safe. Finally, the rainforest is reasonably well represented in protected areas, both in proportion and absolute numbers. Twenty-four percent of rainforest species of conservation concern occur in protected areas, and the vast majority of conservation dependent species in protected areas are rainforest species: 36 of 50 LR cd species are rainforest species.

Epilogue: strategy for conservation

Recognition of New Caledonia as one of 10 hotspots of tropical biodiversity (Myers, 1988) rested mainly on the concern for the future of rainforests. Paradoxically our work shows that rainforest is currently the least threatened of the four native vegetation types there. We have also shown that sclerophyll forests and low or middle altitude maquis are un-

Table 7. Conservation efficiency index (see text for definition) of the protected area network *vis à vis* the threatened and conservation dependent plants of New Caledonia

Formations	Conservation efficiency index (%)
Rainforest	19.9
Sclerophyll forest	0
Low and middle altitude maquis	1.1
High altitude maquis	50

doubtedly the most threatened vegetation types in New Caledonia, with respectively 49.6 and 32.4 % of their species categorized as VU, EN or CR. This does not mean however that all is well for rainforest plants in New Caledonia: despite a lower percentage (13 %) of globally threatened species, as many as 145 rainforest species are of conservation concern.

With over 80 % of the 397 globally threatened plant species growing exclusively outside protected areas, the magnitude of the biodiversity conservation problem in New Caledonia is obvious. The survival of the many endemic biota of New Caledonia necessitates a range of complementary initiatives:

(a) Protected areas now cover only two subregions of floristic diversity: the Mt Panié range in the North-East and the South of the main island. This ensures insufficient representation of the various vegetation types and floristic subregions. The obvious strategy to improve the network is to set aside for conservation publicly-owned tracts of land from among a much broader range of geographical/floristic subregions and vegetation types.

(b) We suggest that the local classification of conservation areas should be simplified. Conservation areas should protect both native fauna *and* flora, rather than fauna *or* flora as is often the case now. We also suggest that all conservation areas should be under a mining ban. Such mining bans would benefit the high altitude maquis on the Mt Humboldt and Mt Kouakoué reserves most. Conservation areas are meaningless if they are just parks on paper. Effective conservation means increased staffing, and effective and efficient fire fighting.

(c) Virtually all remaining sclerophyll forest patches are on private land. Recently, landowners have allowed the authorities of Province Sud to erect exclosures excluding cattle from a few hectares of forest. Such initiatives are naturally welcome, but we are worried that in the long term they may not be permanent, e.g. as ownership changes. We believe that it is already too late to save *in situ* all threatened dry forest species. Conservation strategy should include *ex situ* multiplication of the most critically endangered plants, and their re-introduction if and when a significant tract of land suitable for dry forest is acquired and restored. Sites at Leprédour and Pouembout have already been targeted as being of highest priority (Bouchet *et al.*, 1995).

(d) Rainforests occupy roughly 21 % of the land area and it is unrealistic to imagine that all will be included in protected areas. Conservation of rainforests outside reserves will be feasible only if the economic pressure for logging native trees diminishes significantly. This can be achieved through high-yield production forest, based either on local or exotic species, which should be encouraged by conservation groups. However, the impact of potential invasive species prior to large scale introduction of exotics should be properly evaluated to avoid the cure becoming more detrimental than the disease (Hughes, 1994; Gargominy *et al.*, 1996).

More generally, conservation of biodiversity outside and inside reserves would be greatly enhanced by a policy of fire control, including, e.g., establishment of firebreaks and plantation of appropriate tree species. Fire probably constitutes the single most important threat to the survival of the biota of New Caledonia.

Note added in proof

Two recently established special fauna and flora reserves should now be added to Table 3, the Haute-Pourina and Nodela. The Haute-Pourina is included within the Haute Yaté special fauna reserve and covers 4480 ha; conversely, Nodela is an entirely new conservation area and, with 935 ha, brings the terrestrial protected area to a total of 53 589 hectares. Both new reserves are located in the South Province and their main vegetation type is rainforest. Although a welcome addition to the list of protected areas, they reinforce the imbalance analyzed in this paper, i.e. the central and northern regions of New Caledonia, and vegetation types other than rainforest and high altitude maquis, are not adequately covered by the protected area network.

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Appendix: Threatened species of the endemic flora of New Caledonia

Species per families	Threat categories	Criteria	Subcriteria
ACANTHACEAE			
Graptophyllum balansae Heiné	VU	D	1
Graptophyllum ophiolithicum Heiné	VU	D	1
Hemigraphis neocaledonica Heiné	EN	B	1 2
Justicia pinensis S. Moore	EN	B	1 2
Pseuderanthemum incisum Benoist	VU	B	1 2
ANACARDIACEAE			
Euroschinus aoupiniensis Hoff	VU	B	1 2
Euroschinus jaffrei Hoff	VU	B	1 2
Semecarpus riparia Virot	EN	B	1 2
APOCYNACEAE			
Alstonia quaternava Van Heurck	LRcd		
Alstonia saligna S. Moore	LRcd		
Alyxia integricarpa Boit.	LRcd		
Alyxia sp1 (V.6575)	VU	B	1 2
Cerberiopsis neriifolia (S. Moore) Boit.	EN	B	1 2
Cerberiopsis obtusifolia (Muell. Arg.) Boit.	VU	B	1 2
Melodinus insulae-pinorum Boit.	EN	B	1 2
Melodinus reticulatus Boit.	VU	B	1 2
Melodinus tiebaghiensis Boit.	VU	B	1 2
Neisosperma brevituba (Boit.) Boiteau	VU	D	2
Neisosperma sevenetii (Boit.) Boiteau	EN	B	1 2
Neisosperma thiollierei (Montr.) Boit.	CR	B	1 2
Ochrosia grandiflora Boit.	VU	B	1 2
Ochrosia inventorum L. Allorge	CR	Aa	1a
Rauvolfia sevenetii Boit.	CR	B	1 2
Rauvolfia spathulata Boit.	LRcd		
ARALIACEAE			
Apiopetalum velutinum Baillon	LRcd		
Meryta sonchifolia Linden & André	VU	B	1 2
Myodocarpus angustialatus Lowry ined.	VU	B	1 2

Appendix (*Continued*)

Species per families	Threat categories	Criteria	Subcriteria
Polyscias nothisii Lowry ined.	VU	B	1 2
Pseudopanax scopoliae (Baillon) Philipson	VU	B	1 2
Pseudosciadium balansae Baillon	VU	B	1 2
Schefflera apioidea Baillon	VU	B	1 2
Schefflera veillonorum Bernardi	LRcd		
ARAUCARIACEAE			
Agathis corbassonii Laubenf.	VU	B	1 2
Agathis lanceolata Lindley ex Warb.	LRcd		
Agathis montana Laubenf.	LRcd		
Agathis moorei (Lindley) Masters	VU	B	1 2
Agathis ovata (C. Moore) Warb.	LRcd		
Araucaria bernieri J.Buchholz-Ham	LRcd		
Araucaria biramulata J.Buchholz	LRcd		
Araucaria humboldtensis J.Buchholz	LRcd		
Araucaria laubenfelsii Corbasson	LRcd		
Araucaria luxurians (Brongn. & Gris) Laubenf.	EN	B	1 2
Araucaria muelleri (Carrière) Brongn. & Gris	LRcd		
Araucaria nemorosa Laubenf.	CR	B	1 2
Araucaria rulei F. Muell.	EN	C	1
Araucaria schmidii Laubenf.	LRcd		
Araucaria scopulorum Laubenf.	EN	B	1 2
BALANOPACEAE			
Balanops balansae Baillon	LRcd		
BURSERACEAE			
Canarium sp (V.7485)	VU	D	1
Canarium whitei Guillaumin	CR	Ca	2a
CAPPARIDACEAE			
Capparis neocaledonica Vieill. ex Schltr.	VU	B	1 2
Capparis spa (MK.17508)	VU	B	1 2
Capparis spb (J.2637)	CR	B	1 2
Oceanopapaver neocaledonicum Guillaumin	VU	A	2
CASUARINACEAE			
Gymnostoma leucodon (Poisson) L. Johnson	VU	B	1 2
CELASTRACEAE			
Elaeodendron gomenense Virot	EN	B	1 2
Elaeodendron vieillardii Guillaumin	EN	B	1 2
CHRYSOBALANACEAE			
Hunga cordata Prance	EN	B	1 2
Hunga gerontogea (Schltr.) Prance	VU	B	1 2
Hunga guillauminii Prance	VU	B	1 2
Hunga mackeeana Prance	VU	B	1 2

Appendix (*Continued*)

Species per families	Threat categories	Criteria	Subcriteria
COMBRETACEAE			
Terminalia cherrieri MacKee	CR	A	1
Terminalia novocaledonica Däniker	VU	B	1 2
Terminalia sp.a (MK.40207)	VU	B	1 2
COMPOSEAE			
Brachycome neocaledonica Guillaumin	VU	B	1 2
Brachycome sarasinii Däniker	VU	B	1 2
Lagenophora neocaledonica S. Moore	VU	B	1 2
CONVOLVULACEAE			
Turbina inopinata Heiné	CR	A	1
CUNONIACEAE			
Cunonia aoupiniensis Hoogl. ined.	VU	D	2
Cunonia ouaiemensis Guillaumin & Virot	VU	D	2
Cunonia rotundifolia Däniker	LRcd		
Pancheria humboldtiana Guillaumin	LRcd		
Pancheria multijuga Guillaumin	LRcd		
Pancheria robusta Guillaumin	LRcd		
Weinmannia ouaiemensis (Guillaumin & Virot) Hoogl. ined.	VU	D	1
CUPRESSACEAE			
Callitris neocaledonica Dummer	LRcd		
Callitris sulcata (Parlatore) Schltr.	EN	B	1 2
Libocedrus austrocaledonica Brongn.	LRcd		
Libocedrus chevalieri J. Buchholz	EN	B	1 2
Libocedrus yateensis Guillaumin	LRcd		
Neocallitropsis pancheri (Carrière) Laubenf.	LRcd		
CYPERACEAE			
Baumea veillonis Raynal	LRcd		
Chorizandra sp (MK.43278)	VU	B	1 2
Tricostularia guillauminii (Kük.) Raynal	VU	D	2
DILLENIACEAE			
Hibbertia bouletii Veillon	CR	B	1 2
Hibbertia favieri Veillon	CR	D	
Hibbertia margaretae Veillon	CR	B	1 2
Hibbertia rubescens Vieill. ex Guillaumin	CR	B	1 2
Hibbertia sp (MK.27839)	VU	B	1 2
EBENACEAE			
Diospyros cherrieri F. White	VU	D	1
Diospyros erudita F. White	EN	B	1 2
Diospyros fastidiosa F. White	VU	D	2
Diospyros impolita F. White	VU	B	1 2
Diospyros macrocarpa Hiern	LRcd		
Diospyros margaretae F. White	VU	D	1

Appendix (*Continued*)

Species per families	Threat categories	Criteria	Subcriteria
Diospyros minimifolia F. White	VU	B	1 2
Diospyros nebulosa F. White	LRcd		
Diospyros neglecta F. White	EN	B	1 2
Diospyros perplexa F. White	VU	B	1 2
Diospyros pustulata F. White	VU	B	1 2
Diospyros revolutissima F. White	VU	B	1 2
Diospyros spl (V.7386)	CR	B	1 2
Diospyros trisulca F. White	VU	D	1
Diospyros veillonii F. White	CR	B	1 2
ELAEOCARPACEAE			
Dubouzetia guillauminii Virot	LRcd		
Elaeocarpus biflorus Tirel	VU	D	1
Elaeocarpus colnettianus Guillaumin	VU	D	1
Elaeocarpus gordonii Tirel	LRcd		
Elaeocarpus kaalaensis Däniker	EN	B	1 2
Elaeocarpus moratii Tirel	VU	D	1
Elaeocarpus vaccinioides F. Muell.	LRcd		
Sloanea lepida Tirel	VU	D	1
Sloanea suaveolens Tirel	VU	D	1
EPACRIDACEAE			
Dracophyllum alticola Däniker	EN	B	1 2
Dracophyllum ouaiemense Virot	VU	B	1 2
Styphelia violaceo-spicata (Guillaumin) McPherson	EN	B	1 2
ERICACEAE			
Agapetes neocaledonica Guillaumin	VU	D	1
ESCALLONIACEAE			
Platyspermation crassifolium Guillaumin	LRcd		
EUPHORBIACEAE			
Acalypha balansae Guillaumin	LRcd		
Alphandia resinosa Baillon	EN	B	1 2
Austrobuxus cracens McPherson	VU	D	1
Austrobuxus montis-do Airy Shaw	LRcd		
Baloghia pininsularis Guillaumin	EN	B	1 2
Bocquillonia arborea Airy Shaw	EN	B	1 2
Bocquillonia castaneifolia Guillaumin	EN	B	1 2
Bocquillonia longipes McPherson	EN	B	1 2
Cleidion lemurum McPherson	CR	D	
Cleidion lochmios McPherson	VU	B	1 2
Cleidion marginatum McPherson	VU	B	1 2
Cleidion veillonii McPherson	VU	D	2
Cocconerion minus Baillon	VU	B	1 2
Codiaeum oligogynum McPherson	EN	B	1 2
Croton cordatulus Airy Shaw	EN	B	1 2
Myricanthe discolor Airy Shaw	EN	B	1 2

Appendix (*Continued*)

Species per families	Threat categories	Criteria	Subcriteria
Phyllanthus aoupinieensis M. Schmid	VU	D	2
Phyllanthus artensis M. Schmid	VU	B	1 2
Phyllanthus avanguiensis M. Schmid	VU	B	1 2
Phyllanthus baraouaensis M. Schmid	EN	B	1 2
Phyllanthus buxoides Guillaumin	VU	B	1 2
Phyllanthus casearoides S. Moore	CR	D	
Phyllanthus cherrieri M. Schmid	VU	D	2
Phyllanthus comptonii S.Moore	EX		
Phyllanthus conjugatus M. Schmid	VU	B	1 2
Phyllanthus deciduiramus Däniker	VU	B	1 2
Phyllanthus deplanchei (Baillon) Muell. Arg.	VU	B	1 2
Phyllanthus dumbeaensis M. Schmid	VU	D	1
Phyllanthus dzumacensis M. Schmid	VU	D	1
Phyllanthus fractiflexus M. Schmid	EN	B	1 2
Phyllanthus golonensis M. Schmid	EN	B	1 2
Phyllanthus guillauminii Däniker	VU	D	2
Phyllanthus houailouensis M. Schmid	VU	D	2
Phyllanthus jaffrei M. Schmid	VU	B	1 2
Phyllanthus jaubertii Vieill. ex Guillaumin	CR	D	
Phyllanthus koghiensis Guillaumin	VU	B	1 2
Phyllanthus koniamboensis M. Schmid	VU	B	1 2
Phyllanthus kouaouaensis M. Schmid	VU	B	1 2
Phyllanthus longeramosus Guillaumin ex M. Schmid	VU	B	1 2
Phyllanthus luciliae M. Schmid	VU	B	1 2
Phyllanthus mandjeliaensis M. Schmid	VU	B	1 2
Phyllanthus margaretae M. Schmid	VU	D	2
Phyllanthus mcphersonii M. Schmid	EN	B	1 2
Phyllanthus meuieensis M. Schmid	VU	D	2
Phyllanthus moratii M. Schmid	VU	D	2
Phyllanthus natoensis M. Schmid	EN	B	1 2
Phyllanthus nitens M. Schmid	VU	B	1 2
Phyllanthus nothisii M. Schmid	VU	D	2
Phyllanthus paucitepalus M. Schmid	EN	B	1 2
Phyllanthus peltatus Guillaumin	VU	B	1 2
Phyllanthus petchikaraensis M. Schmid	EN	B	1 2
Phyllanthus pindaiensis M. Schmid	CR	B	1 2
Phyllanthus pinjenensis M. Schmid	EN	B	1 2
Phyllanthus polygynus M. Schmid	VU	B	1 2
Phyllanthus poumensis Guillaumin	VU	B	1 2
Phyllanthus pterocladus S. Moore	VU	B	1 2
Phyllanthus quintuplinervis M. Schmid	VU	D	1
Phyllanthus rhodocladus S. Moore	VU	D	2
Phyllanthus rozennae M. Schmid	EN	B	1 2
Phyllanthus stenophyllus Guillaumin	EN	B	1 2
Phyllanthus stipitatus M. Schmid	VU	B	1 2
Phyllanthus tangoensis M. Schmid	VU	B	1 2

Appendix (*Continued*)

Species per families	Threat categories	Criteria	Subcriteria
Phyllanthus tiebaghiensis M. Schmid	VU	D	2
Phyllanthus tireliae M. Schmid	VU	B	1 2
Phyllanthus tixieri M. Schmid	VU	B	1 2
Phyllanthus unifoliatus M. Schmid	CR	B	1 2
Phyllanthus unioensis M. Schmid	VU	D	2
Phyllanthus veillonii M. Schmid	EN	B	1 2
Phyllanthus virgultiramus Däniker	VU	B	1 2
Scagea oligostemon (Guillaumin) McPherson	VU	B	1 2
Trigonostemon cherrieri Veillon	CR	C	1
FAGACEAE			
Nothofagus baumanniae (Baum.-Bodenh.) Steenis	LRcd		
Nothofagus discoidea (Baum.-Bodenh.) Steenis	VU	D	2
FLACOURTIACEAE			
Casearia coriifolia Lescot & Sleumer	LRcd		
Casearia kaalensis Lescot & Sleumer	EN	B	1 2
Homalium betulifolium Däniker	EN	B	1 2
Homalium buxifolium Däniker	EN	B	1 2
Homalium juxtapositum Sleumer	EN	B	1 2
Homalium mathieuanum (Vieill.) Briq.	EN	B	1 2
Homalium polystachyum (Vieill.) Briq.	EN	B	1 2
Homalium rubiginosum (Vieill.) Warb.	VU	B	1 2
Homalium rubrocostatum Sleumer	EN	B	1 2
Homalium sleumerianum Lescot	VU	B	1 2
Lasiochlamys hurlimannii (Guillaumin) Sleumer	EN	B	1 2
Lasiochlamys mandjeliana Sleumer	VU	D	2
Lasiochlamys pseudocoriacea Sleumer	VU	D	2
Lasiochlamys trichostemona (Guillaumin) Sleumer	LRcd		
Xylosma boulindae Sleumer	VU	D	1
Xylosma capillipes Guillaumin	CR	B	1 2
Xylosma grossecrenatum (Sleumer) Lescot	CR	D	2
Xylosma inaequinervium Sleumer	EN	B	1 2
Xylosma kaalense Sleumer	VU	B	1 2
Xylosma molestum Sleumer	VU	D	2
Xylosma peltatum (Sleumer) Lescot	CR	B	1 2
Xylosma pininsulare Guillaumin	CR	B	1 2
Xylosma serpentinum Sleumer	VU	D	2
Xylosma tuberculatum Sleumer	VU	D	2
GESNERIACEAE			
Cyrtandra mareensis Däniker	EN	B	1 2
GOODENIACEAE			
Scaevola coccinea Däniker	VU	B	1 2
Scaevola macropyrena I. Mueller	EN	B	1 2
GRAMINAEAE			
Ancistrachne numaeensis (Bal.)	EN	B	1 2

Appendix (*Continued*)

Species per families	Threat categories	Criteria	Subcriteria
Oryza neocaledonica Morat	CR	B	1 2
Setaria jaffrei Morat	VU	B	1 2
GUTIFERAE			
Montrouziera cauliflora Planchon & Triana	VU	B	1 2
LAURACEAE			
Cryptocarya bitriplinervia Kosterm.	EN	B	1 2
Endiandra lecardii Guillaumin	VU	D	2
Endiandra poueboensis Guillaumin	VU	D	2
Litsea imbricata Guillaumin	EN	B	1 2
Litsea longepedunculata Kosterm.	VU	B	1 2
Litsea mackeei Kosterm.	VU	B	1 2
Litsea stenophylla Guillaumin	EN	B	1 2
LEGUMINOSAE			
Albizia guillainii Guillaumin	CR	B	1 2
Archidendropsis glandulosa (Guillaumin) Nielsen	VU	B	1 2
Archidendropsis lentiscifolia (Benth.) Nielsen	VU	B	1 2
Archidendropsis paivana (Fourn.) Nielsen	VU	Ca	2a
Canavalia favieri Nielsen	CR	D	
Cassia artensis (Montr.) Beauv.	EN	B	1 2
Desmodium kaalense Guillaumin	EN	B	1 2
Desmodium stenophyllum Harms	EN	B	1 2
Serianthes calycina Benth.	VU	Ca	2a
Serianthes germainii Guillaumin	EN	B	1 2
Serianthes margaretae Nielsen	VU	Ca	2a
Serianthes petitiana Guillaumin	LRcd		
Sophora spl (V.6573)	CR	B	1 2
Storckiella sp (MK.43372)	EN	B	1 2
Tephrosia leratiana Harms	EN	B	1 2
Tephrosia sp (MK.33359)	EN	B	1 2
LILIACEAE			
Arthropodium sp (MK.41085)	EN	B	1 2
LOGANIACEAE			
Logania imbricata (Guillaumin) Steenis & Leenh.	EN	C	1
MELIACEAE			
Dysoxylum pachypodum (Baillon) C. DC.	CR	D	
MONIMIACEAE			
Hedycarya aragoensis Jérémie	VU	D	2
Hedycarya perbracteolata Jérémie	LRcd		
MORACEAE			
Ficus mutabilis Bureau	VU	B	1 2
Streblus sclerophyllus Corner	VU	B	1 2

Appendix (*Continued*)

Species per families	Threat categories	Criteria	Subcriteria
MYRSINACEAE			
Tapeinosperma campanula Mez	VU	D	1
MYRTACEAE			
Austromyrtus horizontalis (Pancher ex Brongn. & Gris) Burret	VU	B	1 2
Austromyrtus lotoides (Vieill. ex Guillaumin) Burret	VU	B	1 2
Austromyrtus sp1 (V.6578)	EN	B	1 2
Austromyrtus sp2 (V.6853)	CR	B	1 2
Callistemon brevisepalus J. Wyndham Dawson	VU	B	1 2
Cloezia aquarum (Guillaumin) J. Wyndham Dawson	EN	B	1 2
Cupheanthus microphyllus Guillaumin	VU	B	1 2
Eugenia daenikeri Guillaumin	EN	B	1 2
Eugenia ericoides Guillaumin	VU	B	1 2
Eugenia gatopensis Guillaumin	VU	B	1 2
Eugenia kaalensis Guillaumin	VU	B	1 2
Eugenia mackeeana Guillaumin	VU	B	1 2
Eugenia noumeensis Guillaumin	VU	D	2
Eugenia virotii Guillaumin	VU	B	1 2
Melaleuca gnidioides Brongn. & Gris	VU	B	1 2
Metrosideros cherrieri J. Wyndham Dawson	VU	D	2
Metrosideros humboldtiana Guillaumin	LRcd		
Metrosideros longipetiolata J. Wyndham Dawson	VU	B	1 2
Metrosideros punctata J. Wyndham Dawson	VU	B	1 2
Metrosideros tetrasticha Guillaumin	EN	B	1 2
Tristaniopsis jaffrei J. Wyndham Dawson	VU		
Tristaniopsis lucida J. Wyndham Dawson	LRcd		
Tristaniopsis macphersonii J. Wyndham Dawson	VU	D	2
Tristaniopsis minutiflora J. Wyndham Dawson	VU	B	1 2
Tristaniopsis ninndoensis J. Wyndham Dawson	VU	B	1 2
Tristaniopsis polyandra (Guillaumin) P.G. Wilson & Waterhouse	EN	B	1 2
Tristaniopsis reticulata J. Wyndham Dawson	VU	B	1 2
Tristaniopsis vieillardii Brongn. & Gris	VU	B	1 2
Tristaniopsis yateensis J. Wyndham Dawson	EN	B	1 2
Xanthostemon carlii J. Wyndham Dawson	VU	B	1 2
Xanthostemon francii Guillaumin	EN	B	1 2
Xanthostemon glaucus Pampan.	CR	D	
Xanthostemon lateriflorus Guillaumin	EN	B	1 2
Xanthostemon longipes Guillaumin	EN	B	1 2
Xanthostemon sebertii Guillaumin	EX		
Xanthostemon sulfureus Guillaumin	VU	B	1 2
OLEACEAE			
Jasminum kriegeri Guillaumin	VU	B	1 2
Jasminum linearifolium Guillaumin	VU	B	1 2
Jasminum noumeense Schltr.	EN	D	2
Jasminum promonturianum Däniker	VU	B	1 2

Appendix (*Continued*)

Species per families	Threat categories	Criteria	Subcriteria
ORCHIDACEAE			
Bulbophyllum lophoglottis (Guillaumin) Hallé	VU	D	2
Dendrobium munificum (Finet) Hallé	CR	A	1
Dendrobium muricatum Finet	VU	B	1 2
Habenaria insularis Schltr.	VU	D	2
Megastylis latissima (Schltr.) Schltr.	EN	D	
Megastylis paradoxa (Kränzlin) Hallé	EN	D	1
Peristylus minimiflorus (Kränzlin) Hallé	VU	D	1
OXALIDACEAE			
Oxalis balansae Guillaumin	VU	B	1 2
PALMAE			
Actinokentia huerlimanii H. Moore	LRcd		
Alloschmidia glabrata (Becc.) H. Moore	VU	D	2
Basselinia favieri H. Moore	LRcd		
Basselinia humboldtiana (Brongn.) H. Moore	LRcd		
Basselinia iterata H. Moore	VU	D	2
Basselinia porphyrea H. Moore	LRcd		
Basselinia tomentosa Becc.	VU	D	2
Basselinia vestita H. Moore	VU	D	2
Brongniartikentia lanuginosa M. Moore	LRcd		
Chambeyronia lepidota H. Moore	LRcd		
Cyphophoenix elegans Wendl.	VU	B	1 2
Cyphophoenix nucele H. Moore	CR	B	1 2
Kentiopsis oliviformis (Brongn. & Gris) Brongn.	EN	B	1 2
Lavoixia macrocarpa H. Moore	CR	D	
Mackeea magnifica H. Moore	VU	B	1 2
Moratia cerifera H. Moore	LRcd		
Pritchardiopsis jeanneneyi Becc.	CR	D	
PANDANACEAE			
Pandanus clandestinus Stone	LRcd		
Pandanus decastigma Stone	VU	B	1 2
Pandanus decumbens (Brongn.) Solms-Laub.	VU	B	1 2
Pandanus lacuum St. John	EN	B	1 2
Pandanus verecundus Stone	CR	D	
PITTOSPORACEAE			
Pittosporum aliferum Veillon & Tirel	EN	B	1 2
Pittosporum artense Guillaumin	VU	B	1 2
Pittosporum brevispinum Veillon & Tirel	CR	D	
Pittosporum collinum Guillaumin	VU	B	1 2
Pittosporum gatopense Guillaumin	EN	B	1 2
Pittosporum gomonenense Guillaumin	EN	B	1 2
Pittosporum muricatum Veillon & Tirel	EN	B	1 2
Pittosporum ornatum Veillon & Tirel	EN	B	1 2
Pittosporum paniense Guillaumin	VU	D	2
Pittosporum stenophyllum Guillaumin	EN	B	1 2

Appendix (*Continued*)

Species per families	Threat categories	Criteria	Subcriteria
Pittosporum tanianum Veillon & Tirel	EX		
PODOCARPACEAE			
Dacrydium guillauminii J. Buchholz	CR	B	1 2
Podocarpus polyspermus Laubenf.	VU	B	1 2
Podocarpus decumbens N. Gray	LRcd		
Retrophyllum minor (Carr.) C. Page	EN	Ca	1a
PROTEACEAE			
Beauprea congesta Virot	EN	D	2
Beauprea crassifolia Virot	VU	D	2
Beauprea penariensis Guillaumin	CR	D	
Kermadecia pronyensis (Guillaumin) Guillaumin	VU	D	2
Macadamia angustifolia Virot	EN	B	1 2
Macadamia neurophylla (Guillaumin) Virot	VU	B	1 2
Stenocarpus dumbeensis Guillaumin	EX		
Stenocarpus heterophyllus Brongn. & Gris	EN	B	1 2
Stenocarpus villosus Brongn.	CR	D	
RHAMNACEAE			
Alphitonia erubescens Baillon	VU	B	1 2
Emmenosperma pancherianum Baillon	VU	B	1 2
RUBIACEAE			
Bikkia kaalaensis Hallé	EN	B	1 2
Bikkia lenormandii Hallé	EN	B	1 2
Bikkia pachyphylla Guillaumin	LRcd		
Captaincookia margaretae Hallé	CR	B	1 2
Cyclophyllum tenuipes Guillaumin	VU	D	1
Guettarda noumeana Baillon	VU	B	1 2
Guettarda sp1 (V.6915)	VU	B	1 2
Psychotria deverdiana Guillaumin	EN	B	1 2
Psychotria sp1 (V.7349)	CR	B	1 2
Psydrax paradoxa (Virot) combined.	VU	B	1 2
RUTACEAE			
Boronella koniamboensis (Daniker) T.G.Hartley	VU	B	1 2
Dutaillyea amosensis (Guillaumin) T. Hartley	VU	D	1
Medicosma articulata T. Hartley	EN	D	
Medicosma congesta T. Hartley	EN	D	
Medicosma diversifolia T. Hartley	EN	D	
Medicosma exigua T. Hartley	EN	D	
Medicosma gracilis T. Hartley	EN	D	
Medicosma latifolia T. Hartley	EN	D	
Medicosma leratii (Guillaumin) T. Hartley	EN	D	
Medicosma parvifolia T. Hartley	EN	D	
Medicosma petiolaris T. Hartley	EN	D	
Medicosma suberosa T. Hartley	EN	D	

Appendix (*Continued*)

Species per families	Threat categories	Criteria	Subcriteria
Medicosma subsessilis T. Hartley	EN	D	
Medicosma tahafeana T. Hartley	EN	D	
Oxanthera aurantium Tanaka	VU	B	1 2
Oxanthera brevipes Stone	VU	B	1 2
Oxanthera fragrans Montr.	EN	B	1 2
Oxanthera neocaledonica (Guillaumin) Tanaka	EN	B	1 2
Oxanthera sp1(V.7005)	CR	D	
Oxanthera undulata (Guillaumin) Swingle	CR	D	
Sarcomelicope glauca T. Hartley	CR	B	1 2
Zieria chevalieri Virot	VU	B	1 2
Zieridium sp2 (V.7361)	CR	D	
SANTALACEAE			
Amphorogyne staufferi Markgraf	VU	B	1 2
Elaphanthera baumannii (Stauffer) Hallé	VU	B	1 2
Exocarpos clavatus Stauffer	VU	B	1 2
Exocarpos spathulatus Schltr.	VU	B	1 2
SAPINDACEAE			
Arytera nekorensis H.Turner	VU	B	1 2
Cossinia trifoliata (Baillon) Radlk.	VU	B	1 2
Cupaniopsis crassivalvis Radlk.	EX		
Cupaniopsis glabra Adema	EN	B	1 2
Cupaniopsis globosa Adema	VU	B	1 2
Cupaniopsis mouana Guillaumin	EN	B	1 2
Cupaniopsis rosea Adema	EN	B	1 2
Cupaniopsis rotundifolia Adema	EN	B	1 2
Cupaniopsis squamosa Adema	EN	B	1 2
Cupaniopsis subfalcata Adema	EN	B	1 2
Cupaniopsis tontoutensis Guillaumin	EN	B	1 2
Elattostachys dzumacensis Adéma	VU	D	1
SAPOTACEAE			
Beccariella brevipedicellata (Royen) Aubrév.	EN	B	1 2
Iteiluma leptostylidifolium (Guillaumin) Aubrév.	EN	B	1 2
Iteiluma pinifolium (Baillon) Aubrév.	EN	B	1 2
Iteiluma rheophytopsis (Royen) Aubrév.	EN	B	1 2
Leptostylis gatopensis Guillaumin	EN	B	1 2
Leptostylis goroensis Aubrév.	CR	D	
Leptostylis multiflora Vink	VU	B	1 2
Leptostylis petiolata Vink	VU	B	1 2
Leptostylis sp1 V.6850	CR	D	
Ochrothallus blanchonii Aubrév.	EN	B	1 2
Ochrothallus francii (Guillaumin & Dubard) Guillaumin	VU	B	1 2
Planchonella contermina Pierre ex Dubard	EN	B	1 2
Planchonella daenikeri Aubrév.	VU	B	1 2
Planchonella kaalaensis Aubrév.	EN	B	1 2
Planchonella koumaciensis Aubrév.	EN	B	1 2

Appendix (*Continued*)

Species per families	Threat categories	Criteria	Subcriteria
Planchonella pronyensis Guillaumin	VU	B	1 2
Planchonella spl (V.6585)	VU	B	1 2
Pycnandra kaalaensis Aubrév.	VU	B	1 2
Pycnandra paniensis Aubrév.	VU	D	2
SIMAROUBACEAE			
Soulamea cardioptera Baillon	VU	B	1 2
Soulamea sp a (J.2738)	VU	D	2
Soulamea sp b (J.2803)	VU	D	2
Soulamea sp d (J.2910)	VU	B	1 2
SOLANACEAE			
Solanum hugonis Heiné	CR	D	
Solanum insulaepinorum Heiné	EN	B	1 2
Solanum pancheri Guillaumin	VU	B	1 2
Solanum pseuderanthemoides Schltr.	CR	D	
Solanum styraciflorum Schltr.	VU	B	1 2
Solanum vaccinioides Schltr.	EN	B	1 2
STERCULIACEAE			
Acropogon aoupiniensis Morat	VU	D	2
Acropogon bullatus (Pancher & Sebert) Morat	VU	B	1 2
Acropogon domatifer Morat	VU	D	2
Acropogon fatsioides Schltr.	VU	B	1 2
Acropogon megaphyllus (Bureau & Poisson ex Guillaumin) Morat	VU	D	2
Acropogon veillonii Morat	EN	B	1 2
THYMELIACEAE			
Deltaria brachyblastophora Steenis	CR	D	
ULMACEAE			
Celtis balansae Planchon	VU	B	1 2
Celtis hypoleuca Planchon	EN	B	1 2
VERBENACEAE			
Gmelina lignumvitreum Guillaumin	CR	D	
Oxera cauliflora Deplanche ex Dubard	VU	B	1 2
Oxera crassifolia Virot	LRcd		
Oxera macrocalyx Dubard	VU	B	1 2
Oxera nuda Virot	VU	B	1 2
Vitex evoluta Däniker	EN	B	1 2
Vitex spl (V.7016)	VU	B	1 2
WINTERACEAE			
Zygogynum cristatum Vink	VU	B	1 2
Zygogynum oligostigma Vink	EN	B	1 2
Zygogynum tanyostigma Vink	VU	B	1 2
XYRIDACEAE			
Xyris guillauminii Conert	VU	B	1 2