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Diversity of Useful Plants in Cabo Verde Islands: A Biogeographic and Conservation Perspective

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Abstract: Cabo Verde's biodiversity is threatened by activities that meet human needs. To counteract this, an integration of scientific and indigenous knowledge is required, but no comprehensive list of the useful local plants is available. Thus, in this work, we assess (1) their diversity and phytogeography; (2) the role of geophysical, historical, and socio-economic factors on species distribution and uses; and (3) potentially relevant species for sustainable development. Data were obtained from flora, scientific publications, historical documents, herbarium specimens and field work. Many species were introduced since the 15th century to support settlement and commercial interests. We identified 518 useful taxa, of which 145 are native, 38 endemic and 44 endangered. The number of useful taxa is correlated with altitude and agricultural area, as well as with rural population indicators, but not with total population or socio-economic indicators such as gross domestic product. Native taxa are mostly used for fuelwood, forage and utilitarian purposes. Agrobiodiversity and traditional practices seem crucial to cope with recurrent droughts and ensure food security. Most of the introduced species do not present conservation problems, contrasting with the overuse of some native taxa. The safeguarding of native populations will ensure the sustainable exploitation of these resources and benefit the local economy.

Keywords: food security; historical perspective; Macaronesia islands; native plants; sustainable exploitation of natural resources; traditional uses

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1. Introduction

A sixth mass extinction of life on Earth is under way, and habitat loss is among the most important anthropogenic threats, followed by over-exploitation, introduced species and climate change, leading to a loss of species and ecosystems [1]. Although island and mainland regions have undergone equivalent past habitat loss, projections indicate

that land-use-driven changes to islands might be stronger in the future. Given their conservation risks, smaller land areas and high levels of endemism richness, islands may offer particularly high returns for species conservation efforts and therefore warrant a high priority in global biodiversity conservation [2].

In the north-eastern Atlantic Ocean, the Macaronesian archipelagos (i.e., Azores, Madeira, Selvagens, Canary Islands and Cabo Verde) are an outstanding center of biodiversity but also one of the most threatened areas, mainly by human activity. These islands show a strong climatic gradient from an oceanic temperate climate in the Azores to a warm arid climate in Cabo Verde [3]. Cabo Verde is vulnerable to natural disasters, and particularly rural populations are dependent on natural resources and on agriculture-based economy [4,5]. Therefore, the need to integrate local indigenous knowledge for sustainable management and conservation of natural resources is increasingly recognized. Recently, some studies have focused on important plant families widely used as food and forage sources (e.g., pulses (Fabaceae) [6] and millets (Poaceae) [7]). In addition, the possible economic benefits, especially from medicinal species [8] or native forest products [9], have been emphasized as particularly attractive approaches for economically weak countries such as Cabo Verde. However, there is limited knowledge of useful species in this and other Macaronesian archipelagos, and only a few complementary initiatives have been undertaken, such as the Spanish network of autochthonous plant genetic resources and wild plant (Red Española de Bancos de Germoplasma de Plantas Silvestres y Fitorrecursos Autóctonos, REDBAG).

The use of plant species is a common ancestral practice and has been an invaluable resource since the colonization of Cabo Verde islands [10]. Whether native or introduced, several species are particularly important as sources of food, forage, medicines, building materials, fiber and fuel, among others, especially for local communities [11], providing not only economic income, particularly relevant in natural resource-poor regions, as is the case of Cabo Verde, but also playing important social and cultural roles for local people. The progressive abandonment of centuries-old uses and practices, together with land use shifts, particularly the extensive forestation [12,13] or the development of tourism [14], justifies an urgent assessment of the plants traditionally used in Cabo Verde. Previous works (e.g., [11,15–17]) pinpoint the importance of such resources for population subsistence and wellbeing. However, knowledge about such plants is incomplete, and no exhaustive approach has been conducted so far.

To enhance the livelihoods of local communities, and in line with global efforts (e.g., Aichi Biodiversity Target 18, concerning the safeguarding of the traditional knowledge), we aimed to gather the available traditional knowledge and practices about useful plants from Cabo Verde, using an integrative approach (i.e., biological, ecological and historical), to provide crucial data not only with scientific purposes but also for local government policies with respect to agriculture and the conservation of plant genetic resources. This information is essential to assess the socio-economic value of the archipelago's flora as a provider of widely diverse ecological services such as supplying food and other goods for human use, forage to feed livestock and control of soil erosion, while serving as a basis to assess the potential risks of these uses to their sustainability and conservation in Cabo Verde.

Thus, this work aims to (1) assess the taxonomic diversity and phytogeographic distribution of the useful plants in Cabo Verde; (2) establish the role of geophysical characteristics of the islands, as well as of the demographic, historical, economic and socio-cultural factors driving the distribution patterns of the species and their uses; and (3) identify relevant species, particularly native ones, with a future relevant role in the sustainable development of the archipelago.

2. Results

2.1. The First Reported Useful Species—A Brief Historical Note

Cabo Verde was uninhabited until 1456, when it was discovered by the Portuguese, and the species introduced by the settlers can be retrieved from the known historical documents. Sugarcane, figs, grapes and melons, among other fruits largely used in mainland Portugal, are referenced as early as 1506 by Valentim Fernandes (in Monod et al. [18]). By 1545, the accounts of Piloto Anónimo (in Sauvageot [19]) include citruses (such as oranges, lemons and citrons), pomegranates, coconuts and vegetables. By the end of the 16th century, Gaspar Frutuoso (in Frutuoso [20]) also mentions cotton, bananas, pears, beans, pumpkins and "Milho branco e grado de maçaroca e milho miúdo", probably referring to small grain millets and sorghum [21] used in West Africa. Already in the 18th century, the British sailor George Roberts, who stayed for two years (1722–1724) in the archipelago, reported maize (*Zea mays*) and cassava (*Manihot esculenta*), two American crops introduced into Africa in the 16th century, as well as beans, guinea millets (possibly referring to species of the genus *Urocholoa*), pumpkins (*Cucurbita pepo*), fruit trees such as lemons (*Citrus* × *limon*), sweet and sour oranges (*Citrus* × *aurantium*), limes (*Citrus* × *aurantiifolia*), cidron (*Citrus medica*), guavas (*Psidium* spp.), sugar-apples (*Annona* spp.), tamarinds (*Tamarindus indica*), coconuts (*Cocos nucifera*), pineapples (*Ananas comosus*), plantains (*Musa* spp.), sweet potatoes (*Ipomoea batatas*), watermelons (*Citrullus lanatus*) and melons (*Cucumis melo*) [22]. In addition, cotton (*Gossypium* spp.) and indigo (*Indigofera tinctoria*) were mainly reported from Boavista, Maio and Santo Antão, as well as sugarcane plantations (*Saccharum officinarum*) and vineyards (*Vitis vinifera*) in Santiago, Fogo and São Nicolau.

In 1772, the botanist Johann Forster was in Santiago, and in his short list of collected species, most of them already mentioned by George Roberts, he included several tropical American species, such as papaya (*Carica papaya*), *Vachellia farnesiana* and *Caesalpinia pulcherrima*, a beautiful ornamental tree, and Asian basil (*Ocimum basilicum*) [23].

By the end of the 18th century, João da Silva Feijó, a Portuguese naturalist taking part in the "Philosophical Journeys" under the patronage of the Portuguese Crown, made an extensive work in Cabo Verde and provided the inventory of natural productions of the islands. Between 1783 and 1789, he collected hundreds of species, reported in his manuscripts (e.g., in Feijó [24]; for details see Gardère [25]). The lists, including both native and exotic species, show that more than 50 economically relevant species from all over the world were already established in the archipelago by then. Adding to those reported by previous explorers, species are mentioned such as the African *Adansonia digitata*, *Coffea arabica*, *Hibiscus sabdariffa*, and *Ricinus communis*; the American *Annona squamosa*, *Arachis hypogaea*, *Capsicum frutescens*, *Furcraea foetida*, *Gossypium hirsutum*, *Jatropha curcas*, *Mammea americana*, *Nicotiana tabacum*, *Opuntia ficus-indica*, *Physalis peruviana*, and *Spondias mombin*; the Asiatic *Abelmoschus esculentus*, *Cassia fistula* and *Rhaphiolepis bibas*, or the European *Ceratonia siliqua*, *Cydonia oblonga*, *Malus domestica*, *Ficus carica* and *Pyrus communis*, to mention only some examples.

The list of exotic species with economic interest present in Cabo Verde did not cease to grow in the following centuries (e.g., [26–28]), and most of them still occur in the archipelago. The introduction of new food species is continuous, as shown with the recent introduction of the American dragon fruit (epiphytic cacti of the genus *Selenicereus*) or the star fruit (*Averrhoa carambola*).

In Cabo Verde, the association of different crops is a common practice. Already indicated in historical texts, this may be related to the restricted availability of suitable land for agricultural activities (e.g., watered valleys, well-exposed slopes), leading to the concentration of a wide diversity of crops in small areas. Currently, these practices are one of the ways in which farmers minimize the risks both of pests and diseases and of climatic irregularity, seeking to ensure the success of at least some of the productions. Thus, it is common to find maize, cabbage (*Brassica oleracea*), potatoes, pumpkins (*Cucurbita* spp.), beans and fruit trees such as bananas (*Musa* spp.), avocado (*Persea americana*), guava

(*Psidium guajava*) and lemon as well as sugarcane, tomato (*Solanum lycopersicum*), carrot (*Daucus carota*), papaya and mango (*Mangifera indica*) [29] growing together in small fields.

2.2. Taxonomic Diversity

The complete lists of plants used in Cabo Verde, with common names and respective uses, are presented in Table 1 (endemic and non-endemic native taxa) and in Table 2 (introduced taxa); species for which there is information on their historical use (until the end of the 18th century) are also indicated.

Table 1. Native useful taxa occurring in Cabo Verde, including information on family, common names (mostly in creole), main uses (Fd, food; Fr, forage; Ml, melliferous; P, poison; S, social uses; Fu, fuelwood; T, timber; U, utilitarian uses; Mt, materials; O, ornamental; E, environmental use; for details, see Materials and Methods), and historical use (Hist.). Taxonomic authorities according to Plants of the World Online [30].

Taxa	Common Names	Uses	Hist.
Acanthaceae			
Dicliptera verticillata	Joelho, orelha-de-rato, rapazinho	Fr	
Aizoaceae			
Zaleya pentandra	Erva-de-rapé	S,O	
Amaranthaceae			
Aerva javanica	Florinha, panasco	U	
Amaranthus graecizans subsp. *graecizans*	Bredo, bredo-femba	Fr	
Arthrocaulon franzii	Murraça, murraça-rosa-crioula, murraçona	Fu	
Celosia trigyna		Fd	
Patellifolia procumbens	Selga	Fr	
Apiaceae			
**Tornabenea annua* [a]	Funcho, funtcho, futcho-bravo	Fr	
**Tornabenea tenuissima* [a]	Aipo, funtcho	Fr	
**Tornabenea bischoffii* [a]	Funcho	Fr	
Apocynaceae			
Calotropis procera	Bombardeiro	Fr,Fu,U	•
**Periploca chevalieri*	Corcabra, curcabra, lantisco, lentisco	Fr,Mt	•
Arecaceae			
**Phoenix atlantica*	Tamareira	Fd,Fr,U,O,E	
Asparagaceae			
**Dracaena caboverdeana* [b]	Dragoeiro	Mt,O,E	•
Asteraceae			
**Artemisia gorgonum*	Losna	P	
**Asteriscus daltonii* subsp. *vogelii*	Macela, marcela, marcela-lenha	P	
Blainvillea gayana	Barba-bodi, cachacinho, erva-moura, loura, targa, targa-branco	Fr	
**Conyza feae* [c]	Losna-brava, marcela, marcelinha, mato-contrário, palha-santa	Fr	
Launaea arborescens	Carqueja, craquejo	Fu	
Launaea intybacea	Algodão-de-garça, paja-leite, palha-de-leite, serralha	Fd	
**Launaea picridioides*	Marê-tope, serragem, serralha, tortolhinha, tortolhinho	Fr	
**Launaea thalassica*	Serralha, tortolhinha	Fr	
Pseudoconyza viscosa	Butra, talga, vampiro	Fr	
**Pulicaria diffusa*	Losna	P	
**Sonchus daltonii*	Coroa-de-rei	Fr	
Sonchus oleraceus	Algodão-de-graça, leituga, palha-leite, sarralha, serralha	Fr	
Vernonia colorata	Catchiça	Fr	

Table 1. *Cont.*

Taxa	Common Names	Uses	Hist.
Boraginaceae			
**Echium hypertropicum*	Língua-de-vaca, língua-di-baca	Fr,Fu	
**Echium stenosiphon* subsp. *glabrescens*	Língua-de-vaca	Fr	
**Echium stenosiphon* subsp. *lindbergii*	Língua-de-vaca	Fr	
**Echium stenosiphon* subsp. *stenosiphon*	Língua-de-vaca	Fr	
**Echium vulcanorum*	Língua-de-vaca	Fr,Fu	
Heliotropium ramosissimum	Alfavaca, alfavaca-da-achada, erva-das-sete-sangrias, furtaragem, mama-de-bitcho, tchero-fede, três-marias	Fr	
Brassicaceae			
**Diplotaxis glauca*	Matona, mostarda, mostarda-braba	Fr	
**Diplotaxis varia*	Mostarda-braba	Ml	
**Lobularia canariensis* subsp. *spathulata*		O	
**Lobularia canariensis* subsp. *fruticosa*	Sempre-noivinha	Ml,O	
Caryophyllaceae			
**Polycarpaea* gayi	Cidreira-de-rocha, mato-branco, palha-bidião, palha-de-bidion, talim, talinho, telim	U	
Cistaceae			
**Helianthemum gorgoneum*	Matinho, piorno-de-flor-amarela	Fr	
Commelinaceae			
Commelina benghalensis	Grande-rato, orelha-de-rato, palha-de-água	Fr	
Convolvulaceae			
Distimake aegyptius	Maraganha, n'onhen'onhe, palha-corda	Fr	
Ipomoea eriocarpa	Cordinha, jejé-calabaceira, lagaço-cozinho, legação-cabecinho, monhe-monhe, monho-monho	Fr	
Ipomoea pes-caprae subsp. *brasiliensis*	Lacacã, lacacã-grande, lacacan-de-vaca, legação-de-rocha	E	
Crassulaceae			
**Aeonium gorgoneum*	Ceilão, mata-sede, saião, seilão, sião	O	
Cucurbitaceae			
Citrullus colocynthis	Balancia-brabo, melancia-brava, melão-bravo, olho-de-boi, olho-de-vaca	Fr	
Momordica charantia	Aboboreira-de-são-caetano, banana-rato, erva-de-são-caetano, palha-de-são-caetano, sancaetano, são caetano	Fd,Ml,Mt	
Cyperaceae			
Bulbostylis barbata	Soldinha	Fr,Ml	
Cyperus alternifolius subsp. *flabelliformis*	Chapeudisol, goia, junco	Fr,U	
Cyperus articulatus	Goia, junco	Fr,U	
Cyperus esculentus	Djunça, junça, vista	Fd,Fr	
Cyperus hortensis		Fr,U	
Cyperus rotundus	Grama, guel, injunça, junça, junco	Fd,Fr	
Fimbristylis ferruginea	Junco, junquinho	Fr	
Equisetaceae			
Equisetum ramosissimum	Carsim, cavalinha, talim	S	
Euphorbiaceae			
**Euphorbia tuckeyana*	Tira-olho, tortilho, tortodjo, tortolho	Fu,Mt	•

Table 1. *Cont.*

Taxa	Common Names	Uses	Hist.
Fabaceae			
Abrus precatorius subsp. *africanus*	Jequeriti, santa-clara	Fr,U	
**Acacia caboverdeana* [b]	Espinheiro-branco, neu-neu (fruits)	Fr,Fu,E	•
Alysicarpus ovalifolius		Fr	
Clitoria ternatea	Bachinha-de-cordoniz, palha-lopes	Fr	
Crotalaria senegalensis	Ovos-de-rato, ovos-de-rato-pequeno	Fr	
Desmodium ospriostreblum	Crioulinha	Fr	
Dichrostachys cinerea	Espinheiro, espinheiro-branco, espinheiro-cachupa, espigo-de-cachupa, espinho-cachupa, espinho-catchupa	Fu	
Genista stenopetala		E	
Grona hirta	Maratchinga, marquinha	Fr,E	
Lablab purpureus subsp. *purpureus*	Creca, feijão-branco-de-vagem-branca, feijão-caqui, feijão-careca, feijão-cutelinho, feijão-pedra, feijão-pedra-bombone, feijão-vaca	Fd,Fr	•
**Lotus brunneri*	Cabritagem, cafetalha, cafetagem, piorno-amarelo, piorno-preto	Fr,P	
**Lotus jacobaeus*	Piorno, piorno-preto	Fr	
**Lotus purpureus*	Piorno, piorno-amarelo	Fr	
Macrotyloma daltonii	Corda-lopes, cordeirinha-preta, favalinha, feijoeiro-de-lagartiga	Fr	
Rhynchosia minima var. *memnonia*	Feijoeiro-de-lagartixa	Fr	
Sesbania pachycarpa	Acácia-sizinanthe, sesinanthe, ticome-se	Fr	
Stylosanthes fruticosa		Fr	
Tephrosia linearis		Fr	
Tephrosia purpurea		Mt	
Teramnus labialis subsp. *arabicus*	Caransaqui, corda-lopes-pequena, cordeirinha-branca	Fr	
Vachellia nilotica subsp. *adstringens*	Acácia	Ml,O,E	
Vigna unguiculata subsp. *unguiculata*	Bongolon-d'angola, feijão-bezugo, feijão-bongolon, feijão-bongolon-amarelo, feijão-bongolon-com-boca-preta, feijão-congo	Fd,Fr	•
Frankeniaceae			
**Frankenia caboverdeana* [b]	Mato-de-engodo, mato-de-sargaço, palha-engodo	U	
Lamiaceae			
Lavandula coronopifolia	Marmulano-da-terra, risco, risque	Fr	
**Lavandula rotundifolia*	Aipo, alfazema-brava, gilbon	Fr	
Ocimum americanum		Fd	
Salvia aegyptiaca	Alfazema, alfazema-da-terra,bálsamo-de-pastor, ermofassima, malfazema, marcelina, rosmaninho	Fr	
Malvaceae			
Grewia villosa	Balneda, barnadeiro, barnedo, barneldo, barnelo	Fd,Ml,U	
Melhania ovata	Lolo-branco, mato-branco, salva-vidas	Fd	
Sida rhombifolia	Lolo, loulo, loulo-preto-grande	Fr,U	
Urena lobata	Bassago	U	
Moraceae			
Ficus sur	Figueira, figueira-brava, figueira-preta	Fd,Fr,T	•
Ficus sycomorus	Figueira-branca, figueira-brava, figueira-de-figos-grandes	Fd,Fr,T,E	•
Nyctaginaceae			
Boerhavia coccinea	Albeza, batata-de-asno, batata-de-burro, batata-de-oze, cordeira, costa-branca, costa-branca-fêmea, mato-branco	Fr	
Boerhavia diffusa	Albeza, batata-de-burro, costa-branca, costa-branca-fêmea	Fr,Ml	
Boerhavia repens	Costa-branca, costa-branca-fina, costa-branca-miúda, folha-branca, palha-branca, palha-costa, palha-seca	Fr	
Commicarpus helenae	Albeça-branca, albéza-branco, butra, costa-branca, costa-branca-bastarda, folha-branca, mato-branco, mato-lagarto	Fr	
Plantaginaceae			
**Globularia amygdalifolia*	Argueiro, mato-botão, medronho	Fr	

Table 1. *Cont.*

Taxa	Common Names	Uses	Hist.
Poaceae			
Andropogon gayanus var. *tridentatus*	Palha-ladeira, touça, touça-fêmea	Fr	
Bothriochloa bladhii	Touça, touça-macho, palha-cavalo	Fr,E	
Cenchrus ciliaris	Balanco, palha-branca, palha-grossa, rabo-de-gato	Fr	
Cenchrus pedicellatus subsp. *pedicellatus*	Balanco-branco	Fr	
Cenchrus pedicellatus subsp. *unispiculus*	Balanco-branco	Fr	
Chloris gayana		Fr	
Chloris pilosa		Fr	
Dactyloctenium aegyptium	Djinguilano, jéjé-jiuguilam, palha-de-boi-fraca, pé-de-galinha	Fd,Fr	
Dichanthium annulatum	Palha-soca, soca, touça-fêmea	Fr,U	
Dichanthium foveolatum	Palha-fina, palha-minha, palha-sisuda, sisuda	Fr	
Digitaria ciliaris	Djé-djé-cinha, djé-djé-pequeno, djeiezinho	Fr	
Digitaria horizontalis	Gé-gé, jéjézinho	Fr	
Digitaria nodosa	Palha-carriço, palha-grossa	Fr	
Echinochloa colonum	Djé-djé-pequeno	Fr	
Eleusine indica subsp. *indica*	Barba-de-bode, palha-boi, palha-grossa	Fr	
Eragrostis cilianensis	Djé-djézinho	Fr	
Eragrostis ciliaris	Padja-do-menino-jesus, palhinha	Fr,U	
Eragrostis minor		Fr	
Hackelochloa granularis		Fr	
Heteropogon contortus	Azagaia, rabo-de-asno, soca-mansa, touça-mansa, toussa-matcho	Fr,E	
Heteropogon melanocarpus	Zagaia	Fr	
**Hyparrhenia caboverdeana* [b]	Palha-de-guiné, palha-negra, touça, touça-fêmea	Fr	
Imperata cylindrica	Palha-carga	Fr,U	•
Melinis minutiflora	Palha-governo, palha-mafe, palha-mafó	Fr	
Paspalum scrobiculatum	Patacho	Fr	
Polypogon viridis	Graminho, palha-de-água	Fr	
Rottboellia cochinchinensis	Palha-grossa	Fr	
Schizachyrium brevifolium		Fr	
Setaria barbata	Djé-djé-palha-de-água, jéjé	Fd,Fr	
Setaria pumila	Gé-gé-pequeno	Fr	
Setaria verticillata	Pega-saia	Fr	
Tricholaena teneriffae	Palha-branca, palha-de-vassoura	Fr	
**Urochloa caboverdiana*	Dje-dje, jé-jé	Fd,Fr	
Urochloa ramosa	Djé-djé, jé-jé, jé-jé-folha-larga	Fd,Fr	
Urochloa xantholeuca	Djé-djé	Fr	
Portulacaceae			
Portulaca oleracea	Beldroega, bordulega, brêdo-fêmea, sangue-sangria	Fd,Fr,Ml	
Pteridaceae			
Adiantum capillus-veneris	Aibenca, avenca	O	
Resedaceae			
Caylusea hexagyna	Campa, laca-laca, laga-laga, palha-lagada, piorno	Fr,Ml	
Rhamnaceae			
Ziziphus mauritiana	Simbrom, zimbrão, zimbreiro-da-índia	Fd,Fr,Ml,Fu,T,E	
Rubiaceae			
Oldenlandia corymbosa var. *corymbosa*		Fr	
Sapindaceae			
Cardiospermum halicacabum	Conta-de-cavalo	O	
Dodonaea viscosa		O	
Sapotaceae			
**Sideroxylon marginatum*	Figueira-de-macaco, marmulano, marmolano	Fd,Fr,Fu	•
Solanaceae			
Solanum nigrum	Malagueta-de-galinha, uva-catchorro, uva-de-santa-maria	Fd	
Solanum scabrum		Fd	

Table 1. *Cont.*

Taxa	Common Names	Uses	Hist.
Tamaricaceae			
Tamarix senegalensis	Tarafe, tarrafe, tamargueira	Fu,O,E	•
Typhaceae			
Typha domingensis	Palha-das-esteiras, tabúa	U	
Urticaceae			
**Forsskaolea procridifolia*	Língua-de-vaca-branca, mato-gonçalo, ortiga, palha-renda, pega-saia, rafa-saia, rapa-saia, urtiga	Fr	
Zygophyllaceae			
Fagonia cretica	Arroz-de-pardal, cabritaia-do-campo, matinho-de-agulhas	Fr,P	
Fagonia latifolia [c]	Cabaceira, matinho	Fr	
Tetraena gaetula subsp. *waterlotii* [c]	Acelga-de-água, bidion, fuminga, morraça-branca, murraça	P,Fu,E	
**Tetraena vicentina*		E	

[a] In the absence of a comprehensive review of all the endemic Apiaceae occurring in Cabo Verde, we follow Brochmann et al. [31] and Romeiras et al. [32]. [b] According to Rivas-Martínez et al. [33]. [c] According to World Flora Online [34]. * Endemic taxa. • Taxa with reported historical use.

Table 2. Introduced useful taxa occurring in Cabo Verde, including information on family, common names (mostly in creole), main uses (Fd, food; Fr, forage; Ml, melliferous; P, poison; S, social uses; Fu, fuelwood; T, timber; U, utilitarian uses; Mt, materials; O, ornamental; E, environmental use; for details, see Materials and Methods), and historical use (Hist.). Taxonomic authorities according to Plants of the World Online [30].

Taxa	Common Names	Uses	Hist.
Acanthaceae			
Eranthemum pulchellum	Flor-viúva	O	
Pseuderanthemum maculatum	Dakarense	Ml	
Aizoaceae			
Carpobrotus edulis	Bálsamo	O,E	
Tetragonia tetragonioides	Espinafre-da-nova-zelândia	Fd	
Amaranthaceae			
Alternanthera sessilis	Abri-olho, abrodjo, arre-porra, mão-na-pé, mon-na-pé	Fr,O	
Amaranthus blitum	Bredo	Fd	
Amaranthus caudatus	Bredo-macho	Fd,Fr,O	
Amaranthus cruentus	Crista-de-perú	Fd,Fr	
Amaranthus hybridus subsp. *hybridus*	Bredo-macho, rabo-de-galo	Fr	
Amaranthus spinosus	Bredo, bredo-com-espinhos, bredo-espinhoso, bredo-macho	Fd	
Amaranthus tortuosus	Bredo, bredo-macho	Fr	
Amaranthus viridis	Bredo-sem-espinhos	Fd,Fr	
Atriplex halimus		Fr,O,E	
Beta vulgaris	Beterraba	Fd,Fr,Mt	
Gomphrena globosa		O	
Amaryllidaceae			
Allium ampeloprasum	Alho-francês	Fd	
Allium ascalonicum	Chalota	Fd	
Allium cepa	Cebola	Fd	
Allium fistulosum	Cebolinha	Fd	
Allium sativum	Alho	Fd	
Allium schoenoprasum	Cebolinha-miúda	Fd	
Hymenocallis littoralis	Lírio	Ml,O	
Scadoxus multiflorus		O	

Table 2. *Cont.*

Taxa	Common Names	Uses	Hist.
Anacardiaceae			
Anacardium occidentale	Cadju, cajueiro, cajuleiro	Fd,Ml,T,E	
Mangifera indica	Mangue, mangueira	Fd,Fr,Ml	
Schinus molle	Pimenteira, pimenteira-bastarda, pimenta-rosa	Fd,P,O,E	
Schinus terebinthifolia	Pimenteira	O	
Sclerocarya birrea subsp. *caffra*	Ocanho	Fd	
Spondias mombin	Mamipreiro, manipo	Fd,Ml	•
Annonaceae			
Annona cherimola	Cherimolia	Fd	
Annona muricata	Pinha, pinhão, pinhão-azedo, sap-sap	Fd,O	
Annona reticulata	Anoneira, coração-de-boi	Fd,O	
Annona squamosa	Pinha, pinho	Fd	•
Apiaceae			
Anethum graveolens	Endro, ente, entro, erva-doce	Fd,Fr	
Apium graveolens	Aipo	Fd	
Coriandrum sativum	Coentro, cuentro	Fd	
Daucus carota	Cenoura	Fd	
Foeniculum vulgare	Erva-doce, funcho, funcho-gomado	Fd	•
Petroselinum crispum	Salsa	Fd	
Apocynaceae			
Asclepias curassavica	Cravo, pitchula-de-leite	Ml,O	
Cascabela thevetia	Chapéu-de-napoleão, mundium	Ml,O	
Catharanthus roseus	Bigalo, flor-de-anjo, flor-de-finado, sempre-noiva	Ml,O	
Nerium oleander	Cevadilha, loendro, loureiro-rosa, rosa, rosa-loira, roseira-branca-singela, sempre-noiva-branca, sevadilha	P,O	
Plumeria rubra		O	
Araceae			
Caladium bicolor		O	
Colocasia esculenta	Inhame, mafafa, malanca, muncoco	Fd	
Xanthosoma sagittifolium	Inhame, mafafa-preta, malanca, mincoco	Fd	
Arecaceae			
Borassus flabellifer	Cibe	O	
Cocos nucifera	Coqueiro	Fd,Ml,O,E	•
Elaeis guineensis	Coconote, dem-dem, palmeira-do-azeite	Ml,O	
Phoenix canariensis		O	
Phoenix dactylifera	Palmeira-do-saará, tamareira, tamareira-do-saará	Fd,O,E	•
Washingtonia filifera	Palmeira-leque	O	
Aristolochiaceae			
Aristolochia littoralis		O	
Asparagaceae			
Agave americana		Ml	
Agave sisalana	Carapate-manila, carrapato-de-lisboa, pita, sisal	P,U,O	
Asparagus officinalis	Espargo	Ml	
Dracaena hyacinthoides		O	
Furcraea foetida	Carapate, carrapato, carrapato-da-terra, piteira-de-cabo-verde	P,U,O,E	•
Asphodelaceae			
Aloe vera	Aloés, babosa	Ml,S,O,E	

Table 2. *Cont.*

Taxa	Common Names	Uses	Hist.
Asteraceae			
Bidens bipinnata	Gúia, seta, seta-branca, seta-preta	Ml	
Bidens pilosa	Agulha, gua, palha-agulha, seta, seta-preta, setinha	Fr,Ml	
Calendula arvensis		O	
Cichorium endivia	Endivia	Fd	
Cichorium intybus	Chicória	S,O	
Helianthus annuus	Girassol	Ml	
Lactuca sativa	Alface	Fd	
Synedrella nodiflora	Targa	Fr,Ml	
Tagetes erecta	Cravo, cravo-branco, cravo-de-burro	Ml,O	
Tanacetum parthenium	Altamires	O	
Urospermum picroides	Palha-leite, palha-leite-amarga, raposade, serralha	Fr,Ml	
Zinnia peruviana	Cravo, cravo-branco, zinha, zinia	Fr,O	
Basellaceae			
Anredera cordifolia		O	
Basella alba	Tinta-de-macaca, tinta-de-macaco	Mt,O	
Bignoniaceae			
Crescentia cujete	Cabaceira, calabaceira	U	
Dolichandra unguis-cati	Unha-de-gato	O	
Handroanthus impetiginosus	Pau-d'arco	S,Fu,Mt,O	
Jacaranda mimosifolia	Jacandrão	O,E	
Kigelia africana subsp. *africana*		O	
Spathodea campanulata	Árvore-da-chama, tulipeira-do-gabão, tulipa-do-gabão	O	
Tabebuia rosea	Farroba	O,E	
Tecoma stans	Ervilha-de-flor	O	
Boraginaceae			
Cordia sebestena		O	
Heliotropium arborescens	Baunilha, baunilha-de-cheiro	O	
Brassicaceae			
Barbarea verna	Agrião-de-terra	Fd	
Brassica juncea	Mostarda	Fd	
Brassica nigra	Mostarda, mostarda-branca, mostarda-brava, mostarda-preta	Fd,Ml	
Brassica oleracea	Couve	Fd,Fr	
Brassica rapa	Couve-chinesa, nabo	Fd	
Eruca vesicaria	Rúcula	Fd	
Lobularia maritima	Sempre-noiva	O	
Matthiola maderensis		O	
Nasturtium officinale	Agrião, agrião-de-água, agrião-vulgar	Fd	
Raphanus raphanistrum subsp. *sativus*	Rábano, rabanete	Fd	
Bromeliaceae			
Ananas comosus	Ananaseiro	Fd	•
Cactaceae			
Opuntia ficus-indica	Figueira-da-índia, figueira-do-inferno, tabaibo	Fd,Fr,Ml,O	•
Pereskia aculeata		O	
Selenicereus undatus	Barse, pilahayo	Fd,O	
Calophyllaceae			
Mammea americana	Abricó-do-pará, mamão, mamoeiro	Fd	•
Cannaceae			
Canna indica	Cana-da-índia, coqueirinho, coqueirinho-de-jardim, lírio	O	
Caprifoliaceae			
Lonicera confusa	Madressilva, madressilva-de-cheiro	O	
Caricaceae			
Carica papaya	Bijagó-preta, papaeira	Fd	•

Table 2. *Cont.*

Taxa	Common Names	Uses	Hist.
Caryophyllaceae			
Dianthus caryophyllus		O	
Casuarinaceae			
Allocasuarina verticillata		E	
Casuarina equisetifolia	Casuarina	E	
Combretaceae			
Terminalia catappa	Amendoeira, amendoeira-da-índia	Fd,T,O	
Commelinaceae			
Tradescantia zebrina		O	
Convolvulaceae			
Argyreia nervosa		O	
Ipomoea batatas	Batata, batata-belém, batata-doce, batata-doce-preta, batata-malevinho, batata-quarenta-dias, corda-copo, cordinha, giginha-muralha, nhá-júlia, pau-de-vinho, quirino, temerosa	Fd,Fr,Ml	•
Ipomoea carnea		O	
Ipomoea muricata	Calabaceira	O	
Ipomoea tuberculata	Rosas-de-madeira	Fr,O	
Crassulaceae			
Kalanchoe daigremontiana	Bálsamo	O	
Kalanchoe pinnata	Bálsamo, figueirinha	O	
Cucurbitaceae			
Citrullus lanatus	Melancia	Fd	•
Cucumis anguria	Pepino-bravo, pepino-de-macaco, pepino-sanjo, pepino-santcho	Fr	
Cucumis melo	Melão	Fd	•
Cucumis sativus	Pepino	Fd	
Cucurbita maxima	Abóbora-roca, aboboreira, roca	Fd,Ml	
Cucurbita moschata	Abóbora-de-sequeiro-de-porco, abóbora-jarda, aboboreira	Fd,Ml	
Cucurbita pepo	Aboboreira, aboboreira-vulgar	Fd,Ml	•
Lagenaria siceraria	Abobreira-de-cabaça, buli, cabaça, cabaceira	Fd,U	
Luffa aegyptiaca	Bobra	U	
Cupressaceae			
Cupressus sempervirens	Cupressus	Fu,E	
Hesperocyparis arizonica		E	
Hesperocyparis lusitanica	Cedro-português, cedro-do-buçaco	Fu,E	
Hesperocyparis macrocarpa		E	
Dioscoreaceae			
Dioscorea japonica		Fd	
Euphorbiaceae			
Acalypha wilkesiana		O	
Breynia disticha	Groselhinha	O	
Euphorbia chamaesyce	Solda-inglesa	Fr,P	
Euphorbia heterophylla	Travador	Ml	
Euphorbia hirta	Desfamador, erva-santa-luzia, itervina, marcelinha, marcelintra, palha-pico, solda-inglesa, solda-inglesa-grande	Fr,Ml	
Euphorbia hyssopifolia	Padja-lete, palha-leite, palha-soda, solda-inglesa	Fr	
Euphorbia milii	Coroa-de-cristo	Ml	
Euphorbia pulcherrima		O	
Euphorbia splendens		O	
Euphorbia tirucalli	Borracha, mato-leitoso	O	
Euphorbia tithymaloides		O	
Jatropha curcas	Purga, purgueira	Mt,E	•
Jatropha gossypiifolia	Chagas-velhas, purgueira, purgueira-da-guiné	Fr	
Jatropha multifida	Purgueira-da-guiné	O	
Manihot carthagenensis subsp. *glaziovii*	Borracheira, mandioqueira-borracha	Mt,O	

Table 2. *Cont.*

Taxa	Common Names	Uses	Hist.
Manihot esculenta	Mandioca, mandioca-borracha, mandioca-branca, mandioca-brasil, mandioca-mulata, mandioca-pau-de-terra	Fd,Fr,Ml	•
Ricinus communis	Bafureira, djague, djague-djague, jag-jag, mamona, rícino	Fr,Ml	•
Fabaceae			
Acacia bivenosa		E	
Acacia brachystachya		E	
Acacia cyclops		E	
Acacia holosericea	Alosericia, oredjona	Ml,E	
Acacia longifolia		E	
Acacia mearnsii		E	
Acacia pycnantha		E	
Acacia salicina		E	
Acacia saligna		E	
Acacia victoriae		E	
Adenanthera pavonina	Coral	O	
Albizia lebbeck	Pau-feijão	Ml,O,E	
Arachis hypogaea	Amendoim, mancarra	Fd,Fr	•
Bauhinia galpinii		O	
Bauhinia monandra		O	
Caesalpinia pulcherrima	Barbas-de-barata, brinco-de-princesa	O	•
Cajanus cajan	Congo, feijão-congo, feijão-ervilha, feijão-figueira	Fd,Fr	•
Canavalia ensiformis	Fava-rica	Fd,Fr	
Cassia fistula	Canafístula, canafrista, jardim	O	•
Ceratonia siliqua	Alfarrobeira	Fd,Fr,E	•
Chamaecytisus prolifer		Fr	
Colophospermum mopane		O	
Crotalaria retusa var. *retusa*	Bons-dias, flor-de-lagartixa, gaivé, ovos-de-rato	Fr	
Delonix regia	Acácia-rubra	Ml,O	
Desmanthus virgatus	Bencaiumba, bom-de-caimbra, caiumbra, quintinha, sementinha	Fr,Ml	
Desmodium tortuosum	Crioula, crioula-fina, crioula-pequena, marquinha	Fr	
Erythrina variegata		O	•
Erythrina velutina	Fabatera	O	
Erythrostemon gilliesii	Barbas-de-barata	Ml,O	
Gliricidia sepium		Fr,O	
Guilandina bonduc	Ouri, uri, uriseira	U	
Indigofera tinctoria	Tinta	Mt	•
Leucaena leucocephala	Acácia, acácia-leucena, linhaça, linhacho, sementinha-da-terra	Fr,Ml	
Libidibia coriaria	Crisalpina	Mt,O	
Lonchocarpus sericeus		O	
Medicago sativa	Anafe, luzerna	Fr	
Millettia thonningii		O	
Mucuna pruriens	Canhoma, feijão-de-bitcho, feijão-de-lagartixa, ganhoma	Fr	
Parkia biglobosa	Alfarroba-da-guiné	O	
Parkinsonia aculeata	Acácia, acácia-espinheiro, acácia-martins, espinho-branco	Fr,Ml,E	
Phaseolus lunatus	Banjona, bonjinho, fava, fava-terra, favona, feijão, feijão-bombone-branco, feijão-bonge, feijão-espadinha, feijão-fava	Fd	•
Phaseolus vulgaris	Bonje, favona, feijão, sapatinha	Fd	•
Pithecellobium dulce	Mampisa, roseira	Fd,O	
Prosopis chilensis		E	
Prosopis juliflora	Acacia-americana, algaroba	Fr,Ml,O,E	
Prosopis pallida		E	
Prosopis tamarugo		E	
Samanea saman	Pau-feijão	Fd,Fr	

Table 2. *Cont.*

Taxa	Common Names	Uses	Hist.
Senegalia senegal		E	
Senna artemisioides nothosubsp. *sturtii*		E	
Senna bicapsularis	Beijinho, canafístula, flor, jardim, jardineira	O	
Senna corymbosa		O	
Senna obtusifolia		O	
Senna occidentalis	Baguinha, canafista, empincheira, fedegosa, munhanóca, pincheira, trincheira	Ml,S	
Senna septemtrionalis		O	
Senna siamea		O	
Sesbania grandiflora	Cacia-japónica	Fd,Ml,O	
Tamarindus indica	Tamarindeiro, tamarindo, tambarindo, tambarino	Fd,Fr,Fu,O,E	•
Tara spinosa	Tara-do-chile	O	
Tipuana tipu		O	
Trifolium glomeratum	Bonança, trevo	Fr	
Vachellia farnesiana	Acácia-esponja, aroma, espinheiro-branco, espinheiro-preto, espinho-branco, espinho-preto, esponjeira, imbulda, perfume	Ml,Mt,O,E	•
Vachellia nilotica subsp. *indica*	Acácia, espinheira, espinheiro-preto, espinho-preto	Fr,Fu,Mt,O,E	
Vachellia seyal		E	
Vachellia tortilis		E	
Geraniaceae			
Pelargonium × *hybridum*		O	
Pelargonium inquinans		O	
Pelargonium zonale	Malva-sardinheira	O	
Iridaceae			
Iris florentina	Lírio-branco, tulipa-branca	O	
Lamiaceae			
Clerodendrum speciosissimum	Rosaquina, rosa-quina	O	
Clerodendrum umbellatum		O	
Lavandula dentata	Rosmaninho	O	
Leonurus sibiricus		O	
Mentha × *wirtgeniana*	Bergamota, hortolô, hortelã	Fd	
Mentha pulegium	Poeijos	Fd	
Mentha x *piperita*	Ortelã-pimenta	Fd	
Ocimum basilicum	Mangericão, mangerona, mangirão, mangirona	Fd	•
Ocimum gratissimum		Fd	
Origanum vulgare	Mangerona-selvagem	Fd	
Salvia coccinea	Trepadeira-de-lisboa	O	
Salvia eriocalyx	Salva	O	
Salvia leucantha		O	
Salvia rosmarinus	Alecrim, alecrim-de-portugal	Fd	
Tectona grandis	Teca	T	
Volkameria aculeata		O	
Lauraceae			
Cinnamomum burmanni	Caneleira	Fd	
Cinnamomum camphora	Árvore-de-cânfora, canforeira	O	
Cinnamomum verum	Caneleira	Fd,O	
Laurus nobilis	Loureiro	Fd,P	
Persea americana	Abacate, abacateiro	Fd,Ml	
Loasaceae			
Mentzelia aspera	Lapadeira, pega-saia, rapo-tchapo, rato-tchapo	Ml	
Lythraceae			
Punica granatum	Romã, romangeira, romanzeira, romãzeira	Fd,Mt,O	•

Table 2. *Cont.*

Taxa	Common Names	Uses	Hist.
Malvaceae			
Abelmoschus esculentus	Quiabo	Fd	•
Abutilon grandifolium	Vara-de-lobo	Mt	
Adansonia digitata	Calabaceira, caxabuceira, imbondeiro	Fd,Ml	•
Ceiba pentandra	Poilão, polon	Fd,Ml,U,E	
Cola lateritia	Amoreira, maria-cujá, moreira	Fd,O	
Gossypium hirsutum	Algodão, algodoeiro, algodoeiro-vulgar	U	•
Hibiscus cannabinus	Malva-brava	Fd,U	
Hibiscus rosa-sinensis	Cardeal, cardiais	Fr,Ml,O	
Hibiscus sabdariffa	Bissap	Fd	•
Hibiscus surattensis		O	
Sida salviifolia	Lol-branco, lôlo-preto	Fr,U	
Thespesia populnea	Bela-sombra	O	
Meliaceae			
Azadirachta indica	Primo-de-morôdjo	P,E	
Khaya senegalensis	Mogno	Ml,E	
Melia azedarach	Intendente, tendente, tindint, viúva	T,U,O,E	
Trichilia emetica	Mafureira, mafurra, mafurreira, mufurreira	Fd,O	
Moraceae			
Artocarpus altilis	Fruta-pão	Fd	
Artocarpus heterophyllus	Jaqueira	Fd	
Artocarpus integer	Jaqueira	Fd	
Ficus benjamina	Figueira-brava-da-índia	O	
Ficus carica	Figueira, figueira-de-portugal	Fd	•
Ficus elastica	Borracheira	O	
Ficus leonensis		O	
Ficus lutea	Lemba-lemba	O	
Ficus religiosa	Figueira-de-goa, figueira-da-índia	O	
Ficus thonningii		Fr,O	
Morus nigra	Amoreira, morreira	Fd	
Moringaceae			
Moringa oleifera	Acácia-blanco, acácia-branca, moringa	Fd,Fr,Mt,O	
Musaceae			
Musa × *paradisiaca*	Banana-pão, bananeira	Fd,Ml	•
Myrtaceae			
Corymbia citriodora		O,E	
Eucalyptus camaldulensis subsp. *camaldulensis*	Calipe, calipo, calipto, eucalipto	Ml,O,E	
Eucalyptus globulus	Calipe, calipo, calipto, eucalipto	P,O	
Eucalyptus gomphocephala	Calipe, calipo, calipto, eucalipto	E	
Eucalyptus pruinosa	Calipe, calipo, calipto, eucalipto	O	
Eucalyptus tereticornis	Calipe, calipo, calipto, eucalipto	E	
Eucalyptus viminalis	Calipe, calipo, calipto, eucalipto	O	
Eugenia uniflora	Pitangueira	Fd	
Psidium cattleyanum	Araçá, goiavinha	Fd	
Psidium guajava	Goiabeira	Fd,Fr	•
Syzygium jambos	Jamboeiro, jambre	Fd,O	
Nyctaginaceae			
Bougainvillea glabra	Bongavilia, buganvílea	O	
Bougainvillea spectabilis	Buganvil, buganvila, buganvílea, mungavi	Ml,O	
Mirabilis jalapa	Batata-de-burro, batata-de-porco, gasimi, jesimi, maravilhas	Fr,O	
Olacaceae			
Ximenia americana	Ameixieira, ameixeira-brava	Fd	•

Table 2. *Cont.*

Taxa	Common Names	Uses	Hist.
Oleaceae			
Jasminum officinale		O	
Jasminum sambac	Jasmineiro	O	
Olea europaea subsp. *europaea*	Oliveira, oliveira-brava, zambujeiro, zambujo	O	
Oxalidaceae			
Averrhoa bilimbi		Fd	
Oxalis debilis		O	
Oxalis latifolia	Azedinha	O	
Papaveraceae			
Argemone mexicana	Cardo, cardo-santo	Ml,Mt	•
Passifloraceae			
Passiflora edulis	Maracujá-pequeno	Fd	
Passiflora quadrangularis	Maracujá-grande	Fd	
Petiveriaceae			
Rivina humilis	Uva-de-macaco	Mt	
Phyllanthaceae			
Phyllanthus acidus	Azedinha, groselheira, groselha	Fd,O	
Phytolaccaceae			
Phytolacca americana	Capa-rosa, uva-macaco	Fd	
Phytolacca dioica	Bela-sombra	O,E	
Pinaceae			
Pinus canariensis		Fu,E	
Pinus halepensis		Fu,E	
Pinus pinaster		Fu,E	
Pinus radiata		Fu,E	
Plantaginaceae			
Antirrhinum majus	Boca-de-lobo-pequena, boca-dilobo, mataquim	Ml	
Cymbalaria muralis		O	
Plantago major	Fedegosa, tanchagem, tantchas	Fr	
Plumbaginaceae			
Plumbago zeylanica	Fogo-da-serra, joelho-de-cabra, mato-gonçalves, pega-cabrito	O	
Poaceae			
Arundo donax	Caniço, cariço	U	
Avena sativa	Palha-de-trigo	Fr	
Bambusa vulgaris	Bambu-grande, carisso-da-guiné	U	
Coix lacryma-jobi		O	
Cymbopogon citratus	Belgata, capim-limão, chá-de-príncipe, chali, xali	Fd	
Eragrostis tenella		Fr	
Paspalum vaginatum		Fr,O	
Saccharum officinarum	Cana-de-açúcar, cana-doce-preta	Fd,Fr	•
Setaria parviflora	Balanco, gôgô, rabo-de-gato, rabo-de-raposa	Fr	
Sorghum bicolor	Bimberim, sorgo	Fd,Fr,Ml	•
Sorghum halepense	Achada-carreira, sololo	Fr,U	
Stenotaphrum secundatum		Fr,O	
Zea mays	Midjo, milho, milho-de-capa-preta	Fd,Fr,Ml	•
Polygonaceae			
Antigonon leptopus	Fátima, rosa-di-campo, rosa-di-fátima, trepadeira-de-fátima	Ml,O	
Coccoloba uvifera	Bela-sombra, mogno	O	
Proteaceae			
Grevillea robusta	Carvalho-prateado, grevilia	Ml,T,O,E	

Table 2. *Cont.*

Taxa	Common Names	Uses	Hist.
Rosaceae			
Cydonia oblonga	Gamboeiro, marmeleiro	Fd	•
Fragaria × *ananassa*	Morangueiro	Fd	
Malus domestica	Macieira	Fd	•
Prunus persica	Pessegueiro	Fd,O	
Pyrus communis	Pereira, pereira-mansa	Fd	•
Rhaphiolepis bibas	Nespereira, nespereira-do-japão	Fd	•
Rosa × *centifolia*	Roseira	O	
Rosa moschata	Roseira	O	
Rosa sempervirens	Roseira	O	
Rubiaceae			
Cinchona pubescens	Quineira	O	
Coffea arabica	Cafeeiro, cafezeiro	Fd,S	•
Mitracarpus hirtus	Beitece, beio-teso, beiteso, locotém	Fr,P	
Morinda citrifolia	Noni	Fd	
Spermacoce verticillata	Bedjo-teso, biteso, lactane, locotane, locotano, velho-teso	Fr	
Rutaceae			
Chloroxylon swietenia	Pau-setim	O	
Citrus × *aurantium*	Laranjeira, laranjeira-azeda, laranjeira-doce	Fd,Ml	•
Citrus × *limon* var. *bergamia* [a]	Bergamo, bergamota	Fd	
Citrus × *limon* var. *limon*	Limoeiro	Fd,Ml	•
Citrus maxima	Toranjeira	Fd	
Citrus medica	Cidreira, limoeiro	Fd	•
Citrus x *aurantiifolia*	Limeira, limeira-azeda, limoeiro-pequeno	Fd	•
Ruta chalepensis	Arruda, aruda	Ml,S	
Triphasia trifolia		O	
Salicaceae			
Salix x *fragilis*		O	
Sapindaceae			
Melicoccus bijugatus		O	
Sapindus saponaria	Aveleira, aveloa, avelon, boa-madeira, saboeira, sapodilha	P,T,Mt	
Sapotaceae			
Manilkara zapota	Nispere	Fd	
Scrophulariaceae			
Myoporum tenuifolium	Pitosporum	O	
Simmondsiaceae			
Simmondsia chinensis	Jojoba	Mt	
Solanaceae			
Alkekengi officinarum		Fd	
Capsicum annuum	Malagueta, malagueta-arredondada, malaguetona, pimentão	Fd	
Capsicum baccatum	Pimento	Fd,O	
Capsicum frutescens	Malagueta, malagueta-pontiaguda, malaguetinha, piripiri	Fd,P	•
Datura innoxia	Barbiaca-preta, barbiaca-preta, barbidjaca, berbiaca, berbilhaca, burbilhaca, cardo-preto, padja-fede, palha-fede	Ml,O	
Nicotiana glauca	Chaluteiro, charroteira, charuteiro, tabaco-bravo, tabamqueira	O	
Nicotiana tabacum	Erba, erva-brava, erva-santa, tabaco	S,O	•
Petunia axillaris	Petunia	O	
Physalis peruviana	Capucha, caputcha, uva-caneca, uva-canela, uva-madeira	Fd	•
Solanum betaceum	Tomate-arbóreo	Fd	
Solanum lycopersicum	Camacho, tomate, tomateiro, tomatinho	Fd	
Solanum melongena	Beringela, beringelo, bringela	Fd	
Solanum tuberosum	Batata, batata-inglesa, batateira	Fd	
Talinaceae			
Talinum paniculatum	Laranjeirinha, limãozinho	Fd,O	

Table 2. *Cont.*

Taxa	Common Names	Uses	Hist.
Tamaricaceae			
Tamarix canariensis	Tarafe, tarrafe, tamargueira	E	
Tropaeolaceae			
Tropaeolum majus	Chagas	O	
Verbenaceae			
Aloysia citrodora	Lúcia-lima	O	
Lantana camara	Freira, kambara, lantana-cor-de-rosa, lantuna, lantuna-amarela	Fr,O,E	
Verbena officinalis	Agibon-da-terra, gibon, gilbom, verbena	Fd	
Verbena tweedieana		O	
Vitaceae			
Vitis vinifera	Uveira, vinha	Fd	•
Zingiberaceae			
Etlingera elatior	Rosa-de-porcelana	O	
Hedychium gardnerianum		O	
Zingiber officinale	Gengibre	Fd	
Zygophyllaceae			
Balanites aegyptiaca		E	
Tribulus cistoides	Abreodjo, abre-olho, abriolha, abrochona, abroio, abrolho	Fr,Ml	

[a] According to Kalita et al. [35]. • Taxa with reported historical use.

We identified 518 taxa belonging to 338 genera and 88 families (Supplementary Materials Table S1). The best represented families are the Fabaceae, with 87 taxa (four endemics); the Poaceae, with 48 taxa (two endemics); the Asteraceae, with 25 taxa (seven endemics); and the Lamiaceae, with 20 taxa (one endemic) (Figure 1A). With 11 taxa, *Acacia* is the most diverse genus, followed by *Euphorbia* (10), *Ficus* (9), *Amaranthus* (8) and *Senna* (7) (Figure 1B).

Most of the useful plants found in Cabo Verde were introduced (373 taxa, representing 72%) (Supplementary Materials Table S1); among them, about 86% are cultivated in the country. Except for the Poaceae, most of the better-represented families are mainly composed of exotic species (Figure 1A). Exotics also predominate in the best-represented genera (e.g., *Acacia*, *Euphorbia*, *Ficus* or *Amaranthus*), with the exceptions of *Cyperus* (Cyperaceae), *Echium* (Boraginaceae), *Launaea* (Asteraceae) and *Eragrostis* and *Setaria* (Poaceae) (Figure 1B).

There are 145 native taxa, 38 of them endemic, with Asteraceae (7), Boraginaceae (5), Fabaceae (4), Brassicaceae (4), Apiaceae (3) and Poaceae (2) contributing the largest number of endemic species.

Considering the distribution of the useful species in the nine Cabo Verde islands (Santa Luzia, an uninhabited island, is not included in this analysis), there are very high positive correlations of "total useful taxa" with "altitude" (r = 0.900), area occupied by agriculture (r = 0.933), as well as with "total taxa number" (useful or not) present in each island (r = 0.933) (Figure 2). The "rural population" and the "total number of farms" display high positive correlations as well as all the farm categories: "rainfed", "irrigated", and "livestock farming". Less relevant (moderately positive) is the correlation with "forest holdings".

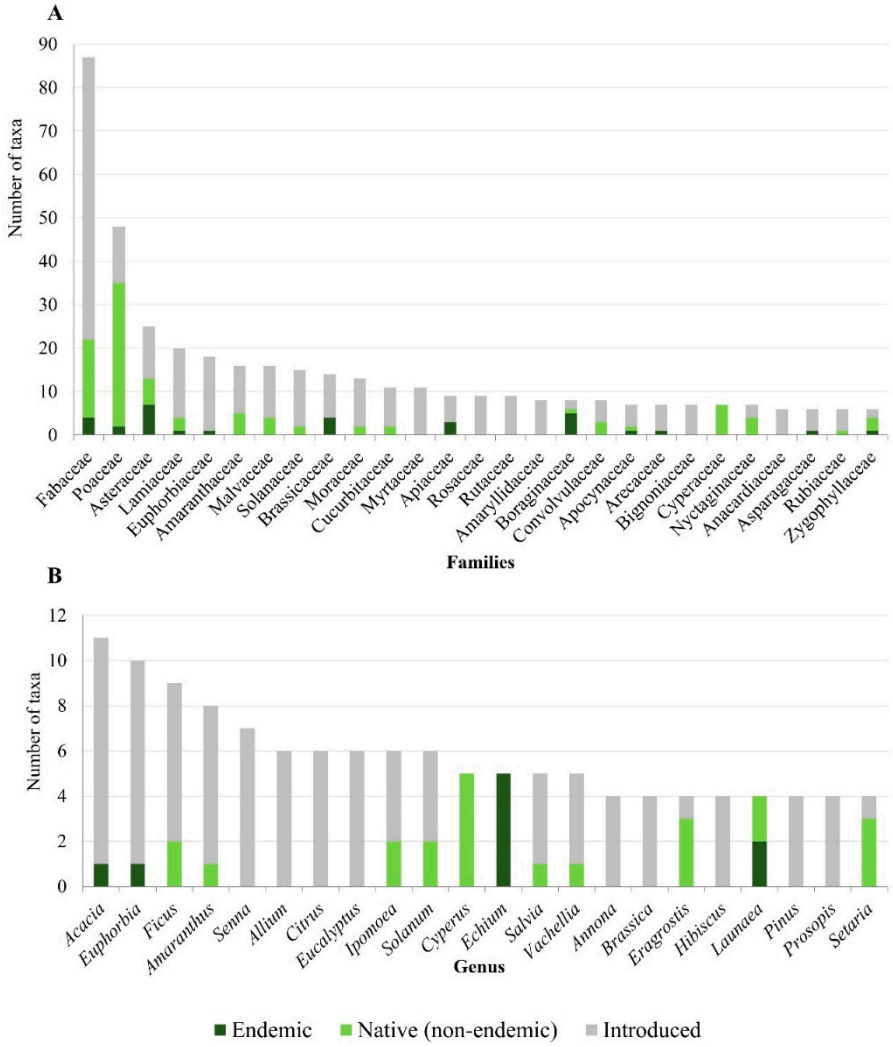

Figure 1. Number of endemics, native non-endemics and introduced useful taxa identified in Cabo Verde. (**A**) Family (only families with more than five taxa are represented); (**B**) Genus (only genera with more than three taxa are represented).

No significant correlations were found between the "total useful taxa" and the variables "total population", and indicators of other economic activities such as "tourists" or "gross domestic product" (GDP).

2.3. Main Uses of Cabo Verdean Flora

Among the 11 considered classes of use, the most frequent are ornamental, with 183 taxa (corresponding to 35.3%); forage and pasture, with 171 taxa (33%); food, with 158 taxa (30.5%); environmental, with 72 taxa (13.9%); and melliferous with 71 (13.7%). The other classes represent less than 10% each (Supplementary Materials Table S1 and Figure 3).

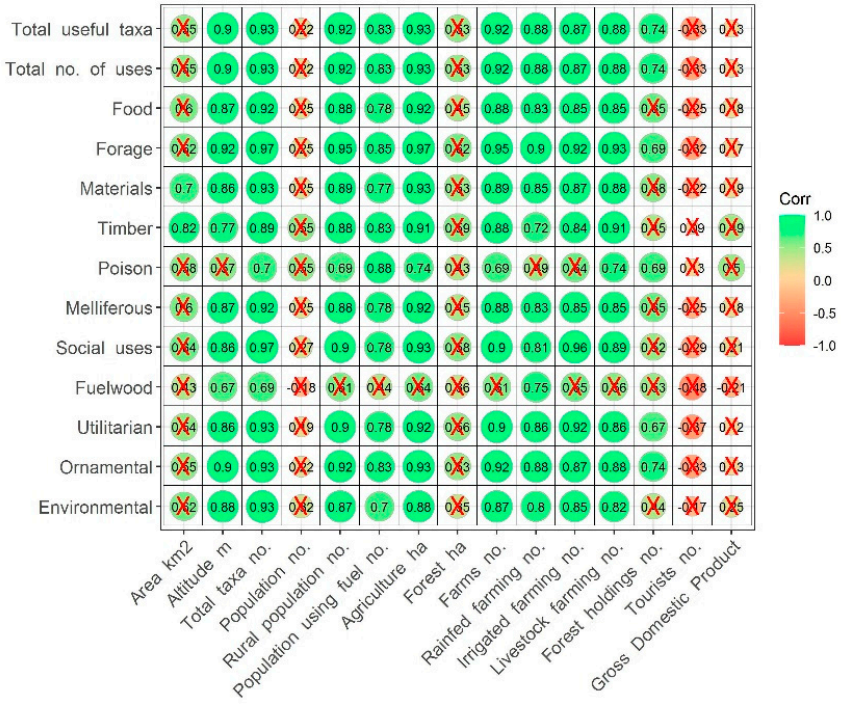

Figure 2. Spearman correlation coefficients between useful taxa (total number and classes of use) and geographic, demographic and economic indicators. Color-coded correlation scale is provided on the right of the plot (green represents positive correlations, and red represents negative correlations); darker color tones and larger circles represent larger correlation coefficients. Values marked with an X are not statistically significant (p-value > 0.05).

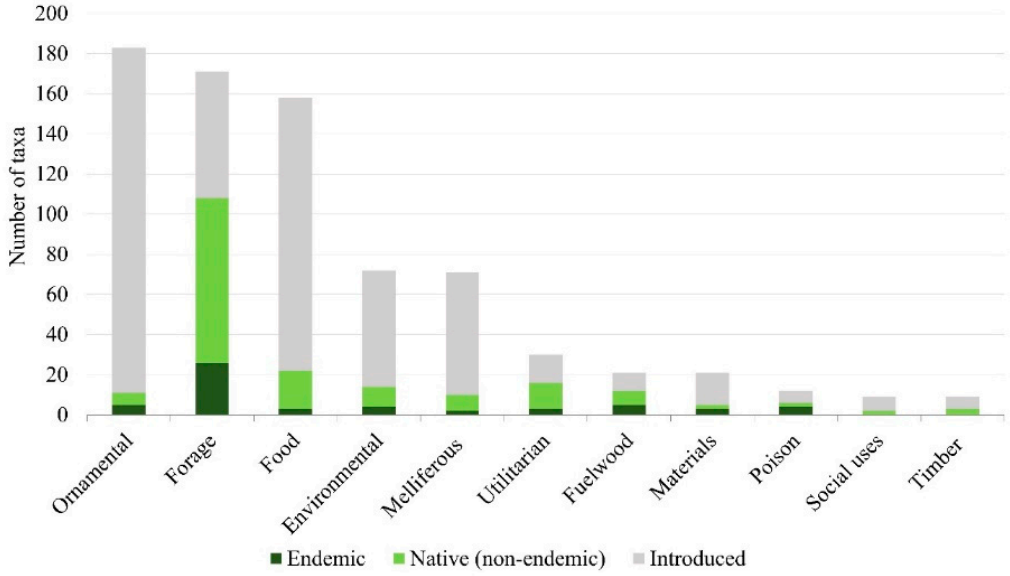

Figure 3. Main uses of the useful taxa found in Cabo Verde and respective origin in Cabo Verde.

Some taxa are used for multiple purposes, for instance, *Vachellia nilotica* subsp. *indica* is used for ornamental purposes and for forage, fuelwood, materials, and environmental objectives, in addition to being a melliferous plant. *Moringa oleifera* is a very useful plant for alimentary, pasture, ornamental and materials purposes. In addition, the native *Ziziphus mauritiana* is used for food, forage, melliferous, fuelwood and timber. However, most

taxa (350 taxa, corresponding to 67.6%) are reported for only one use, the top three being ornamental (111), forage (89) and food (88).

Native plants (including endemic taxa) represent most of the taxa used as fuelwood (57.1%), as forage (63.2%) and for utilitarian applications (53.3%) (Figure 3). Most of the endemic taxa (26) are reported as forage, exceeding the other categories by far. Exotic species are mainly present in the other categories and are particularly well-represented as ornamentals (172 taxa, 94%).

2.4. Growth form Diversity and Uses

The useful plants of Cabo Verde present a high diversity of growing habits and life cycles. About 28.4% are trees or palms, 25.3% are shrubs or subshrubs, 23.2% are annual or biennial herbs, 16.8% are perennial herbs and 6.3% are climbers, including vines and lianas (Figure 4). Trees are the most used for environmental purposes and, as expected, timber; annuals and biennials are most commonly used for forage and human food; ornamentals are mostly trees and shrubs.

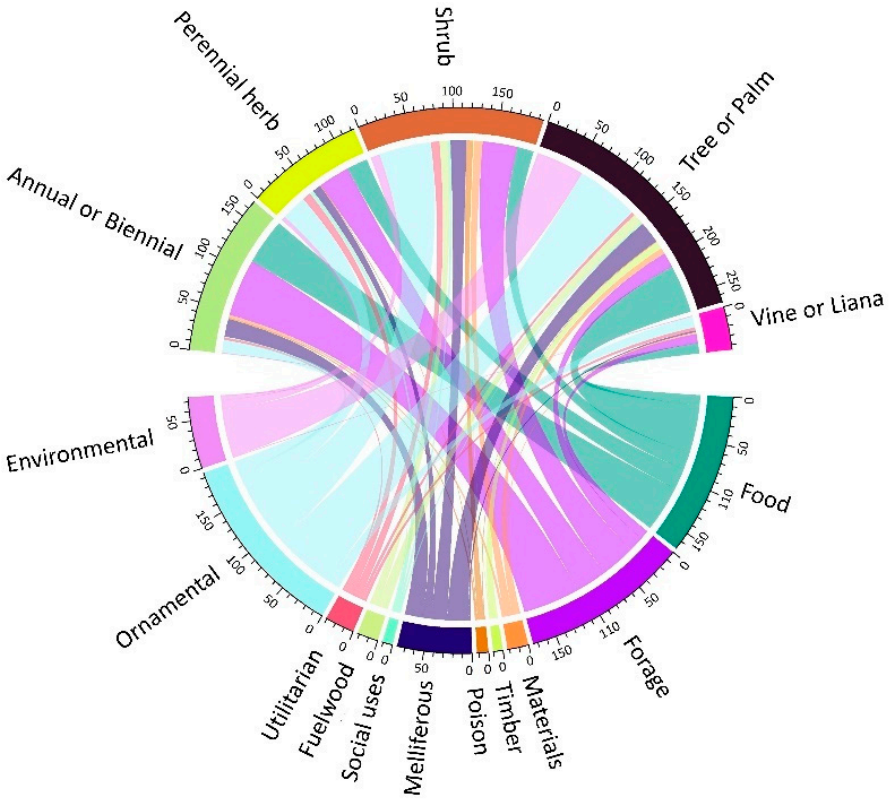

Figure 4. The chord diagram shows the relation between the uses and the habit of the taxa. The areas are proportional to the number of taxa.

The use categories encompassing the widest variety of species are forage, human food and ornamental, including all growth forms.

2.5. Distribution across Cabo Verde Archipelago

Santiago and Santo Antão are the islands with more useful taxa, at 388 and 372 taxa, respectively (Supplementary Materials Table S1, Figure 5B). Fogo, Brava and São Nicolau have 297, 243 and 234 taxa, respectively. The remaining islands have between 203 (São Vicente) and 123 taxa (Sal).

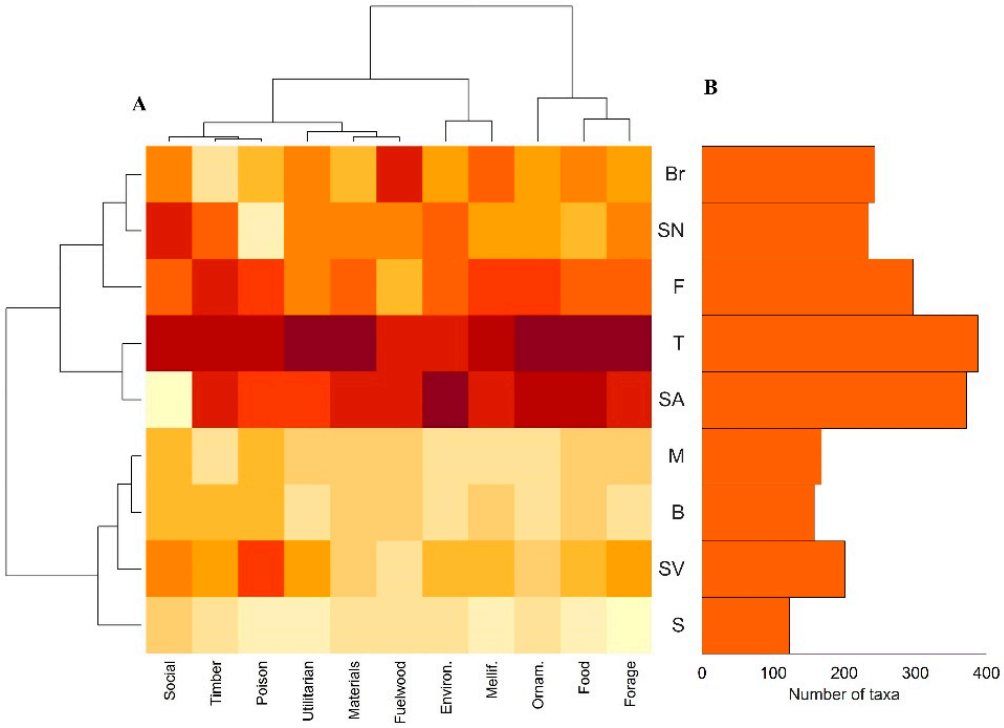

Figure 5. (**A**) Heatmap of the categories of uses identified for the species occurring in each island. Number of records of useful plants per category of use (axis *x*) and islands (*y* axis). Yellow boxes indicate the low values, and dark red boxes indicate high values. The heatmap was constructed based on a correlation matrix; the horizontal lines are the clusters of Cabo Verde islands (B—Boavista; Br—Brava; F—Fogo; M—Maio; S—Sal; T—Santiago; SA—Santo Antão; SN—São Nicolau; SV—São Vicente) and the vertical columns are the clusters of the use categories. (**B**) Number of useful taxa per island.

The islands where agricultural activities prevail (i.e., with higher "number of farms", or larger "agriculture area"—Supplementary Materials Table S2), are also those where higher numbers of useful taxa are reported (e.g., Santo Antão, Santiago and Fogo).

Based on the number of species per use category (see heatmap in Figure 5A), the UPGMA analysis reveals two main groups of islands: (1) Santo Antão, Santiago, Fogo, São Nicolau and Brava, the islands with the highest values for most of the use categories, with Santiago presenting the highest values for ten categories; and (2) a group including the remaining islands, with the lowest values in most of the use categories.

Correlation coefficients of "total number of uses" and individual uses roughly follow the same pattern as the "total useful taxa" (Figure 2).

2.6. Uses vs. Biogeographic Origin

The huge biogeographic diversity of exotic species among the useful flora of Cabo Verde is remarkable.

Taxa of Afrotropical origin prevail as forage (Figure 6). That is the case for grass species such as *Andropogon gayanus* and *Urochloa xantholeuca*, reported as excellent forage, or the leguminous species from the genera *Crotalaria*, *Desmodium*, *Grona*, *Macrotyloma*, *Rhynchosia*, *Sesbania*, *Tephrosia* and *Vigna*, besides several endemic species of *Lotus*.

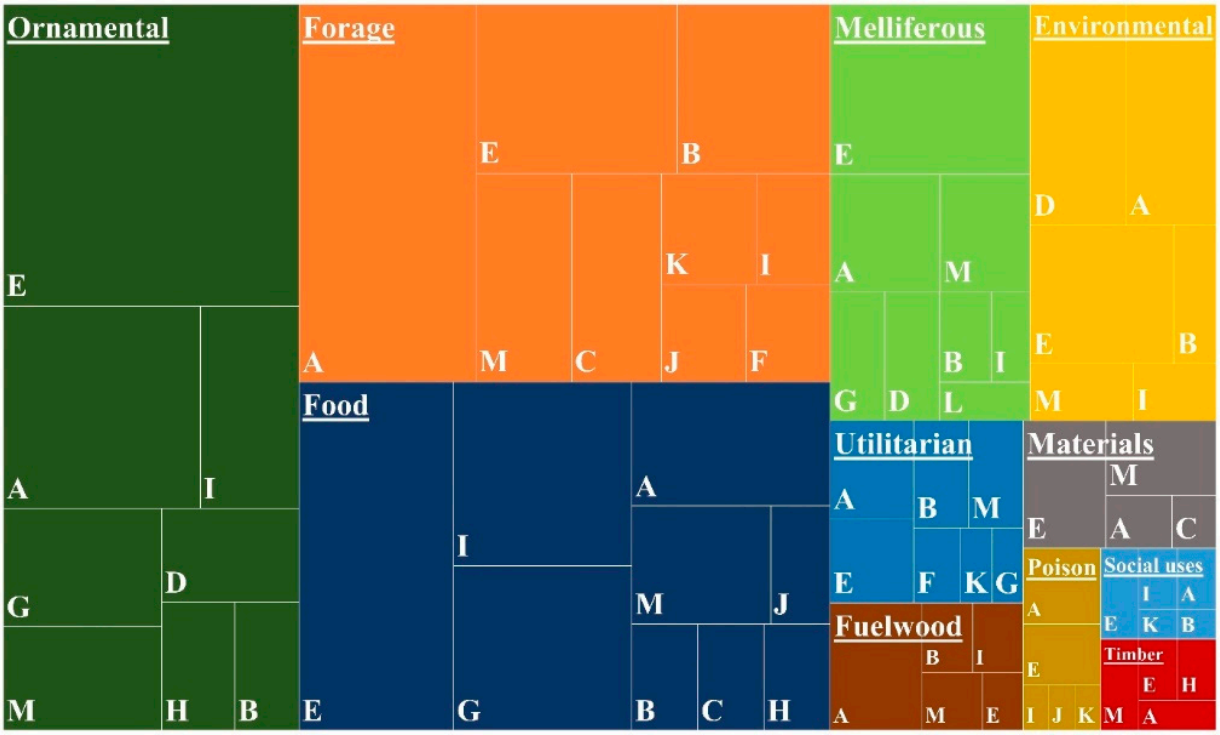

Figure 6. Relationship between taxa uses and biogeographic origin. The areas of the polygons are proportional to the number of taxa. (**A**): Afrotropical; (**B**): Afrotropical and Oriental; (**C**): Afrotropical, Oriental and Austral (optional); (**D**): Austral; (**E**): Neotropical; (**F**): Neotropical, Afrotropical, Oriental and Austral (optional); (**G**): Oriental; (**H**): Oriental and Austral; (**I**): Palaearctic; (**J**): Palaearctic and Afrotropical; (**K**): Palaearctic, Afrotropical, Oriental, and Austral (optional); (**L**): Nearctic; (**M**): Other. Notes: Afrotropical (includes Afrotemperate region); Austral (includes one or more of the Neoguinean, Australotemperate and Neozelandic regions); Neotropical (includes Andean region).

The taxa used for ornamental purposes are mainly of Neotropical origin, namely Apocynaceae (e.g., *Asclepias curassavica*, *Cascabela thevetia*, *Plumeria rubra*), Fabaceae (e.g., *Caesalpinia pulcherrima*), and Lamiaceae (e.g., *Salvia* spp.), only to mention a few examples. Of the same origin are most taxa used as food (e.g., species of the genera *Amaranthus*, *Annona*, *Cucurbita*, *Capsicum*, and *Solanum*). The Neotropical region is also the main origin of melliferous plants and of the taxa used to obtain materials and timber, however with considerably lower importance.

The Austral origin prevails in the environmental purposes category, with the well-represented genera *Acacia* and *Eucalyptus*.

Most taxa (364 taxa) occur in only one biogeographic region. Overall, 432 taxa, corresponding to 83.4% of all the useful taxa, occur as native in either Afrotropical, Neotropical, Australotropical or Oriental regions (in single or mixed classes). Of the 86 taxa that do not occur in at least one of these regions, more than half (54) have an exclusively Palearctic distribution.

2.7. Native Species Conservation

Only 202 (37.6%) of the studied taxa were assessed by the International Union for Conservation of Nature (IUCN) Red List of Threatened Species [36] and Romeiras et al. [37]. Most of them (144) are classified as Least Concern (LC), 7 as Near Threatened (NT), 9 as Vulnerable (VU), 23 as Endangered (EN), and 5 as Critically Endangered (CR). Fourteen taxa are classified as Data Deficient (DD).

Forage is the use category that includes most threatened Cabo Verdean species (about 20), and most of them occur in highlands communities [37]. Several species can be pointed

out as examples: *Diplotaxis glauca* (CR), *Tornabenea tenuissima* (CR), *Conyza feae* (EN), *Echium stenosiphon* (EN), *Echium vulcanorum* (EN), *Globularia amygdalifolia* (EN), *Helianthemum gorgoneum* (EN), *Tornabenea annua* (EN), *Tornabenea bischoffii* (EN), *Periploca chevalieri* (EN), *Sonchus daltonii* (EN), *Launaea picridioides* (VU), *Forsskaolea procridifolia* (NT) and *Lavandula rotundifolia* (NT). Besides these herbaceous or shrub species, also trees, such as *Phoenix atlantica* (EN), are reported as fodder (leaves). Classified as Data Deficient, several species of *Lotus* (e.g., *L. brunneri*, *L. jacobaeus*, and *L. purpureus*) are also well known for their major importance as forage.

Two Endangered endemic species are used for their edible fruits: *Phoenix atlantica* and *Sideroxylon marginatum*; and *Urochloa caboverdiana*, classified as Vulnerable, is used in times of food shortage (seeds).

The populations of several endemics, such as *Echium vulcanorum*, *E. hypertropicum* (EN), *Euphorbia tuckeyana* (NT) and *Sideroxylon marginatum*, have been depleted for firewood or charcoal. Also threatened are species once widely used for leather tanning, such as *Periploca chevalieri* (leaves), and *Euphorbia tuckeyana* (sap). *Asteriscus daltonii* subsp. *vogelii* (NT) and *Pulicaria diffusa* (EN) are reported as used in fumigations, and *Dracaena caboverdeana* (CR), produces the famous dragon's blood, a red resin used as varnish, besides being a valuable ornamental species. Other relevant endemic ornamentals are the palm *Phoenix atlantica* and the Crassulaceae *Aeonium gorgoneum* (EN).

The use of some non-endemic native taxa is also of concern. This is the case with the use as fuelwood of *Arthrocaulon franzii*, used in lime kilns, *Tamarix senegalensis*, and *Tetraena gaetula* subsp. *waterlotii*.

Some of the introduced species are also classified as threatened in their native areas of distribution (e.g., *Jacaranda mimosifolia*, *Kalanchoe daigremontiana*, or *Khaya senegalensis*). However, in most cases, the unknown origin of the introduced plants in Cabo Verde (wild populations or plant nurseries) hampers a correct evaluation of their relevance for species conservation.

2.8. Agrobiodiversity and Traditional Knowledge

The plants cultivated and preserved by rural communities for a long time and, as such, extremely well adapted to the diversity of bioclimatic conditions of the archipelago constitute a valuable reservoir of plant genetic resources. The cultivation of this agrobiodiversity, together with the traditional knowledge on cultural practices (selection, propagation, and conservation), is crucial to face the drought cycles that are common in Cabo Verde and to ensure food security. However, in drought years, many of these genetic resources are lost, as farmers lose their seeds when crops fail to grow due to lack of rain.

Beans are perhaps the crop with most varieties. For example, in Santo Antão, the "feijão-caqui" (a variety of *Lablab purpureus* subsp. *purpureus*), highly resistant to dryness, keeps the pods closed at the end of maturation, thus avoiding the need to collect grains from the ground [29]. Regarding corn, the selection is made by choosing the best ears (those fully filled with grains and with more "rows"), which are not threshed until the time of sowing and from which only the largest and best-formed grains are used [29].

An example of a traditional technique for propagule conservation is, in Santo Antão, the storage of potatoes (*Solanum tuberosum*) in cool places such as caves, dug out of pozzolanic rocks, which are very common in the region due to their volcanic origin [29].

In Santiago, it is documented that sweet potato (*Ipomoea batatas*) seedlings or cuttings are sold/offered to farmers in highlands, where the cooler climate allows for their conservation; during the planting season, these same plants are again sold/offered to farmers in lower areas. This is a secular practice that is used in this and also in other islands (e.g., Fogo) and also with other crops such as cassava.

To prevent the emergence of pests during storage of seeds and the serious damage they cause, namely in maize and beans, plant species that are rich in essential oils and act as biocides are traditionally used. This is the case of pink pepper leaves (*Schinus molle*), "losna" (*Artemisia gorgonum*), neem (*Azadirachta indica*), laurel (*Laurus nobilis*), leaves and

fruits of eucalyptus (*Eucalyptus globulus*) and fruits of chilli pepper (*Capsicum frutescens*). The latter seem to allow the conservation of seeds and maintain their germination ability for many years [29].

3. Discussion

In Cabo Verde, as well as worldwide, the use of plants for a variety of purposes is a common practice. The data provided in this paper improve our knowledge of the flora used by local populations in Cabo Verde and underline the high dependence of the populations on the use of plants for multiple purposes.

Our comprehensive inventory, including historical works, collected previously ignored information on particular uses of species and also drew attention to some species that are no longer used, contributing to the general knowledge of useful species, as has been done in other tropical regions, such as South America (e.g., Cámara-Leret et al. [38]), Asia (e.g., Vu and Nguyen [39]) or Africa (e.g., Nortje and van Wyk [40]; Welcome and Van Wyk [41]), where this knowledge is still insufficient.

3.1. Taxonomic Diversity

Useful plant species make a considerable portion of total Cabo Verdean flora. With 518 taxa, they are mainly represented by introduced species (72%).

Species not previously recorded for the archipelago, to the best of our knowledge, are here reported, e.g., *Tabebuia rosea* (a Bignoniaceae with several centuries-old specimens and recently used as ornamental street tree) and the Fabaceae *Gliricidia sepium*, both in Santiago Island.

Following a common worldwide pattern [42], the three most diverse families of useful plants are the Fabaceae, the Poaceae and the Asteraceae, with a high number of crops of global significance. In addition, these families are among the largest plant families, corresponding, respectively, to the first (Asteraceae), third (Fabaceae), and fifth (Poaceae) best-represented families [43].

The best represented families are mostly composed of exotic species, with Poaceae being an exception (see Figure 1A). The high dispersal ability as well as its extraordinary adaptability to dryness [44] place this family among the most successful in the archipelago.

Species diversity is closely related with altitude, with the highest islands (Santiago, Santo Antão and Fogo) presenting the highest numbers of useful species. Furthermore, the two groups highlighted on the heat map (see Figure 5A) show that altitude is responsible for a similar pattern in the distribution of the types of uses among islands. This is certainly related with the greater suitability of high-altitude islands, with better climatic conditions, for agricultural activities (consequently housing a larger rural population) and also to the presence of a richer flora [13,45]. Moreover, reinforcing the relevance, in this respect, of more traditional economic sectors, such as agriculture, forestry and livestock farming, the diversity of useful plants is neither related with touristic activities nor with the gross domestic product—two indicators that are highly correlated ($r = 0.800$; data not shown).

3.2. History behind Diversity

The archipelago was uninhabited until it was discovered by the Portuguese in 1456, and most of Cabo Verde's inhabitants are of mixed Portuguese and African ancestry [46]. With a five century long settlement history, the combined influences of both cultures are evident in the use of plants, with many commonly used species (e.g., fruits and vegetables from Europe, cereals from West Africa). This knowledge was further enriched with the introduction of useful plants from other regions, such as the American continent (namely Brazil and Western Indies), resulting from the overseas trade of the Portuguese since as early as the 16th century [47].

In the early times, the introduced species were essential, if not decisive, for human survival. At the same time, they supported the dominant commercial interests linked to the slave trade and supply of merchant ships.

It is interesting to reference the example of the attempt of the first European settlers to maintain their eating habits in Cabo Verde. According to Torrão [48], seeds and other propagules accompanied the Portuguese colonizers, hoping that their Mediterranean crops would provide both food and a sociocultural link to their homeland. Early chroniclers such as Valentim Fernandes by 1506 (in Monod et al. [18]) reported that, in Santiago Island, some valleys were cultivated with fruit trees used in Europe (e.g., pears, apples, oranges, lemons, figs, grapes, etc.), reflecting the wish of European settlers to maintain their own traditions. However, the climatic constraints of the tropical climate seldom allowed the successful development of some of them (e.g., the cultivation of some cereals such as wheat and barley).

In addition, with the slaves from the West African coasts came the crops included in their dietary habits, namely rice (*Oryza glaberrima*), and "milho", referring to *Sorghum* and/or *Pennisetum*, two common crops in Guinean coasts (not *Zea mays*, the maize from South America, not yet introduced in Africa, and later also named "milho" by the Portuguese) [48]. The emotional memory attached to food was certainly an important promoter of the plant diversity that is still found everywhere in these islands.

The high number of species whose use dates back to the beginning of colonisation is remarkable. Historical documents (until the end of the 18th century) report almost 70 species, not including vegetables, which are rarely mentioned (see Tables 1 and 2).

Even considering the overall climatic constraints, the orographic diversity of the archipelago accounts for a wide range of habitat types, allowing the presence of species from temperate zones, such as Northern Europe or New Zealand, as well as of those with a tropical or subtropical distribution, e.g., from Central and South America or from India. In fact, introduced species have been a constant presence in Cabo Verde since the early times of colonization.

Due to geographical and historical circumstances, this archipelago in the middle of the North Atlantic became a pivotal region between Europe, Africa and America. This excellent location fostered the introduction of a wide variety of economically valuable plants, for acclimatization and further dissemination to other regions of the world. In fact, Cidade Velha (in Santiago), the former capital of the archipelago and the first town built in the tropics by Europeans (in the late 15th century), was an essential Atlantic port of call and rapidly became a commercial hub between Europe, Africa and the New World [49,50] promoting the introduction and later diffusion of many useful plants.

Overall, species were introduced to meet the needs of local populations, and the shifts over time reflect the changing in socio-economic requirements, from the most basic needs—food, fuelwood or timber—to higher-level demands, e.g., aesthetics.

3.3. Plant Uses and Sustainability

Ornamental followed by forage/pasture and food purposes are the primary uses of plants in Cabo Verde. The common use of ornamental plants in this archipelago is not surprising. The same occurs worldwide, with estimates pointing to 28,000 plant species of ornamentals (including gardening and landscaping plants), while cultivated crops correspond to about 7000 species [51]. However, it is worth mentioning that more than half of the species reported as ornamentals in Cabo Verde are also used for other purposes, namely for medicinal uses (data not included in the present analysis), food or for environmental projects.

Species used as forage or pasture, the second most reported use, are mainly from the families Poaceae and Fabaceae and are very common in grasslands and savannas. Several species are reported as high-quality forages (e.g., *Desmodium tortuosum* and *Teramnus labialis*), revealing their extraordinary value to improve natural pastures for cattle raising, a main economic sector in Cabo Verde [52].

Concerning edible species, it is interesting to note the presence of several commonly overlooked fruit-trees such as the introduced *Syzygium jambos* or *Spondias mombin*, and the reference to some native species whose fruits are used for human consumption such as

Momordica charantia, *Grewia villosa*, *Ficus sur*, *F. sycomorus*, *Solanum scabrum* (leaves also used as vegetable) and the endemics *Phoenix atlantica* and *Sideroxylon marginatum*. The flour made from dry fruits of *Ziziphus mauritiana* is consumed by the populations living in dry areas, and, formerly, the fruits of *Tamarindus indica* were cooked together with meat [53]. Other native species used for food (vegetables) are *Launaea intybacea*, an ingredient of the most emblematic dish in Cabo Verde ("cachupa"), *Portulaca oleracea*, to make soups, *Celosia trigyna*, and the edible tubers of *Cyperus esculentus* and *C. rotundus*. *Senna occidentalis* was used, until recently, as a coffee substitute.

Particularly interesting are several native species reported as being used in times of food shortages (e.g., seeds used to make flour): the Malvaceae *Melhania ovata* and the Poaceae *Dactyloctenium aegyptium*, *Setaria barbata*, *Urochloa caboverdiana* and *U. ramosa*.

Note that several grass species occurring in Cabo Verde are considered as millets, a group of cereal crops with small grains used for human consumption. That is the case of the Guinea millet *Urochloa deflexa*, or the browntop millet *Urochloa ramosa*. Although abandoned many years ago, the millets are now being considered valuable functional foods for their good nutritional properties [7], and their use could be relevant to improve food security in arid regions owing to their ability to withstand adverse agroecological conditions [54].

Guinea millets, together with tubers, e.g., cassava, were the food base of island populations until the introduction of maize by the end of the 15th century/early 16th century [55]. These small grain crops are now uncommon, with maize (*Zea mays*) and beans (*Cajanus cajan*, *Lablab purpureus*, *Phaseolus lunatus*, *Ph. vulgaris* and *Vigna unguiculata*) being the prime food species in Cabo Verde [6].

Currently, maize and bean are the ingredients of traditional dishes: the "xerém" and "couscous", prepared in different ways with maize, and "cachupa", prepared with maize, several species of beans, cabbages, cassava and sweet potato.

Besides millets, other valuable small grain crops—*Amaranthus caudatus* and *A. cruentus*—are also present in Cabo Verde. These minor crops are presently underused but are becoming increasingly relevant as alternative crops in dry and semi-dry areas where major crops do not develop well [56], representing a promising resource to support food security.

In the early centuries of the archipelago's colonization, several plants played crucial roles in the local economic activities. That was the case of native tanning plants, such as *Periploca chevalieri* and *Euphorbia tuckeyana* (tanned leather was one of the most reputed exports) and the orseille, *Roccella* spp. or *Ramalina* spp. (lichens, a taxonomic group not included in the present work), widely used to dye textiles ("panos da terra") [55] and exploited in Cabo Verde since 1469 [57]. Other relevant productions were indigo (obtained from *Indigofera tinctoria*), extracted and used around the 16th century [58], cotton (*Gossypium* spp.), sugarcane (*Saccharum officinarum*) and the American physic nut (*Jatropha curcas*), whose seed oil was extracted to make soap or candles, all main exports during the 19th century [55]. Today, and except for sugarcane—used to produce "grogue" (an alcoholic spirit similar to rum), one of the main exports, produced in Santo Antão, São Nicolau and Santiago—and coffee (*Coffea* spp.)—in Fogo and São Nicolau islands (where it was introduced in 1778, [59]—these activities are almost completely abandoned.

Species used for utilitarian purposes include *Sida rhombifolia*, to make brooms; *Urena lobata* and *Calotropis procera*, to obtain fiber, with the latter used to fill mattresses and pillows (as reported by Roberts and Defoe [22]) as well as for firewood; *Phoenix atlantica* leaves, for basketry; *Cyperus alternifolius* subsp. *flabelliformis*, for mat weaving; and *Dichanthium annulatum* and *Imperata cylindrica*, for roofing.

For centuries, the continuous need for wood as a fuel for cooking and as a building material led to the overexploitation of the few native woody species and, therefore, to a severe reduction of their populations. There are interesting references in the early 18th century [22] to the over-exploitation of wild fig trees (probably *Ficus sycomorus* and *F. sur*) to build canoes, and of the dragon tree (*Dracaena caboverdeana*) to build houses in São Nicolau. Other widely used species were *Sideroxylon marginatum*, for timber, and *Arthrocaulon franzii*,

Calotropis procera, *Dichrostachys cinerea*, *Echium vulcanorum*, *Launaea arborescens*, *Tamarix senegalensis* and *Tetraena gaetula* subsp. *waterlotii* for firewood.

It should be noted that the percentage of inhabitants currently using fuelwood is still quite significant, particularly in Fogo (50.1%), Santo Antão (39.6%), Santiago (30.9%) and Maio (30.5%) (see Supplementary Materials Table S2).

The social and cultural role of plants is also relevant in Cabo Verde, with particular species being of great symbolic value for ceremonial festivities. A few examples are the use of leaves of *Phoenix* spp. for religious ceremonies, such as at Easter time, or to decorate the streets to welcome governors in colonial times, or the use, in São Nicolau, of the endemic *Asteriscus smithii* in bonfires on Saint John's eve.

To meet population needs, as well as to restore degraded land and improve soil characteristics, several woody species were introduced through afforestation programs, especially by the mid-20th century. In the highlands of Santo Antão, Santiago and Fogo, species of the genera *Eucalyptus*, *Hesperocyparis* and *Pinus*, among others, were and still are widely planted, while the lowlands are extensively afforested with the Southern American *Prosopis juliflora*, species of the genera *Acacia* and *Vachellia*, and *Ziziphus mauritiana*. To halt the erosion of slopes, several exotic species such as *Aloe vera*, *Lantana camara*, and *Furcraea foetida* were formerly used. Native grasses, such as *Heteropogon contortus* and *Bothriochloa bladhii*, are also reported as important species for this purpose, and their use may be a good alternative to consider.

With the increasing valuation of native species (e.g., Bozzano et al. [60]), the use of autochthonous resources in reforestation/afforestation programs is now being promoted by the Cabo Verdean authorities in charge of forestry—e.g., Direção Geral da Agricultura Silvicultura e Pecuária (DGASP-MAAP) and international agencies (such as the World Bank, the United States Agency for International Development, or the Global Climate Change Alliance). These species are better adapted to local conditions and more likely to enhance biodiversity and improve ecosystem services while providing traditional products (e.g., fruits, wood) to local communities.

Most of the useful species in Cabo Verde are introduced and/or distributed worldwide and, as such, they do not represent serious conservation issues, except for the environmental impacts resulting from the invasive behaviour of some of them. This is the case with *Lantana camara*, *Furcraea foetida*, *Prosopis juliflora* or *Eucalyptus* spp., which are currently seriously damaging native species and ecosystems.

More worrying is the overuse of some native species (e.g., the non-endemic *Tamarix senegalensis* or *Ficus* spp.) and, in particular, of the 38 endemic species listed in the present work, most of them endangered. Reported for all use types, they are relevant in the livelihood of Cabo Verdean population.

The end of some commercial activities (e.g., tanning, dyeing) and the switch from firewood to cooking gas, especially in rural households, have reduced anthropogenic pressure, but the sustainability of some native plant populations (e.g., *Sideroxylon marginatum, Dracaena caboverdeana*) is far from certain.

Finally, most ornamental species are introduced and do not raise conservation concerns. However, some native or even endemic species (e.g., *Echium* spp., *Nauplius* spp., *Phoenix atlantica* or *Aeonium gorgoneum*) are become increasingly attractive to local population as ornamentals and for other purposes, which may threaten their populations. This situation can be avoided, provided that cultivation is promoted and no pressure is imposed on wild populations. On this issue, it is interesting to note that schemes are being proposed (e.g., Krigas et al. [61]) to assess the potential of neglected or underused local endemic plants. Ensuring the safeguarding of native populations, which in Cabo Verde involves their prior recovery, will allow for the sustainable exploitation of these resources and benefit the local economy. In this respect, it is important to mention that several local initiatives, promoted by government agencies and non-governmental organizations (for example, the "Associação Projecto Vitó" on Fogo Island), have played a relevant role in informing and involving local populations in the safeguarding of threatened taxa.

4. Materials and Methods

4.1. The Study Area

Cabo Verde is a volcanic archipelago in the Atlantic Ocean, with 10 islands and several islets, about 600 km off the West African coast. The topography is generally very rugged, with high massifs and deep valleys. The island of Fogo reaches the highest elevation at 2829 m, followed by Santo Antão (1979 m), Santiago (1392 m), and São Nicolau (1304 m) [13].

A dry tropical climate with two well-marked seasons (humid and dry) and a limited and irregular rainfall (mean annual value about 300 mm) constrains the distribution of flora and vegetation. However, the topography contributes to significant spatial variations according to altitude and exposure to prevailing winds, leading to contrasting weather conditions [13,45]. Cabo Verde's biodiversity is poor when compared to the other archipelagos of Macaronesia [62]. Native flora comprises about 400 taxa [63], of which 92 are endemic [32]. Plant communities are diversified and include open woodlands, scrubs, savannas and grasslands [33].

Among the main economic activities are livestock rearing (cattle, goats, poultry, pigs, rabbits, donkeys, and horses) and agriculture, with the latter limited to areas of adequate topographic and edaphoclimatic conditions [4,52].

To mitigate the effects of erosion, afforestation programmes were initiated in the 19th century and intensified during the 20th century, especially in mountainous areas of higher altitude islands (namely, Santo Antão, Santiago and Fogo) and in the more humid windward-facing slopes; the forestation of arid lowlands is more recent, dating from the second half of the 20th century [64,65].

4.2. Listing Useful Plants

A comprehensive review of the literature, including the Flora of Cabo Verde [66–68] and scientific publications (e.g., [11,15,16,25,29,31,63,69–96]), was undertaken to compile the list of useful plants in Cabo Verde and respective common names. We also examined several historical documents published between 1506 and the late 19th century, namely Valentim Fernandes 1506–1510 (in Monod et al. [18]), Gaspar Frutuoso, 1522–1591 (in Frutuoso [20]), Roberts and Defoe [22], Feijó (in Feijó [24], and Gardère et al. [25]), Forster [23], Chelmicki & Varnhagen [26,27], and Ficalho [58], which allowed us to identify the species used since the first settlements. These historical references help to understand how and when species were introduced and to provide a historical perspective on this subject. Information collected from herbarium specimens, especially LISC Herbarium (University of Lisbon), which hosts one of the most complete collections of Cabo Verdean plant species, was also used, as well as data collected in all the islands during field surveys performed by the authors (especially M.C.D., I.G., S.G., A.R., and M.M.R.) during the last decades.

Taxa nomenclature primarily follows Plants of the World Online [30]. Other databases, such as World Flora Online [34], were occasionally used. Note that there is still some uncertainty about the classification of some endemic taxa, which has led to frequent nomenclatural changes; the most relevant cases (for example, in the Apiaceae) are duly noted.

Information about growth form (habit) was obtained from taxa descriptions in the Flora of Cabo Verde and in World Flora Online [34]. Seven categories were considered: annual/biennial herbs, perennial herbs, shrubs/subshrubs (inc. rosette shrubs), trees (including palms and tree-like species), annual herbaceous climbers (annual vines), perennial herbaceous climbers (perennial vines) and woody climbers (lianas).

Eleven categories of uses (adapted from Cook [97]) were considered: food for humans (including beverages, food additives, spices, condiments, colorants, etc.); forage for livestock (including plants for pasture); materials (including plants producing gums, resins, oils, latex, waxes, tannins, dyes, etc.); timber; poison (e.g., for hunting and fishing, or used as biocides); melliferous; social uses (including stimulant, smoking materials, and plants used in ceremonial or ritual practices); fuelwood (firewood, charcoal); utilitarian (including plants used to make domestic utensils or tools, and sources of fibres); ornamental (garden plants, street trees, hedge plants, etc.); and environmental use (for revegetation, forestation

and erosion control, as windbreaks, etc.). Medicinal species and gene source plants were not included in the present analysis.

Species distribution in Cabo Verde and worldwide was mainly based on the Flora of Cabo Verde [66–68], Sánchez-Pinto et al. [63] and Plants of the World Online [30]. Biogeographic distribution was established for each taxon using the regions established by Morrone [98] (Nearctic, Palaearctic, Neotropical, Afrotropical, Oriental, Australotropical, Andean, Afrotemperate, Antarctic, Neoguinean, Australotemperate and Neozelandic). When the species occurred in two or more regions, classification was based on the main distribution area(s). To avoid a large number of classes with a very low representation in Cabo Verde, some regions were merged (for details see the legend of Figure 6).

The conservation status was obtained from Romeiras et al. [37] and the IUCN Red List of Threatened Species [36].

4.3. Geographic and Socio-Economic Data

Fourteen indicators, summarized in Supplementary Materials Table S2, were selected to study the relationships between the diversity and distribution of useful flora in Cabo Verde with geographic, demographic, and economic factors. Data were obtained from official sources, produced by public authorities, namely Instituto Nacional de Estatística [14,99,100], Ministério da Agricultura e Ambiente [101] and Ministério do Desenvolvimento Rural [102].

4.4. Data Analysis

The relationships between the diversity and distribution of useful species and the geographical, demographic and economic indicators were analyzed using Spearman's rank correlation coefficients. Correlation values were calculated using the "cor" function and the "Spearman" method. A probability value equal to or less than 0.05 was used to determine statistical significance. The visualization of the correlation matrix was produced with the packages "ggplot2" and "ggcorrplot" and the function "ggcorrplot". All these statistical analyses were performed in R v. 4.0.5 [103].

The chord diagram showing the relation between the uses and the habit of the taxa was performed with the package "circlize" v.0.4.14 and the function "chordDiagram".

The heatmap was produced based on the number of taxa with different use categories, for each island. This analysis was performed with the function "heatmap", and the resulting chart was normalized by columns.

The treemap chart, providing a hierarchical view of the data, was created in Microsoft Excel v.2202.

5. Conclusions

This study shows that the biodiversity of Cabo Verde is threatened by human activities that meet the basic needs of local populations in the particularly harsh environment of this Macaronesian archipelago. This calls for the integration of scientific information with local indigenous knowledge, but comprehensive knowledge of the plants traditionally used is unavailable. Therefore, we used an integrative approach (i.e., (1) the taxonomic diversity and phytogeographic distribution of useful plants in Cabo Verde; (2) the role of geophysical, demographic, historical, economic, and socio-cultural factors on species distribution and uses; and (3) the potentially relevant species, particularly native ones) for the sustainable development of the archipelago. Information about the plant species and their uses was obtained for 11 categories of uses (e.g., food, forage/pasture, materials, timber, poison, melliferous, social, fuelwood, utilitarian, ornamental and environmental), and species biogeographic distributions and conservation status, as well as 14 geographic and socio-economic indicators, were also taken into account.

Cabo Verde was uninhabited before the mid-15th century, and many exotic plant species were introduced, first to ensure human survival and later also to support commercial interests. In this study, we identified 518 useful taxa (88 plant families), of which only

145 are native and 38 are endemic. Taxa of Afrotropical origin prevail as forage, whereas ornamentals are mainly Neotropical. Only less than 38% of the recorded taxa were assessed by the IUCN Red List, and they include 44 species classified with some level of threat. The number of useful taxa is correlated with altitude and agricultural area, as well as with the size of the rural population, number and type of farms, but not with total population or socio-economic indicators such as the number of tourists or gross domestic product. Plants are primarily used as ornamentals and for forage and food; native taxa—including many threatened ones—are mostly used for fuelwood, forage and utilitarian purposes. The islands where agricultural activities prevail present more useful taxa than the others. The agrobiodiversity and traditional practices (e.g., multiple cropping, selection of resistant varieties and storage of propagules) are crucial to cope with recurrent droughts and to ensure food security in Cabo Verde. Our inventory discloses previously ignored information on particular species; in particular, some species are no longer used.

This study improves the knowledge of the useful plants of Cabo Verde. Most of the useful species are introduced but do not represent serious conservation problems; of much more concern is the overuse of some native taxa and, in particular, of 38 endemics listed, most of them endangered. Only by ensuring the safeguard of native plant populations in Cabo Verde will the sustainable exploitation of these resources be possible and benefit the local economy.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/plants11101313/s1. Table S1. Useful plant species in Cabo Verde islands: taxonomic diversity, origin and uses. Table S2. Geographic, demographic and economic indicators for Cabo Verde.

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