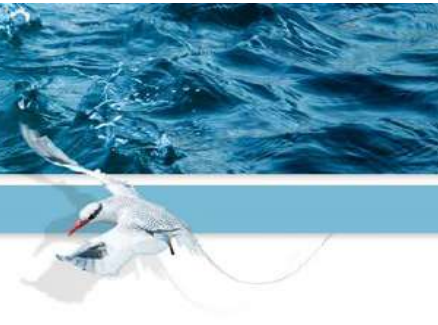




## **TECHNICAL REPORT**

### **SURVEY OF THE AVIFAUNA AND FLORA IN THE WIND FARM IN NORTH OF PRAIA AIRPORT, SANTIAGO ISLAND**

Isabel Fortes Rodrigues & Catelene Monteiro  
Mindelo , 30th April, 2023



## **TECHNICAL REPORT 2023**

# **SURVEY OF THE AVIFAUNA AND FLORA IN THE WIND FARM IN NORTH OF PRAIA AIRPORT, SANTIAGO ISLAND**

### **TECHNICAL AUTHORSHIP:**

This work was prepared by the following Biosfera Conservation team:

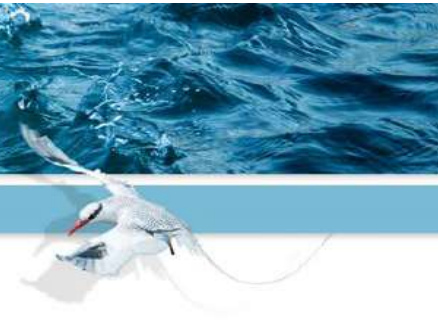
Scientific coordination: Isabel Fortes Rodrigues & Catelene Monteiro

Technical team: Catelene Monteiro & Kenny Delgado

### **BIOSFERA & CABEÓLICA, 2023**

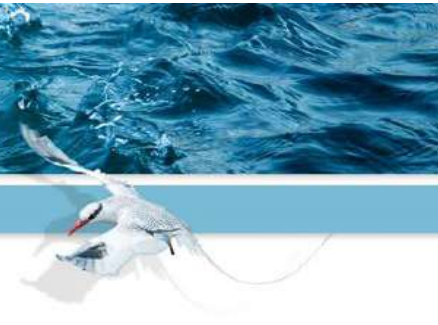
### **ACKNOWLEDGEMENTS:**

To Cabeólica for his availability in doing the study and for the attention. To Paulo Vasconcelos for the identification of flora species and to the whole team and the Biosfera team for their engagement and dedication to the work.



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## **Background**

This report is part of the acquisition of services to survey the fauna and flora in the Wind Farm north of Praia Airport on the island of Santiago. A team was gathered to carry out the inventory, which in the case of fauna was intended to include the group of birds (waders, shorebirds and marine) and flora present in the park.

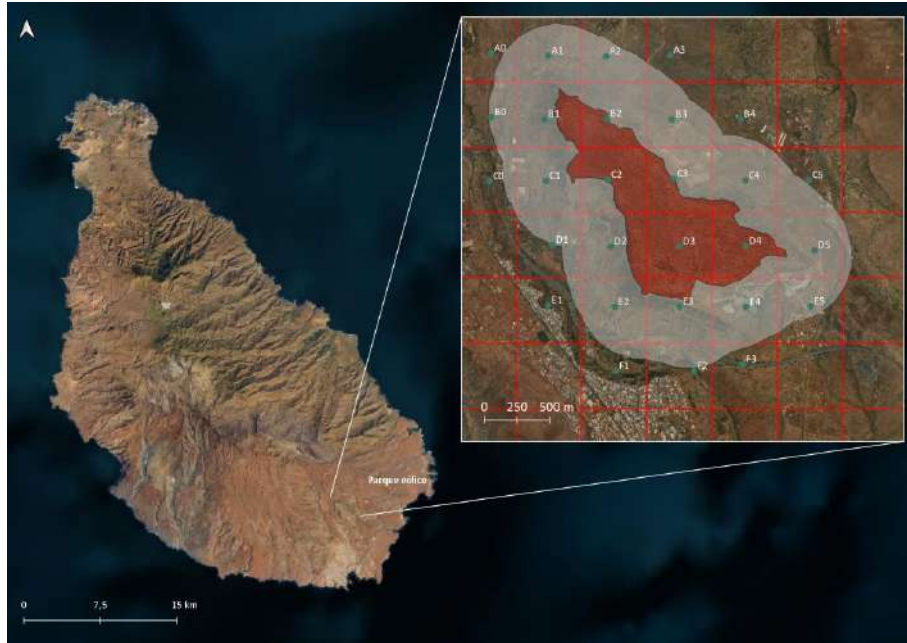
The assessment will aim to characterise the study area and associated ecological corridors, at different times of the year so as to cover different nesting seasons for seabirds, shorebirds and the migratory period for migratory birds. The data collected will be used to form a baseline.

As for the specific objectives, an inventory of the fauna and flora within the study area, mapping and elaboration of the field trip report with results and recommendations will be done.

## **Methodology**

### **Study Area**

The study area is located in Monte de São Filipe, near City of Praia, Santiago Island (**Figure 1**), with an area of 30 hectares of land, and contains 11 wind turbines (Cabéolica, 2022). However, areas identified by Cabeólica as activity implementation zones will be analysed during this assessment, including a 500m perimeter buffer zone and associated ecological corridors.



**Figure 1** – Location of the Wind Farm, Monte de São Filipe, Santiago Island, Biosfera, 2023.

### **Flora Sampling**

At the level of Flora, firstly, bibliographic and documental research was carried out through the search of available official documents, as a way to complement the field work.

To complement this, 7 field trips were carried out from 14 to 20 April, 2023. In these visits we tried to inventory as much as possible of the flora using a system of trails that form grids (**Figure 1**). This system is generally formed by a set of 500m long trails. Within each quadrangle non-linear transects were delineated. Information such as species identification, status and geographical location were recorded.

### **Bird Sampling**

The sampling of avifauna was carried out qualitatively, using the methods of fixed point, transects, photographic and auditory recording (Develey, 2009). Taking into account the characteristics and size of the study area, the sampling was based essentially on non-linear transects, which consisted of walking at a constant velocity, in which the observer records the species detected, visually or audibly, on both sides of the trail, in order to cover all the species that used the study area.

Mostly the transects coincided with the existing tracks throughout the study area. A total of 8 transects were carried out. Morning observations started at sunrise, and in the afternoon, at 4pm. The duration of the records, in both periods, was three/four hours continuous. To complement the avifauna survey, two fixed observation/prospecting points (**P1 and P2**) were established (**Figure 2**).



**Figure 2** – Location of the two fixed birding observation points (P01 e P02), Wind Farm, Monte de São Filipe, Santiago Island, Biosfera, 2023.

In all points, for a period of 30min to 1h, information was collected on the identification of the species present, the number, behaviour and their activity (feeding, resting, flight), flight direction, sex and age, if possible). In addition, some information on physical parameters such as wind speed and direction, cloudiness and occurrence of rain was collected.

To collect information on nocturnal birds (mainly seabirds) that use the area, surveys were applied on their presence/absence in the study area.

Along the 500m perimeter Buffer zone, 3 non-linear transects were completed.



During the observations/prospections binoculars, telescope, GPS (Global Positioning System), camera, field notebook, SWMaps app and bird and flora identification guide were also used. (Barlow & Dodman, 2015; Garcia-del-Rei, 2011).

For a better organization of the data the observation points were named P1 and P2. Birds and plants were identified to the lowest possible taxonomic level. Birds were also grouped according to Habitats.

The diet of each species was determined by their behavior during sampling, according to Sick 1997 and the Wikiaves website. The following categories were identified: insectivores (feeding on insects), omnivores (grains, fruits, insects, fish, among others), detritivores (meat of dead animals), piscivores (fish), carnivores (meat of live animals), nectarivores (flower nectar), granivores (grains) and frugivores (fruits and berries). Individuals that presented more than two types of diet were classified as omnivores.

As for the data analysis, all the information was compiled in databases, previously created in Microsoft Excel. The graphics and tables were created using Microsoft Excel software and the maps with the QGIS software (Quantum Geographic Information System).

## **RESULTS AND DISCUSSION**

### **Flora**

The wind farm is situated on a plateau with an altitude ranging from 170 to 300 metres. The plateau presents a slight inclination towards the Southeast coast (2 to 4%). The adjacent areas are located on the lower floors where the main streams that flow into the City of Praia are formed (Gabinete Advocacia & Consultoria and Procuradoria Jurídica - SKM Company, 2009).

In the study area and surrounding areas, a total of 14 plant species were recorded, distributed in 10 Orders and 11 Families as shown in **Table 1 & Photographic Annex Plant & Figure 3**. Six plant species were not identified. Some species are still unidentified, due to the state they were in. In this

case they were very dry, which made their identification more difficult (**Table 1 & Photographic Annex Plant**).

**Table 1** – Flora survey recorded in the Wind Farm and Buffer Zone area, in Monte de São Filipe, City of Praia, Santiago Island, between the 14th and 20th of April, 2023. Biosfera, 2023. Registration: (PE) Wind Farm, (ZB) Buffer Zone, (L) Literature data; Conservation Status: (CR) Critically Endangered, (EN) Endangered, (VU) Vulnerable, (NT) Near Threatened, (LC) Least Concern, (EX) Extinct, (DD) Data Deficient; (NR) No assessment; (NA) No information; Endemic: (N) Native, (I) Introduced and (E) Endemic.

Order	Family/Species	Register	Conservation Status*	Endemism
Asterales	<b>Asteraceae</b>			
	Craqueja <i>Launea melanostigma</i>	PE	NA	N
Cucurbitales	<b>Cucurbitaceae</b>			
	São Caetano <i>Momordica charantia charantia</i>	PE & ZB	NA	I
Fabales	<b>Fabaceae</b>			
	Parkinsonia <i>Parkinsonia aculeata</i>	PE	LC	
	Acácia americana <i>Prosopis juliflora</i>	PE & ZB	-	I
	Lotus <i>Lotus sp</i>	PE	-	-
	Canudo-de-Pito <i>Senna pendula</i>	PE & ZB	LC	-
Gentianales	<b>Apocynaceae</b>			
	Gestiba <i>Cynanchum daltonii</i>	PE & ZB	LC	E
Lamiales	<b>Plantaginaceae</b>			
	Alegrin brabo <i>Campylanthus glaber</i>	ZB	EN	E
Malpighiales	<b>Euphorbiaceae</b>			
	Purgueira <i>Jatropha curcas</i>	PE & ZB	NA	I
Malvales	<b>Cistaceae</b>			
	Piorno-de-flor-amarela <i>Helianthemum gorgoneum</i>	ZB	EN	E
Poales	<b>Poaceae</b>			
	Azagaia <i>Heteropogon contortus</i>	PE & ZB	-	N
Ranunculales	<b>Menispermaceae</b>			
	<i>Cocculus pendulus</i>	ZB	-	N
Solanales	<b>Convolvulaceae</b>			
	Lacacã <i>Ipomoea pes-caprae</i>	PE	LC	N
	<b>Solanaceae</b>			
	Charuteira <i>Nicotiana glauca</i>	PE	-	I

**Gestiba** (*Cynanchum daltonii*), **Alegrin brabo** (*Campylanthus glaber*) and **Piorno-de-flor-amarela** (*Helianthemum gorgoneum*) are endemic species of Cabo Verde.



**Figure 3** - Map showing the distribution of plant species in the Buffer zone and Monte Filipe Wind Farm, Santiago Island, Biosfera, 2023.

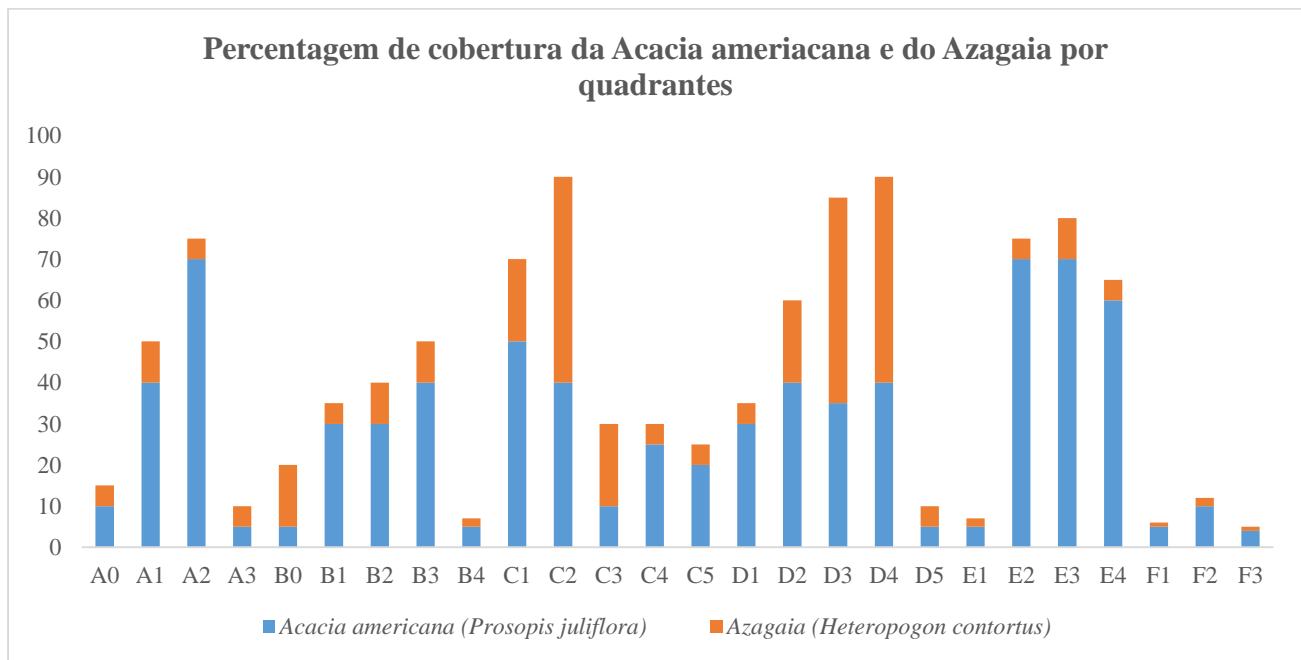
Species such as **Craqueja** (*Launea melanostigma*), **Parkinsonia** (*Parkinsonia aculeata*), **Lotus** (*Lotus sp.*), **Lacacã** (*Ipomoea pes-caprae*) and **Charuteira** (*Nicotiana glauca*) were recorded only in the Wind Farm.

**São Caetano** (*Momordica charantia charantia*), **Acácia americana** (*Prosopis juliflora*), **Canudo-de-Pito** (*Senna pendula*), **Gestiba** (*Cynanchum daltonii*), **Purgueira** (*Jatropha curcas*) and **Azagaia** (*Heteropogon contortus*) were species found in both the Buffer Zone and Wind Farm during the study. And the **Alegrin brabo** (*Campylanthus glaber*), **Piorno-de-flor-amarela** (*Helianthemum gorgoneum*) and (*Cocculus pendulus*) occurred only in the Buffer Zone.

An earlier study carried out prior to the construction of the wind farm (SKM Company, 2009) cites the presence of 10 species: **Ratcha pedra** (*Alternanthera caracasana*), **Alfavaca** (*Heliotropium*), **lacacã** (*Ipomea pes-caprae*), **Malva** (*Abutilon sp.*), **São caetano** (*Momordica charantia*), **Acácia americana** (*Prosopis juliflora*), **Bordolega** (*Portulaca oleraceae*), **Azagaia** (*Heteropogon contortus*), **Craqueja** (*Launea melanostigma*) and the **Costa branca** (*Boehavia difusa*).



Species such as, **Acacia americana** (*Prosopis juliflora*) and **Azagaia** (*Heteropogon contortus*) were not shown on the map above, because they are species that were found throughout the study area (Figure 4).



**Figure 4** - Percentage of *Acacia americana* (*Prosopis juliflora*) and *Azagaia* (*Heteropogon contortus*) cover per 500 x 500m quadrants in the Wind Farm and Buffer Zone.

These species have low water requirements so adapts very well in arid and semi-arid areas. The soil of the Wind Farm is covered by mantle basalts, basanitoids of the eruptive complex. It is possible to observe abundant stony material on the surface of the study area. Along all the park's boundary zone it is possible to note the presence of surface gullies, which were introduced during the implementation phase of the Wind Farm. The land is used as extensive grazing support for cattle and goats that feed on some plant species present in the area (Gabinete Advocacia & Consultoria and Procuradoria Jurídica - SKM Company, 2009).

The family with the highest number of species was the Fabaceae with a total of 4 species. The other families presented only one species. The Fabaceae family is very abundant in quantity of species, being considered the third largest terrestrial plant family. It has a cosmopolitan distribution, being present in all major biomes in almost all climatic regions.



The map below (**Figure 5**) shows the number of species found by quadrant. It can be observed that Quadrant B1 presented the highest richness, with 10 species recorded, followed by Quadrant C2, with 7 species found and D1 with 5 species recorded.



**Figure 5** - Number of plant species found in each quadrant in the Wind Farm and Buffer Zone, Monte de São Filipe, Santiago Island, Biosfera, 2023.

## **Birds**

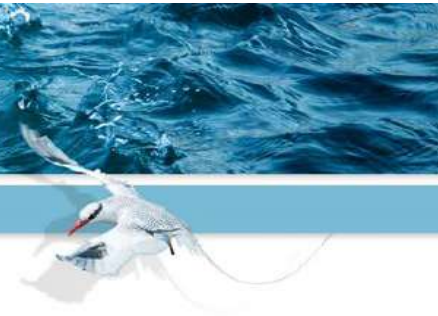
Over the study period, 15 bird species belonging to 11 orders and 13 families were identified within the Wind Farm area (**Table 2 & Photographic Appendix of Birds**).

**Table 2** – Birds survey recorded in the Wind Farm and Buffer Zone area, in Monte de São Filipe, City of Praia, Santiago Island, between the 14th and 20th of April, 2023. Biosfera, 2023. Area: (T) Transect, (PFO) Fixed Point of Observation, (L) Literature Data, (A) Adible. Conservation status: (CR) Critically endangered, (EN) Endangered, (VU) Vulnerable, (NT) Near threatened, (LC) Least concern, (EX) Extinct, (DD) Data deficient; (NR) No assessment; (NA) No information; Diet: (ONI) Omnivorous; (CAR) Carnivorous; (INS) Insectivorous, (DET) Detritivorous, (FRU) Frugivorous, (GRA) Granivorous, (NEC) Nectarivorous; Habitats: (A) Aquatic, (S) Silvicultural, (L) Waders and (M) Marine; Endemism: (N) Native, (I) Introduced and (E) Endemic.

Family/common name/scientific name	Register	Conservation Status*	Diet	Habitats	Endemism
<b>Alaudidae</b>					
Calhandra pastor <i>Eremopterix nigriceps</i>	T e V	PP	INS & GRA	S	N
<b>Alcedinidae</b>					
Passarinha <i>Halcyon leucocephala</i>	PFO, A, T e V	PP	INS	S	N
<b>Apodidae</b>					
Andorinhaão de CV <i>Apus alexandri</i>	PFO, T e V	PP	INS	S	E
<b>Ardeidae</b>					
Garça boeira <i>Bubulcus ibis</i>	PFO, T e V	PP	ONI	L	N
<b>Columbidae</b>					
Pombo comum <i>Columba livia</i>	T, V e L	PP	ONI	S	N
Pombo <i>Columba sp.</i>	T e V	PP	ONI	S	
<b>Falconidae</b>					
Falcão <i>Falco tinnunculus alexandri</i>	T, V e L	PP	CAR & INS	S	E
<b>Numididae</b>					
Galinha do mato <i>Numida meleagris</i>	T, V e L	PP	ONI	S	I
<b>Passeridae</b>					
Pardal espanhol <i>Passer hispaniolensis</i>	PFO, T, V e L	PP	ONI	S	N
Pardal de terra <i>Passer iagoensis</i>	PFO, T, V e L	PP	ONI	S	E
<b>Phasianidae</b>					
Codorniz <i>Coturnix coturnix</i>	T e V	PP	INS & GRA	S	N
<b>Sylviidae</b>					
Toutinegra tomilheira <i>Curruca conspicillata</i>	T, A e V	PP	INS	S	N
<b>Accipitridae</b>					
Milhafre-preto <i>Milvus migrans</i>	PFO, V	PP	CAR	S	Migratory
<b>Glareolidae</b>					
Corredeira <i>Cursorius cursor</i>	L	PP	INS	S	N
<b>Corvidae</b>					
Corvo do deserto <i>Corvus ruficollis</i>	L	PP	ONI	S	N

\*IUCN 2023

Of the 15 bird species found in this survey, 8 have not been catalogued in studies of the region, namely, **Calhandra pastor** (*Eremopterix nigriceps*), **Passarinha** (*Halcyon leucocephala*), **Garça**



**boeira** (*Bubulcus ibis*), **Corredeira** (*Cursorius cursor*), **Pombo** (*Columba* sp. ), **Codorniz** (*Coturnix coturnix*), **Toutinegra tomilheira** (*Curruca conspicillata*) and **Milhafre-preto** (*Milvus migrans*).

Among all the birds identified, regardless of their use of the area, all are classified as being of Least Concern according to the IUCN (International Union for Conservation of Nature).

In terms of endemism, 3 species were identified as endemic to Cape Verde: *Apus alexandri*, *Falco tinnunculus alexandri* and *Passer iagoensis*.

During the period in which this study was carried out, an individual of **Milhafre-preto** (*Milvus migrans*) was recorded at the Wind Farm through direct observation. The bird is a diurnal bird of prey, migratory, which according to the IUCN is classified as *Least Concern*. Generally the bird builds its nest in an elevated area, which may be a tree, a cliff or even a building, or taken advantage of from other species. Since in the study area there is no suitable habitat for the presence of this species, it is considered that its occurrence was only occasional, possibly on migration to breeding/feeding areas.

Species such as, *Cursorius cursor* and *Corvus ruficollis* were not observed. However, they were bird species, which at some point have been observed by the Wind Farm technicians/guards.

In terms of seabirds (nocturnal birds), 100% (n = 4) of the surveys applied stated that they had not noticed or heard seabirds in the area of the park.

#### Non-linear transects

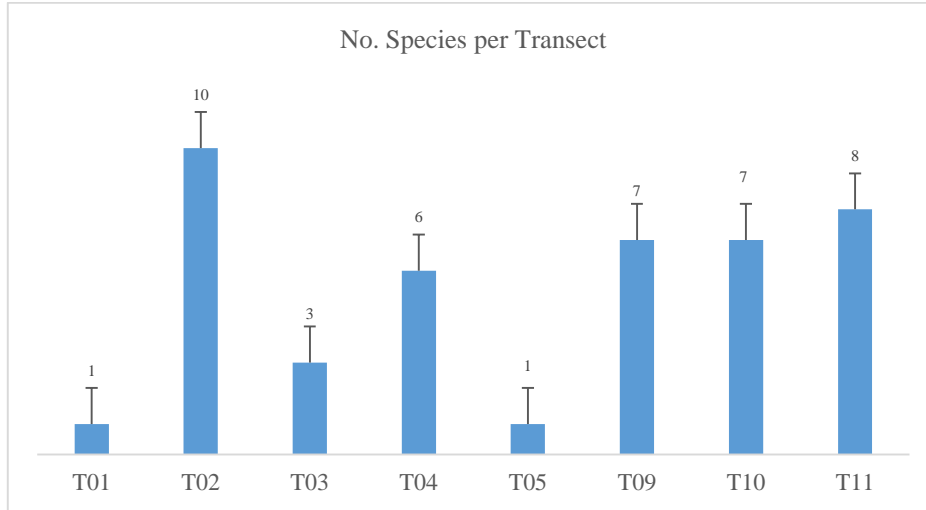
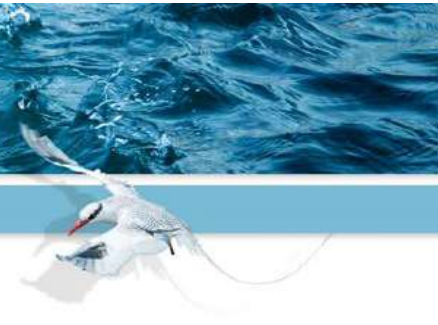
Of the 8 non-linear transects made within the Park and 12 bird species were recorded, with transect T02 showing the highest species richness (**Figure 3 & 4 & Table 3**).



**Figure 6** - Non-linear transects carried out at the Wind Farm, Monte de São Filipe, City of Praia, Santiago Island, between the 14th and 20th of April 2023. Biosphere, 2023.

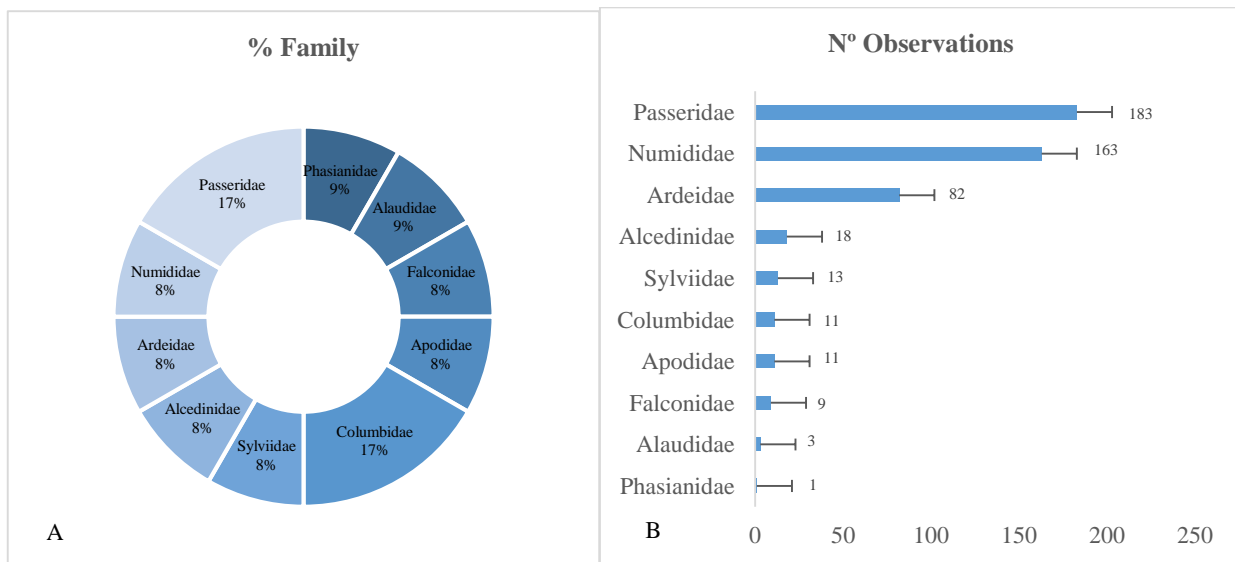
**Table 3** – Bird species observed in each non-linear transect (T01, T02, T03, T04, T05, T09, T10 and T11), as well as the relative frequency percentage (%FR) obtained in each non-linear transect, at the Wind Farm, Monte de São Filipe, Praia, Santiago Island, April 2023. Biosphere, 2023.

Species	T01	%FR T01	T02	%FR T02	T03	%FR T03	T04	%FR T04	T05	%FR T05	T09	%FR T09	T10	%FR T10	T11	%FR T11	Total Geral	%FR
<i>Apus alexandri</i>			7	6					2	100			1	0,75	1	1,96	11	2,23
<i>Eremopterix nigriceps</i>			3	3													3	0,61
<i>Coturnix coturnix</i>															1	1,96	1	0,20
<i>Falco tinnunculus alexandri</i>			2	2							4	6,78	3	2,24			9	1,82
<i>Numida meleagris</i>	2	100	7	6	4	40					31	52,54	99	73,88	20	39,22	163	33,00
<i>Bubulcus ibis</i>			62	54			1	0,83			7	11,9	12	8,96		0,00	82	16,60
<i>Passer hispaniolensis</i>			3	3			15	12,4			3	5,08	6	4,48	6	11,76	33	6,68
<i>Passer iagoensis</i>			20	17			100	82,6			10	17	10	7,46	10	19,61	150	30,36
<i>Halcyon leucocephala</i>			7	6			1	0,83			3	5	3	2,24	4	7,84	18	3,64
<i>Columba sp.</i>			1	0,87											6	11,76	7	1,42
<i>Columba livia</i>					3	30	1	0,83								0,00	4	0,81
<i>Curruca conspicillata</i>			3	2,61	3	30	3	2,48			1	1,69			3	5,88	13	2,63
<b>Total</b>	<b>2</b>	<b>100</b>	<b>115</b>	<b>100</b>	<b>10</b>	<b>100</b>	<b>121</b>	<b>100</b>	<b>2</b>	<b>100</b>	<b>59</b>	<b>100</b>	<b>134</b>	<b>100</b>	<b>51</b>	<b>100</b>	<b>494</b>	<b>100</b>



**Figure 7** – Bird species recorded at each transect at the Wind Farm, Monte de São Filipe, City of Praia, Santiago Island, April 2023. Biosfera, 2023.

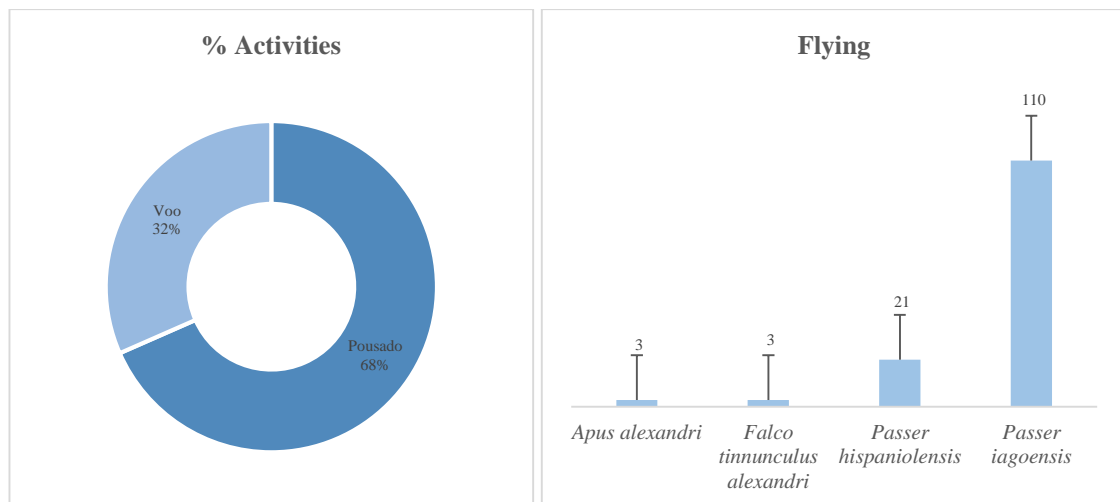
The families with the highest species richness were Columbidae (2 species; 17%) and Passeridae (2 species; 17%) (**Figure 5**). And in terms of number of observations per family, the most notable were Numididae (n = 163; 33%) and Passeridae (n = 183; 37%).



**Figure 8** – Percentage of Family ( Graph A) and Number of Observations ( Graph B) recorded at each transect at the Wind Farm, Monte de São Filipe, City of Praia, Santiago Island, April 2023. Biosfera, 2023.

In terms of Habitats, 83% of the birds observed were classified as forest (n = 412) and 17% as waders (n = 82). Birds in the Aquatic and Marine categories were not recorded during the study period. In the forestry category are found species such as *Apus alexandri*, *Columba livia*, *Columba sp*, *Coturnix coturnix*, *Curruca conspicillata*, *Eremopterix nigriceps*, *Falco tinnunculus alexandri*, *Halcyon leucocephala*, *Numida meleagris*, *Passer hispaniolensis* and *Passer iagoensis*.

Sixty-eight percent of the birds recorded (n = 338) were at rest and 32% were flying (n = 156). Among the birds in flight, the most noteworthy were *Passer iagoensis*, *Passer hispaniolensis*, *Falco tinnunculus alexandri* and the *Apus alexandri* (**Figure 9**).



**Figure 8** - Percentage of Activity (Left Graph) and Number of Individuals Flying (Right Graph) registered in the Wind Farm, Monte de São Filipe, City of Praia, Santiago Island, April 2023. Biosfera, 2023.

#### Fixed points of observation

At the two fixed observation points, 7 bird species were recorded (Table 4). The *Bubulcus ibis* (32%), *Passer iagoensis* (30%) and the *Columba livia* (23%) showed the highest percentages of relative frequency. Both observation points presented the same number of species observed.



**Table 4** – Bird species recorded at the Fixed Points of Observation and their relative frequency percentages (%FR) in the Wind Farm, Monte de São Filipe, City of Praia, Santiago Island, April 2023. Biosfera, 2023.

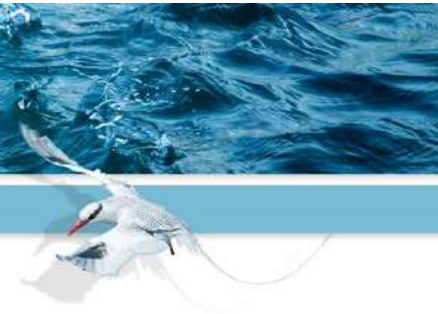
Species	P1	%FRP1	P2	%FRP2	Relative Abundance	%FR
<i>Apus alexandri</i>	6	5	2	3	8	4
<i>Bubulcus ibis</i>	53	45	9	12	62	32
<i>Milvus migrans</i>	-	-	1	1	1	1
<i>Passer hispaniolensis</i>	3	3	14	18	17	9
<i>Passer iagoensis</i>	8	7	50	65	58	30
<i>Halcyon leucocephala</i>	2	2	1	1	3	2
<i>Columba livia</i>	45	38	-	-	45	23
<b>Total</b>	<b>117</b>	<b>100</b>	<b>77</b>	<b>100</b>	<b>194</b>	<b>100</b>

### Buffer Zone

Outside the Wind Farm, in the 500m of *Buffer Zone*, a total of 10 bird species were recorded, distributed in 7 families (**Figure 10 & Table 5**).



**Figura 9** – Non-linear transects (T06, T06 and T08) realized in the 500m of *buffer zone*, Wind Farm, Monte de São Filipe, City of Praia, Santiago Island, April 2023. Biosfera, 2023.



**Table 5** - Number of birds species observed in each non-linear transect (T06, T07 and T08), and the percentage of relative frequency (RF) obtained in each non-linear transect, realized in the 500m of *buffer* zone, Wind Farm, Monte de São Filipe, City of Praia, Santiago Island, April 2023. Biosfera, 2023.

Family/common name/scientific name	T06	%FR T06	T07	%FR T07	T08	%FR T08	Relative frequency	%FR
<b>Alcedinidae</b>	7	13	1	1	4	9	12	7
Passarinha <i>Halcyon leucocephala</i>	7	13	1	1	4	9	12	7
<b>Ardeidae</b>	31	60	3	4	4	9	38	22
Garça boeira <i>Bubulcus ibis</i>	31	60	3	4	4	9	38	22
Garça branca intermedia <i>Ardea intermedia</i>					1	2	1	1
<b>Columbidae</b>	10	19	3	4	17	40	30	17
Pombo comum <i>Columba livia</i>	1	2		0	10	23	11	6
Pombo <i>Columba sp.</i>	9	17	3	4	7	16	19	11
<b>Falconidae</b>	2	4		0	3	7	5	3
Falcão <i>Falco tinnunculus alexandri</i>	2	4		0	3	7	5	3
<b>Numididae</b>		0	18	22	4	9	22	13
Galinha do mato <i>Numida meleagris</i>		0	18	22	4	9	22	13
<b>Passeridae</b>		0	55	68	10	23	65	37
Pardal espanhol <i>Passer hispaniolensis</i>		0	35	43		0	35	20
Pardal de terra <i>Passer iagoensis</i>		0	20	25	10	23	30	17
<b>Sylviidae</b>	2	4	1	1	1	2	4	2
Toutinegra tomilheira <i>Curruca conspicillata</i>	2	4	1	1	1	2	4	2
<b>Total</b>	<b>52</b>	<b>100</b>	<b>81</b>	<b>100</b>	<b>44</b>	<b>100</b>	<b>177</b>	<b>100</b>

However, in the literature there are records of *Ammomanes cincturus*, *Cursorius cursor*, *Eremopterix nigriceps*, *Corvus ruficollis* and *Apus apus* (Gabinete de Advocacia & Consultoria e Procuradoria Jurídica - Empresa SKM, 2009).

In this study, both in the Wind Farm area and in the Buffer Zone, several nests of *Passer hispaniolensis*, *Columba livia*, and *Falco tinnunculus alexandri*. mainly in the *Buffer Zone* (**Figure 11**).



**Figure 11** – Bird nests detected at the Wind Farm, and the *Buffer Zone*, Monte de São Filipe, City of Praia, Santiago Island, April 2023. Biosfera, 2023.

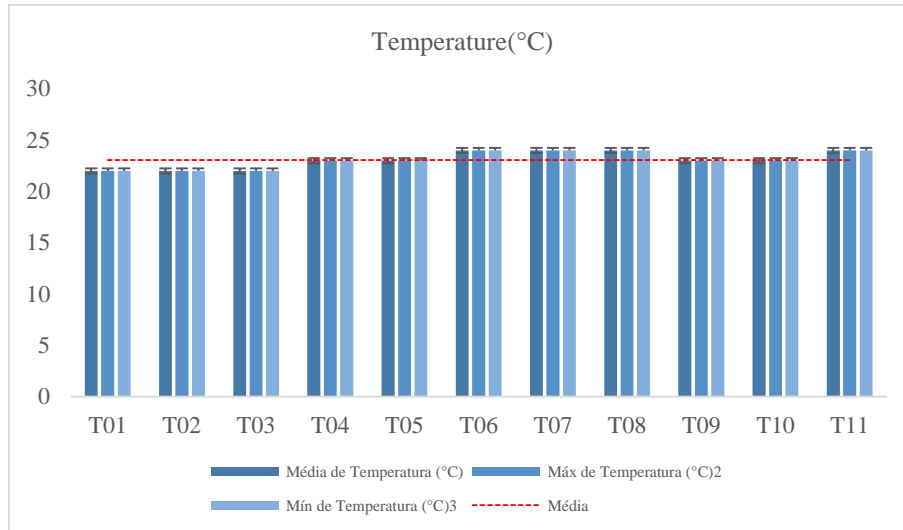
Within the park, we have also identified nests built on the ground, probably of the *Numida meleagris* (**Figure 12**).



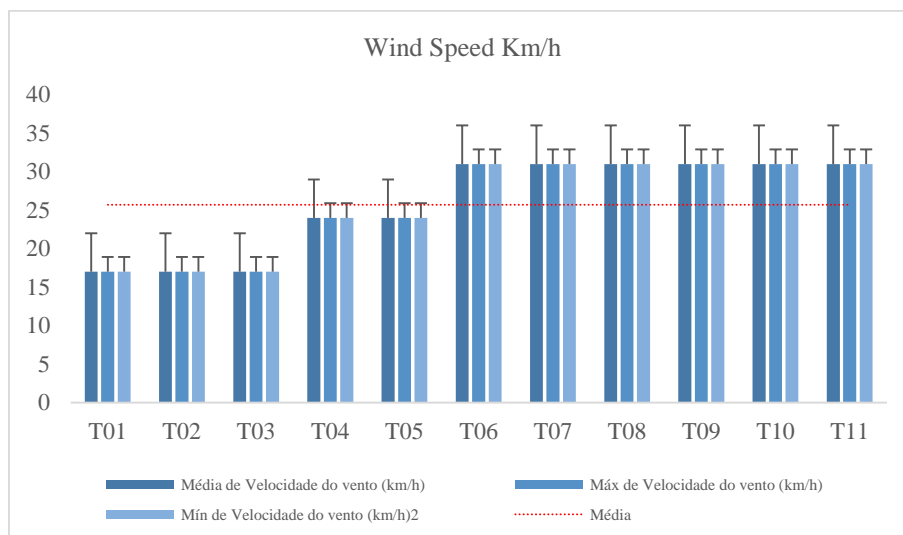
**Figure 12** - Nests build on the ground, probably of the *Numida meleagris* identified in the Wind Farm, Monte de São Filipe, City of Praia, Santiago Island, April 2023. Biosfera, 2023.

### **Environmental Factors**

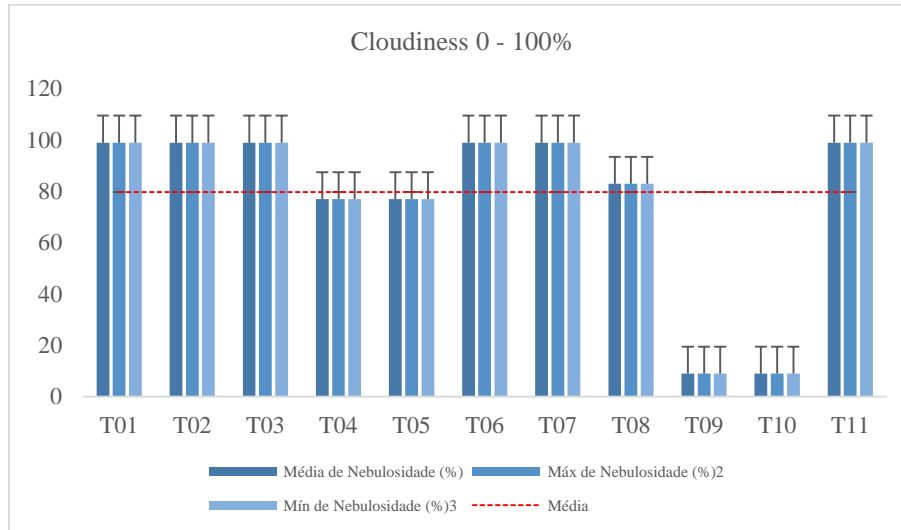
The environmental variables recorded during the study: temperature averaged 23.07°C, wind speed 25.7km/h, and cloudiness 79.7% (**Figures 13, 14 & 15**).



**Figure 10** – Mean, maximum and minimum temperature values (°C) registered in the Wind Farm, Monte de São Filipe, City of Praia, Santiago Island, April 2023. Biosfera, 2023.



**Figure 11** - Average, maximum and minimum Wind Speed values (km/h) registered in the Wind Farm, Monte de São Filipe, City of Praia, Santiago Island, April 2023. Biosfera, 2023.



**Figure 12** - Average, maximum and minimum cloudiness values (0 - 100%) registered in the Wind Farm, Monte de São Filipe, City of Praia, Santiago Island, April 2023. Biosfera, 2023.

Regarding, the influence of weather conditions on the abundance of birds in the Wind Farm area and the *Buffer Zone* significant influences were reported for temperature ( $r^2 = 0.74$ ) and wind speed ( $r^2 = 0.28$ ).

### Others

During the sampling campaigns, two geckos and two lizards, were registered (**Figure 16 & 17**).



**Figure 13** – Location of the observation area of terrestrial reptiles in the Wind Farm, Monte de São Filipe, City of Praia, Santiago Island, April 2023. Biosfera, 2023.



**Figure 17**– Observed geckos in the Wind Farm, Monte de São Filipe, City of Praia, Santiago Island, April 2023. Biosfera, 2023.

In addition, a monkey was observed in the East - Southeast part of the park. Mammals such as cows and goats are frequently observed within the park (**Figure 18**).

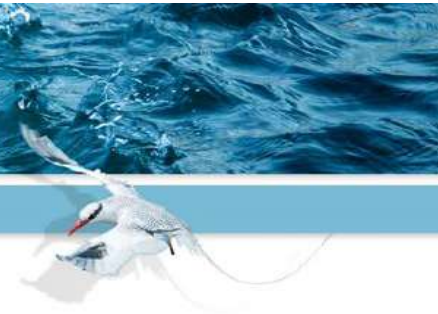


**Figure 18** – A monkey and cow observed in the Wind Farm, Monte de São Filipe, City of Praia, Santiago Island, April 2023. Biosfera, 2023.

Grasshoppers, ants, and various other insect species, including lichens were observed during the work (Wind Farm boundary area). Lichens are organisms formed by association between species of algae and fungi. Those found in the park are included in the category of encrusting, similar to a crust (**Figure 19**). They are not able to tolerate pollution. The fact that they survive only in places that are in good environmental condition makes them bioindicators.



**Figure 19** - Lichens observed in the Wind Farm, Monte de São Filipe, City of Praia, Santiago Island, April 2023. Biosfera, 2023.



## FINAL CONSIDERATIONS

In general, the Wind Farm is the home of a considerable avifauna and flora, with common and uncommon species, among them species endemic of Cabo Verde. Of the 15 bird species found during the study, only 8 have not been catalogued in previous studies of the region, such as the *Eremopterix nigriceps*, *Halcyon leucocephala*, *Bubulcus ibis*, *Coturnix coturnix*, *Curruca conspicillata*, *Milvus migrans* and the *Cursorius cursor* species.

The bird species of the families Alaudidae, Alcedinidae, Apodidae, Ardeidae, Columbidae, Falconidae, Numididae, Passeridae, Phasianidae, Accipitridae, Glareolidae, and Corvidae recorded in this study have a common distribution throughout most of the Capeverdean territory.

In terms of local flora, the species of *Prosopis juliflora* and *Heteropogon contortus* its is found in abundance abundant within the park area as well as in the adjacent areas. Many of the plant species identified previously were not found and it is expected that these species will be found after the rains. Of the 10 species previously identified in previous studies, only six were found, but in compensation new species were identified. This is because many species normally appear during the rainy season (August and September). The distribution of the flora and vegetation is conditioned by these two seasons of the year (rainy season and dry season). Some species are still unidentified, due to the state they were in. In this case they were very dry, which made their identification more difficult.

Knowledge about each species is very important, as it allows the conditions that ensure their presence at the site to be understood and the necessary steps to be taken to maintain them (Stencel and Caxambu, 2018), and therefore, maintenance of biodiversity.

Since this is the first study of the year, the results are not considered final. There are still more sampling campaigns to be done to continue the inventory of the avifauna and flora of the site. The campaigns will be done at different periods in a year so that we can see the variation in the number of species present in the area. In July, there will be another campaign, and the team will focus their efforts on the flora, seeing that the first one was more for reconnaissance of the area and to make a survey/list of the species present there.



## REFERENCES

- Cabéolica S.A. 2022. [CABÉOLICA - WEBSITE \(cabeolica.com\)](http://cabeolica.com) Acessado em 10 de abril de 2023.
- Develey, P.F. 2009. Métodos para estudos com aves, p. 153-168. In: Cullen, J. L.; Rudran, R.; Padua, C. V. (eds.). **Métodos de estudos em Biologia da Conservação e Manejo da Vida Silvestre, 2ª edição**. Curitiba: Editora UFPR.
- Barlow, C.R. & Dodman, T. 2015. **Guia de aves da Rota migratória do Atlântico Leste em África – Guia de Campo Fotográfico das Aves Aquáticas da Costa Atlântica de África**. Common Wadden Sea Secretariat, Wilhelmshaven, Alemanha; BirdLife International, Cambridge, Reino Unido; Programme Rich Wadden Sea, leewarden, Holanda.
- Gabinete Advocacia & Consultoria e Procuradoria Jurídica - Empresa SKM. 2009. **Estudo de Impacte Ambiental Cape Verde Wind Farm Extension Project. Resumo Não Técnico**. Santiago, Cabo Verde.
- Garcia-del-Rey, E. 2011. **Field Guide to the Birds of Macaronesia. Azores, Madeira, Canary Islands, Cape Verde**. Lynx Edicions, Bellaterra, Barcelona.
- GBIF | Global Biodiversity Information Facility (02 de maio de 2023). Disponível em:< <http://www.gbif.org>>. Acessado em 2 de maio de 2023
- IUCN, 2023. **The IUCN Red List of Threatened Species**. Version 2022-2. <https://www.iucnredlist.org>
- Sick H., 1997. **Ornitologia Brasileira I Helmut Sick**. Rio de Janeiro: Nova Fronteira. 910 p.
- Wikimedia Commos (25 de abril de 2023). Disponível em: <<http://commons.wikimedia.org>>.
- World Plants Complete Plant List (02 de maio de 2023). Disponível em:< <http://www.worldplants.de>>. Acessado em 2 de maio de 2023



**PLANTS IDENTIFIED DURING THE SURVEY OF THE  
AVIFAUNA AND FLORA IN THE WIND FARM IN NORTH OF  
PRAIA AIRPORT, SANTIAGO ISLAND**

**PHOTO ANNEX - PLANTS**



## **Acácia americana - *Prosopis juliflora***

An introduced tree species, belong to the Fabaceae family and adapts very well in the arid and semi-arid areas.



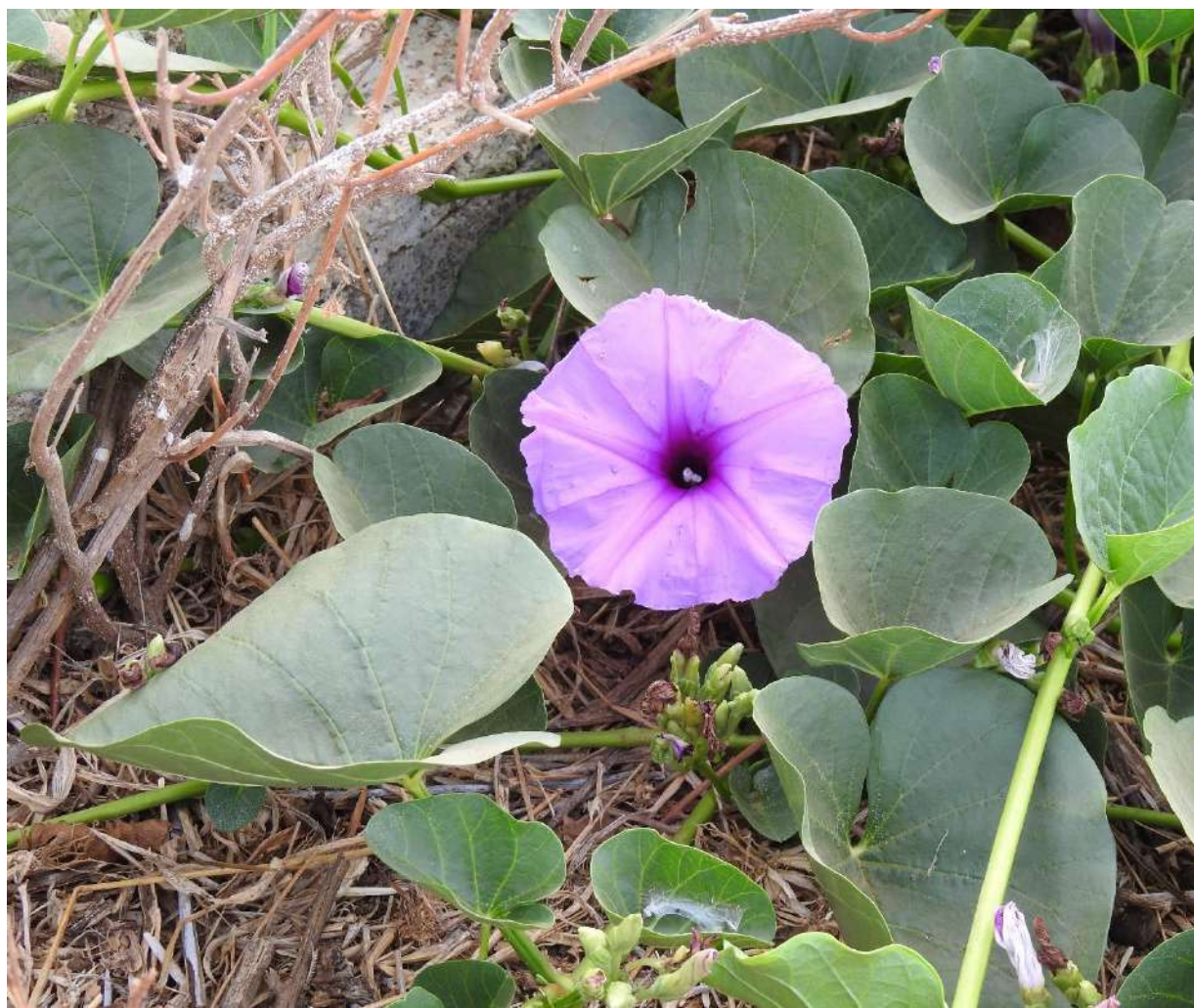
***Gestiba - Cynanchum daltonii (=synonym  
Sarcostemma daltonii Decne)***

An endemic species of Cabo Verde, belong to the Apocynaceae family and Recently assessed as Least Concern (LC) on the Cape Verde Red List. Grows primarily in the subtropical biome.



## **Piorno-de-flor-amarela-*Helianthemum gorgoneum***

An endemic species of Cabo Verde, belong to the Cistaceae family and It is listed as an endangered plant by the IUCN and Cabo Verde Red List. Grows in sub-humid and semi-arid areas, on rocky and volcanic soils.



## Lacacão - *Ipomoea pes-caprae*

Native species of the Convolvulaceae family. It is a tuberous geophyte and grows primarily in the tropical and subtropical biome.



## **Lotus - *Lotus sp***

A genus from the Fabaceae family, which has a cosmopolitan distribution and its species are adapted to different habitats, from coastal environments to high altitudes. They are tolerant of poor soils and high salinities.



## ***Purgueira - Jatropha curcas***

An introduced tree species, of the the Euphorbiaceae family. It is a shrub or tree and grows primarily in the seasonally dry tropical biome.



## **São Caetano - *Momordica charantia***

A native species, of the Cucurbitaceae family. It is a climbing annual and grows primarily in the wet tropical biome.



## **Charuteira - *Nicotiana glauca***

An introduced species, of the the Solanaceae family. It is a shrub or tree and grows primarily in the subtropical biome.



## ***Parkinsonia aculeate***

An introduced species, of the Solanaceae family. This plant has very high tolerance to dry conditions, and prefers full sun exposure, but can grow in a wide range of dry soils.



## **Canudo-de-Pito-*Senna pendula***

From of Fabaceae family. It is a shrub and grows primarily in the seasonally dry tropical biome.



***Craqueja - Launea melanostigma*  
(=*Launaea arborescens*)**

A native species of Cabo Verde, in the Asteraceae family.



## ***Azagaia- Heteropogon contortus***

Native species of the Poaceae family. It is a perennial and grows primarily in the seasonally dry tropical biome.



## **Alegrin brabo - *Campylanthus glaber***

A native species of the Scrophulariaceae family and recently assessed as Endangered (EN) on the Cabo Verde Red List. It is a creeping shrub and grows mainly in the subtropical biome.



## ***Cocculus pendulus* (= *Cebatha pendula*)**

Native species of the Menispermaceae family. It is a scrambling shrub or liana and grows primarily in the desert or dry shrubland biome.



***E1 - By identifying***



***E2 – By identifying***



***E4 - By identifying***



***E5- By identifying***



***E6- By identifying***



***E7- By identifying***