Proposed Expansion of Rodrigues Airport Draft Environmental and Social Impact Assessment Report

VOLUME 2 OF 3

Report prepared for Airport of Rodrigues Ltd.

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AFD Agence Française de Développement
AGL Airfield Ground Lighting
AOI Area of Influence
AQNR Anse Quitor Natural Reserve
ARL Airport of Rodrigues Ltd
AML Airports of Mauritius Co Ltd
ASDA Accelerate-Stop Distance Available
ATC Air Traffic Control
CIA Cumulative Impact Assessment
CCR Constant Current Regulators
CCTV Close Circuit TeleVision
DVOR Doppler VHF Omnidirectional Radio Range
DME Distance Measuring Equipment
EC European Commission
EHS Environment Health Safety
EHSG Environmental, Health and Safety Guidelines
EIA Environmental Impact Assessment
EPA Environment Protection Act
E&S Environmental & Social
ESIA Environmental and Social Impact Assessment
ESCP Environmental and Social Commitment Plan
ESF Environmental and Social Framewor
ESMP Environmental and Social Management Plan
ESS Environmental and Social Standard
ESS1 Assessment and Management of Environmental and Social Risks and Impacts
EU European Union
E&S Environmental and Social
GoM Government of Mauritius
GSE Ground Service Equipment
HVAC Heating, Ventilation, and Air Conditioning
ICAO International Civil Aviation Organisation
IFC International Finance Corporation
MDGs Millennium Development Goals
LDA Landing Distance Available
LED Light Emitting Diode
LON Length of need
NDB Non-Directional Beacon
OLS Obstacle Limitation Surface
PAPI Precision Approach Path Indicator
PCA Plaine Corail Airport
PDR Preliminary Design Report
PQC Pavement Quality Concrete
RAL Runway Approach Lights
RCSS Rodrigues council of Social Services

RESA Runway End Safety Area
RESA-O Overshoot Runway End Safety Area
RESA-U Undershoot Runway End Safety Area
RFF Rescue and Fire Fighting
RFFS Rescue and Fire Fighting Services
RGL Runway Guard Lights
RRA Rodrigues Regional Assembly
RTIL Runway Threshold Identification Lights
TODA Take Off Distance Available
ToR Terms of Reference
TORA Take Off Runway Available
SCP Stakeholder Commitment Plan
SEP Stakeholder Engagement Plan
SIDPR Sustainable Integrated Development Plan for Rodrigues
VDGS Visual Docking Guidance System
VEC Valued environmental and Social component
VHF / UHF Radio frequencies
VIP Very Important Person
VSAT Very Small Aperture Terminal
WB World Bank
World Bank ESF World Bank Environmental and Social Framework
WTP Wastewater Treatment Plant

6.4 Biological environment

6.4.1 Terrestrial biological context

6.4.1.1 Area of influence

The area of influence from a terrestrial natural context is mapped on the figure below.

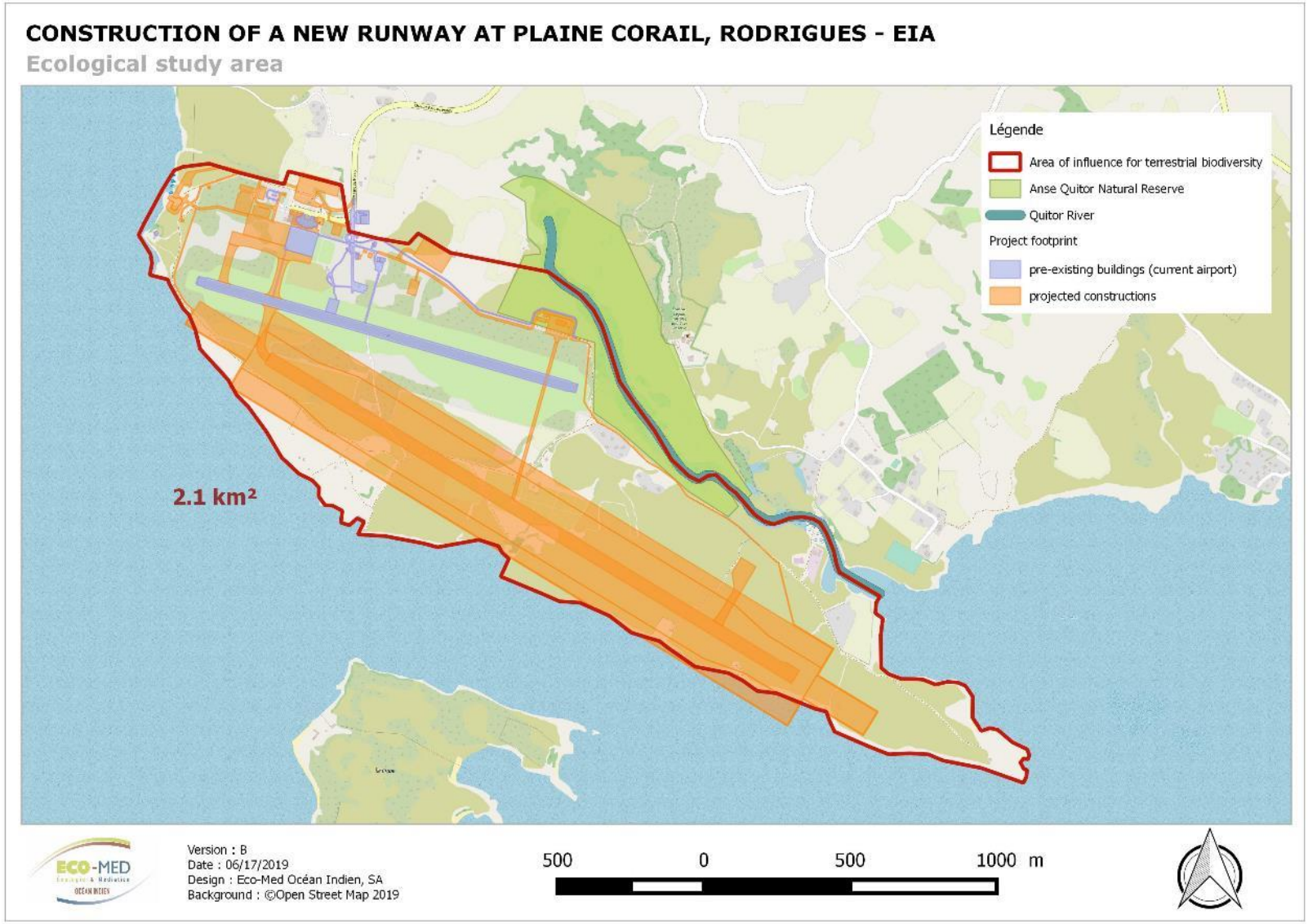

Figure 82: Area of influence

6.4.1.2 Vegetation and flora

6.4.1.2.1 Methodology (2018)

Main habitats and significant land features within the site were initially inspected from aerial photographs (Google Earth 2019). This was followed by site inspections from the 1st to the 4th of April, 2019. Distinct floral habitats were noted during this field campaign. Flora species of interest (native, endemic, endangered, protected) were mapped with a handheld GPS (Garmin GPS Map62), and the number of plants recorded when necessary and/or possible.
Botanical names, author citations, IUCN Red List categories for Rodrigues and regional status follows Strahm et al. 1989, Walter et al. 1997, Rivers et al. 2015 and Kirsakye 2015, the Mauritius Herbarium and the IUCN Red List (2019).

Sensitivity assessment of the habitats
Each of the terrestrial vegetation and habitat types were assigned a relative ecological rank (from “negligible” to “major”) based on species diversity, contributions to ecosystem functions (breeding sites for birds or reptiles…), the presence of rare endangered species and how common the vegetation and habitat type is within the island of Rodrigues.

Sensitivity assessment of the native flora
The sensitivity of the native flora observed in the area of influence was assessed according to the following criteria:

- ⇒ Endemicity or indigenous status: indigenous = 1 point; endemic to the Mascarenes = 2 points; endemic to Rodrigues = 3 points.
- ⇒ Protection status: protected in Rodrigues = 1 point; protected under the Forestry Act (1983) = 3 points
- ⇒ Threat level according to the red list: LC = 0 point; NT = 1 point; VU = 2 points; EN = 3 points; CR = 4 points.

A maximum of 10 points can be assigned to a species. An adjustment by the expert can be made to correct deficiencies in the status of certain species.
Depending on the score obtained, the species is classified according to the following sensitivity levels:

Table 40: Scale value used to assess the plant species sensitivity

Receptor sensitivity	Scale value
Negligible	**0 - 2**
Low	**2 – 4**
Medium	**4 – 6**
High	**6- 8**
Major	**8 – 10**

WARNING: Most of the vegetation (trees, shrubs) was burned (see Figure 83) because of salt sprays propagated by the last two cyclones that reached Rodrigues in early 2019. As a consequence, most of the trees, shrubs and thickets from the inner and shore-line communities were defoliated and thus difficult to identify properly in certain cases.

Figure 83: Example of burned vegetation

6.4.1.2.2 Methodology 2022/2023

The methodology of vulnerability assessment will be revised in the final ESIA update to meet the requirements of the World Bank ESF and the relevant ESS.

As per the World Bank ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources, “Habitat” is defined as a terrestrial, freshwater, or marine geographical unit or airway that supports assemblages of living organisms and their interactions with the non-living environment.

ESS 6 requires a differentiated risk management approach to habitats based on their sensitivity and values. This ESS addresses all habitats, categorized as ‘modified habitat’, ‘natural habitat’, and ‘critical habitat’, along with ‘legally protected and internationally and regionally recognized areas of biodiversity value’ which may encompass habitat in any or all of these categories;

- Modified habitats are areas that may contain a large proportion of plant and/or animal species of nonnative origin, and/or where human activity has substantially modified an area’s primary ecological functions and species composition. Modified habitats may include, for example, areas managed for agriculture, forest plantations, reclaimed12 coastal zones, and reclaimed wetlands;
- Natural habitats are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area’s primary ecological functions and species composition.;
- Critical habitat is defined as areas with high biodiversity importance or value, including: (a) Habitat of significant importance to Critically Endangered or Endangered species, as listed in the IUCN Red List of threatened species or equivalent national approaches; (b) Habitat of significant importance to endemic or restricted-range species; (c) Habitat supporting globally or nationally significant concentrations of migratory or congregatory species; (d) Highly threatened or unique ecosystems; and € Ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d).
- AQNR is hence a ‘critical habitat’ as per ESS6.

6.4.1.2.3 Results

This section describes the terrestrial vegetation and habitat types recorded in the area of influence for terrestrial biodiversity and briefly outlines the relative ecological ranking for each. Descriptions of the ten various vegetation types are provided in the table below and mapped in Figure 88.

Table 41: Habitat types recorded at the area of influence

ID	Sensitivity	Name	Area (ha)	% of the total surface
HA1	**Medium**	Grazing lands on basaltic resurgences	4.55	**2.03%**
	Medium	Grazing lands on calcarenic substratum	66.61	**29.73%**
HA2	**Medium**	Coastal vegetation dominated by Ipomoea pes caprae (shore-line community)	11.52	**5.14%**
HA3	**Negligible**	Anthropized areas	62.77	**28.02%**
HA4	**Major**	Dry forest	17.57	**7.84%**
HA5	**Medium**	Riparian vegetation	1.20	**0.54%**
HA6	**Medium**	Estuarine habitat	8.25	**3.68%**
HA7	**Medium**	Calcarenic dry lawns of anthropogenic origin	2.19	**0.98%**
HA8	**Low**	Coastal grasslands dominated by secondarized thickets (*Lantana camara*)	25.55	**11.40%**
HA9	**Negligible**	Secondarized thickets (*Leucaena leucocephala*)	23.84	**10.64%**

Originally, there was no natural open savannah or grasslands by the coast of Rodrigues. Drought, starvation and grazing are likely to be the most important factors responsible for the disappearance of forested lands throughout the island. Rodrigues, estimated to now support 3,000 cattle and 7,000 sheep and goats, had 4,000 and 12,000 respectively in 1981.

The study site comes on a limestone substratum (calcarenite) mostly turned into pastoral landscapes, though patches of basalt are punctually found (**Figure 86**). Species growing on calcarenite (mainly grasses) are generally the same as those growing on basalt and we found no relevant differences in the vegetation communities from the two substratum. **Grazing lands dominated by introduced grasses** (**ID1**) now dominate the landscape in Plaine Corail. The pastoral landscapes cover about 43% of the total surface area of the study site. A **shore-line community** can be distinguished (**ID2**) with halophytic/halotolerant species, such as *Portulaca oleraceae* or *Ipomoea pes-caprae*, the latter forming a dense mat of low growth, completely covering the soil (**Figure 86A**). The **inner littoral community** (**ID1**) is now composed of intensely grazed grasses spiked with small twisted trees or shrubs which usually do not exceed more than 3 meters. A very large population of *Elaeodendron orientale* (“Bois d’olives”), endemic to the Mascarenes, occurs in Plaine Corail and is of great interest within the limits of the area of influence (**Figure 86B**). Other introduced shrub or tree species can be found, such as *Euphorbia tiraculli*, *Wikstroemia indica* or *Prosopis juliflora.* Some scarce and threatened endemic trees and shrubs were able to survive within the grazing lands: i.e. *Foetidia rodriguesiana* (critically endangered) and *Phyllanthus dumentosus* (vulnerable). The range of

grass species can also be seen as a component of biodiversity in the area of influence, with a broad array of prostrate and erect forb species that considerably enhance the floral biodiversity: *Sarcostemma viminale* (vulnerable), *Fimbristylis* spp., *Cyperus* spp. or the prostrate and rare fern *Adiantum rhizophorum*. A dry calcarenic lawn sequence (**ID7, Figure 86F**) is noted on the area of influence (less than 1% of the total surface area), composed of a sparse but original herbaceous vegetation dominated by *Fimbristylis cymosa* and *Fimbristylis dichotoma*.

Lantana's thickets cover a large part of the grasslands (**ID8**). The species were introduced in the late 1920s and already considered widespread in the lowlands in 1970. It now covers more than 10% of the total surface area of the study site, which is probably underestimated as most of the thickets were totally burned by salt sprays after the tropical storm winds of the cyclone Gelena in March 2019.

Anse Quitor valley, right beside the island's airport, is one of the few reserves that had been created from the 1970s proposals for protecting the remnants of native vegetation. Anse Quitor was finally fenced in 1986 thanks to a FAO funding for revitalizing agriculture. Elsewhere, there are no intact native forests left on Rodrigues. Anse Quitor is known as one of two most important sites for endemic plants of **the lowland dry forest** (**ID4, Figure 86D**). It covers 30 ha, where about 7 ha has been weeded and planted with native species. The valley contains viable populations of several of Rodrigues's most important endemic plants, such as *Zanthoxylum paniculatum, Polyscias rodriguesiana* and large populations of the palms *Latania vershaffeltii* (**Figure 86A**) and *Hyophorbe verschaffeltii*. Restoration started in 1997 with the propagation of 28 native and endemic species, providing a long term security for several species that were intended to disappear in the near term.

The upper part of the Anse Quitor River is composed of degraded **freshwater riparian habitats (ID5, Figure 86H)**, a degradation probably accentuated by the floods caused recently by the past two cyclones in early 2019. Some sequences of riparian habitats are still preserved with shrubs composed of the native *Thespesia populnea*, which is resistant to salt spray and strong winds. The shrub's spreading lower branches leads to dense and impenetrable thickets that is very attractive for the reproduction of the striated heron (*Butorides striata*). Wetland plant communities are locally observed at the boundary between the freshwater banks and the estuarine habitats as we recorded the submersed *Paspalidium geminata* herbaceous community along with the native and rare *Cyperus iria.*

Figure 84: Submersed grass bed of Paspalidium geminata

The lower part of the Anse Quitor River forms an **estuarine ecosystem** (**ID6, Figure 86G**) in which a mangrove restauration program seems to have been conducted in the past 10 years. We found two remnant specimens of mangrove trees with one species, *Rhizophora mucronata*. As reported in the literature, a mangrove replanting program has been implemented in Mauritius under which seven hectares have been planted with *Rhizophora mucronata* and *Bruguiera gymnorhiza*. Some 90 ha of mangroves have been planted in 11 sites in Rodrigues in an effort to create a barrier against terrigenous sediment runoff from reaching the sea, as part of a European Union Development Fund (EDF) project.

In total, **8% of the area of influence for terrestrial biodiversity (=Anse Quitor Nature Reserve) is composed of habitats associated with a high ecological value (meeting the criteria of "Critical Habitats")**, while 42% come with a medium value (grass land, calcarenic lawns, and riverine habitats), 39% with a negligible value (anthropized areas) and 11% with a low value. Most of the grazing lawns were associated with a medium value as it shelters a large population of *Elaeodendron* (Bois d'olives) and a few specimens of rare and threatened (per IUCN categorization) endemic species.

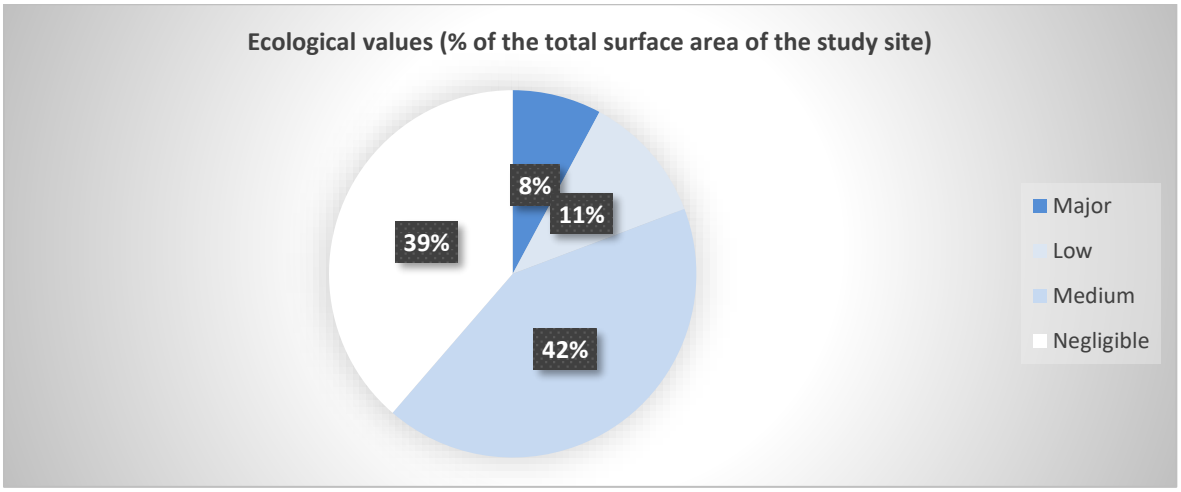

Figure 85: Ecological values of the vegetation on the area of influence

A – Mat of *Ipomoea pes-caprae*

B – Grasslands spiked with shrubs of *Elaeodendron orientale*

C – Leucaena leucoephala thickets

D – Anse Quitor Nature Reserve

F – Dry calcarenic lawns

G – Estuarine habitat (brackish waters)

H – Riparian habitats (fresh water)

Figure 86: Photographic plates of habitat types encountered at the area of influence

Figure 87: Rhizophora mucronota down the Anse Quitor River

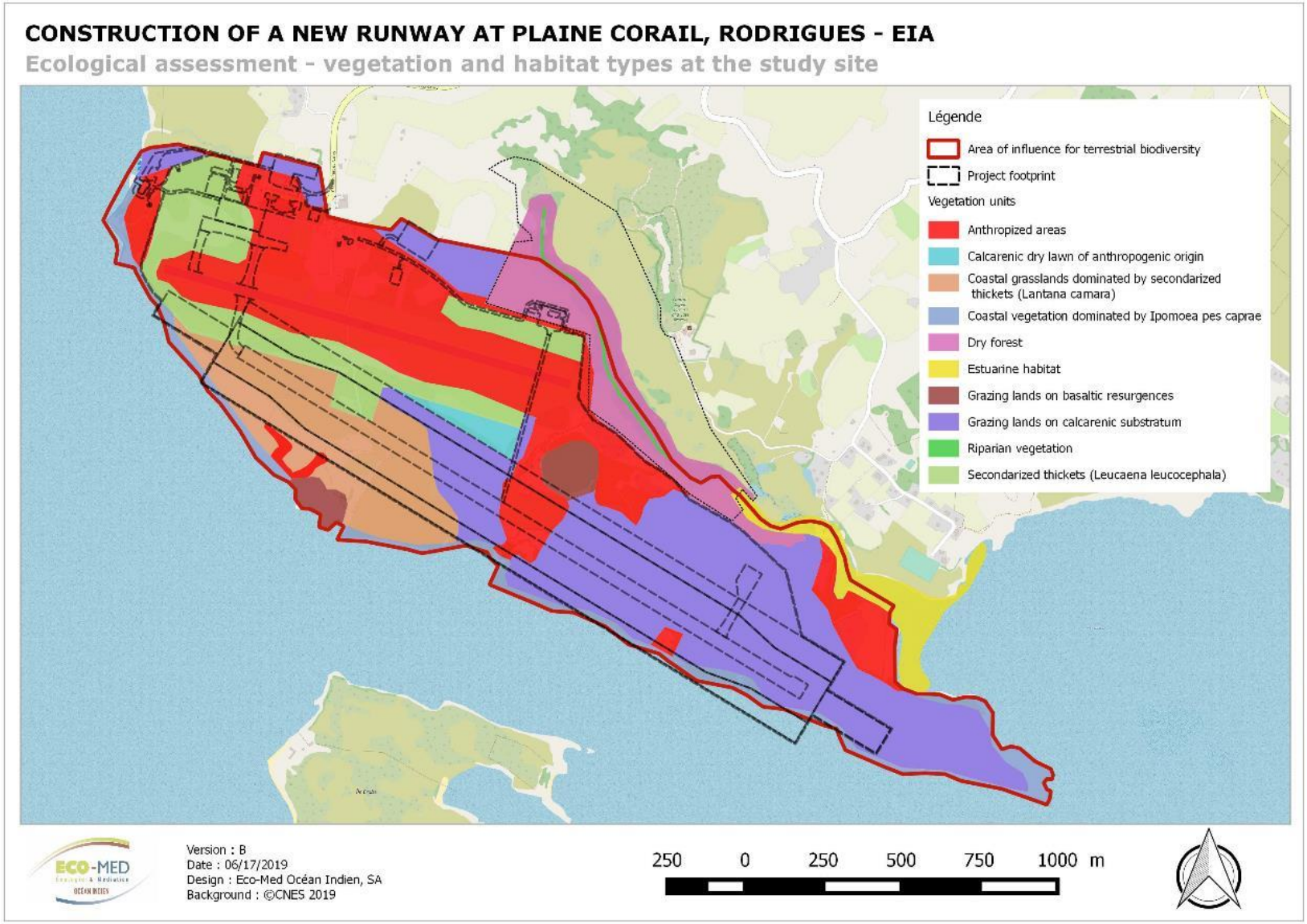

Figure 88: Vegetation and habitat types mapping

6.4.1.2.4 Flora

One hundred and nine plant species were recorded during the field survey (4 days), including 51 native species (15 are endemic to Rodrigues and 4 to the Mascarenes). 57 species are introduced on the study site and represent by far the major part of the total vegetation cover. Moreover, in the lowland dry forest of the Anse Quitor nature reserve, native plant communities (27 species) cover probably more than 50% of the total vegetation cover even if invasive species are still well represented (*Pongamia pinnata, Tabebuia pallida, Leucaena leucocephala*).

The most threatened species recorded in the area of influence for terrestrial biodiversity, as per IUCN red list of threatened species: (updated 2022):

- Critically endangered (CR) species are recorded at the study site, both are located inside the project area, such as *Hyophorbe verschaffeltii, Polyscias rodriguesiana, Latania verschaffeltii, Zanthoxylum paniculatum, Antirhea bifurcate, Foetidia rodriguesiana;*
- Endangered (EN) species are recorded at the study site, which are all partially located inside the project footprint such as *Diospyros diversifolia, Fernelia buxifolia; Clerodendrum laciniatum*

Sarcostemma viminale (now referenced as *Cynanchum viminale (L.) L.*), *Terminalia bentzoe subsp. Rodriguesensis*.are not listed on the IUCN red list of threatened species; they are listed in the red list of Reunion Island.

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Table 42: Summary of the plant species status listed in the area of influence

Species status	Number of species
Unknown species	1
Endemic	15
Exotic	54
Indigenous	32
Naturalized	3
Sub-endemic	4
Total	**109**

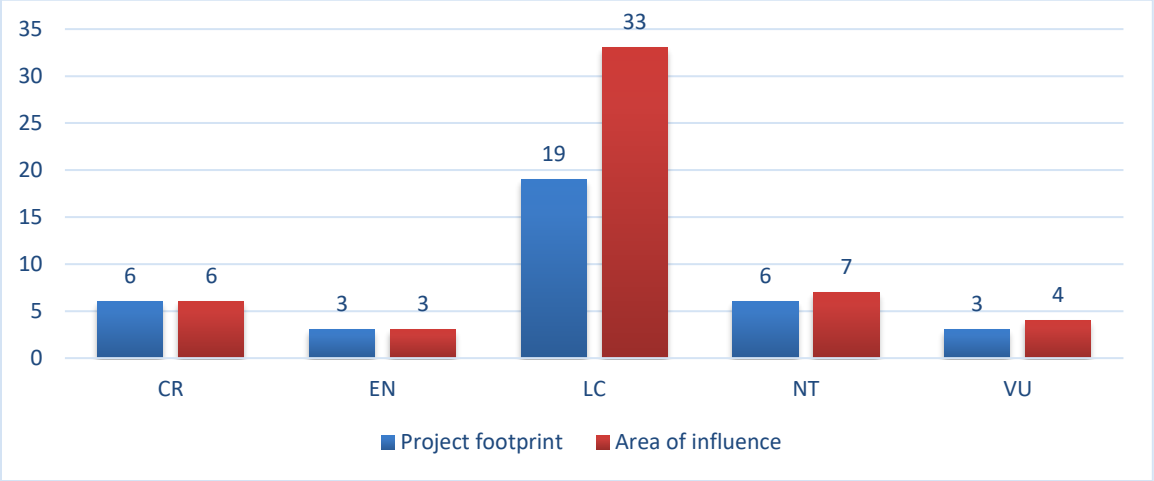
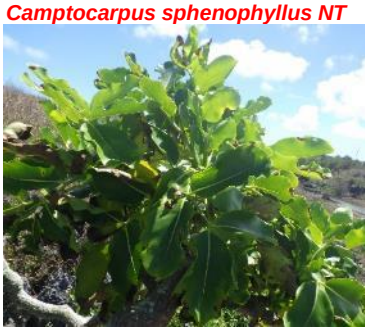


Figure 89: IUCN status and number of associated plant species through the study site/project area


Camptocarpus sphenophyllus NT


Elaeodendron orientale LC


Zanthoxylum paniculatum CR


Polyscias rodriguesiana CR


Latania verschaffeltii EN

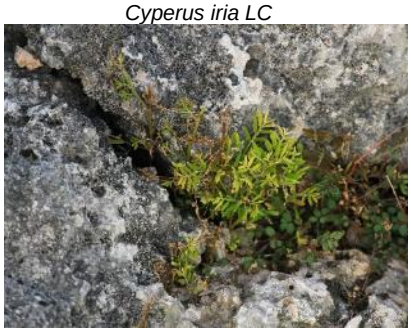

Tournefortia argentea LC


Terminalia bentzoe VU

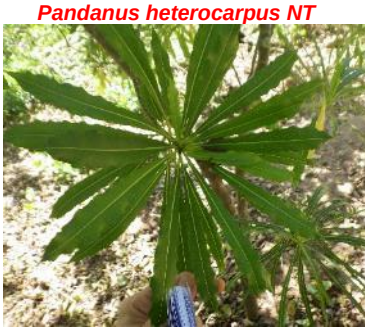

Cyperus iria LC


Foetidia rodriguesiana EN


Pandanus heterocarpus NT


Phyllanthus dumentosus VU


Antirhea bifurcata EN


Mathurina penduliflora NT


Fernelia buxifolia EN


Sarcostemma viminale VU

Figure 90: Photographic plates with some native plant species recorded on the area of influence for terrestrial biodiversity (in red, species recorded inside the project footprint)

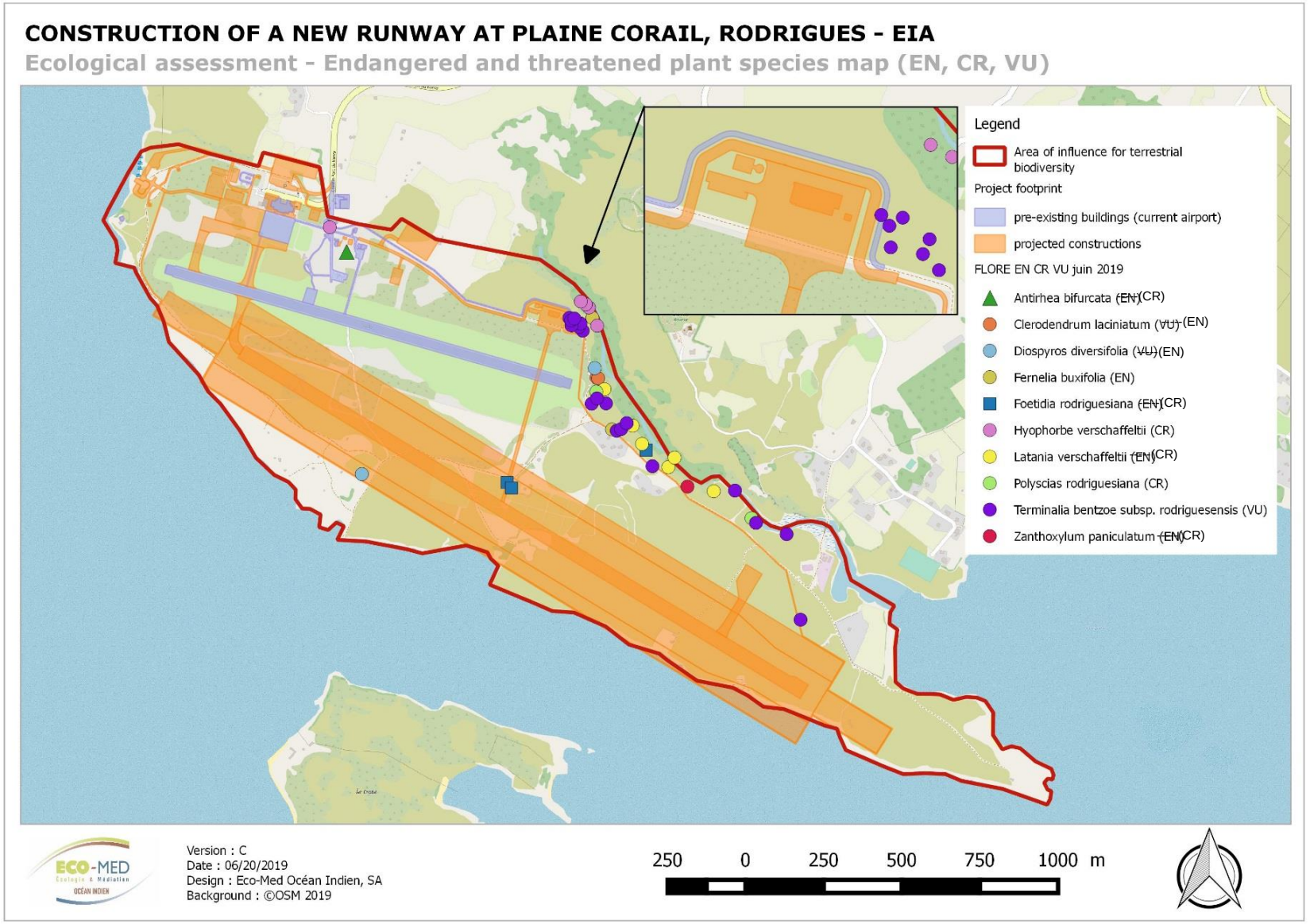


Figure 91: Endangered and threatened plant species map

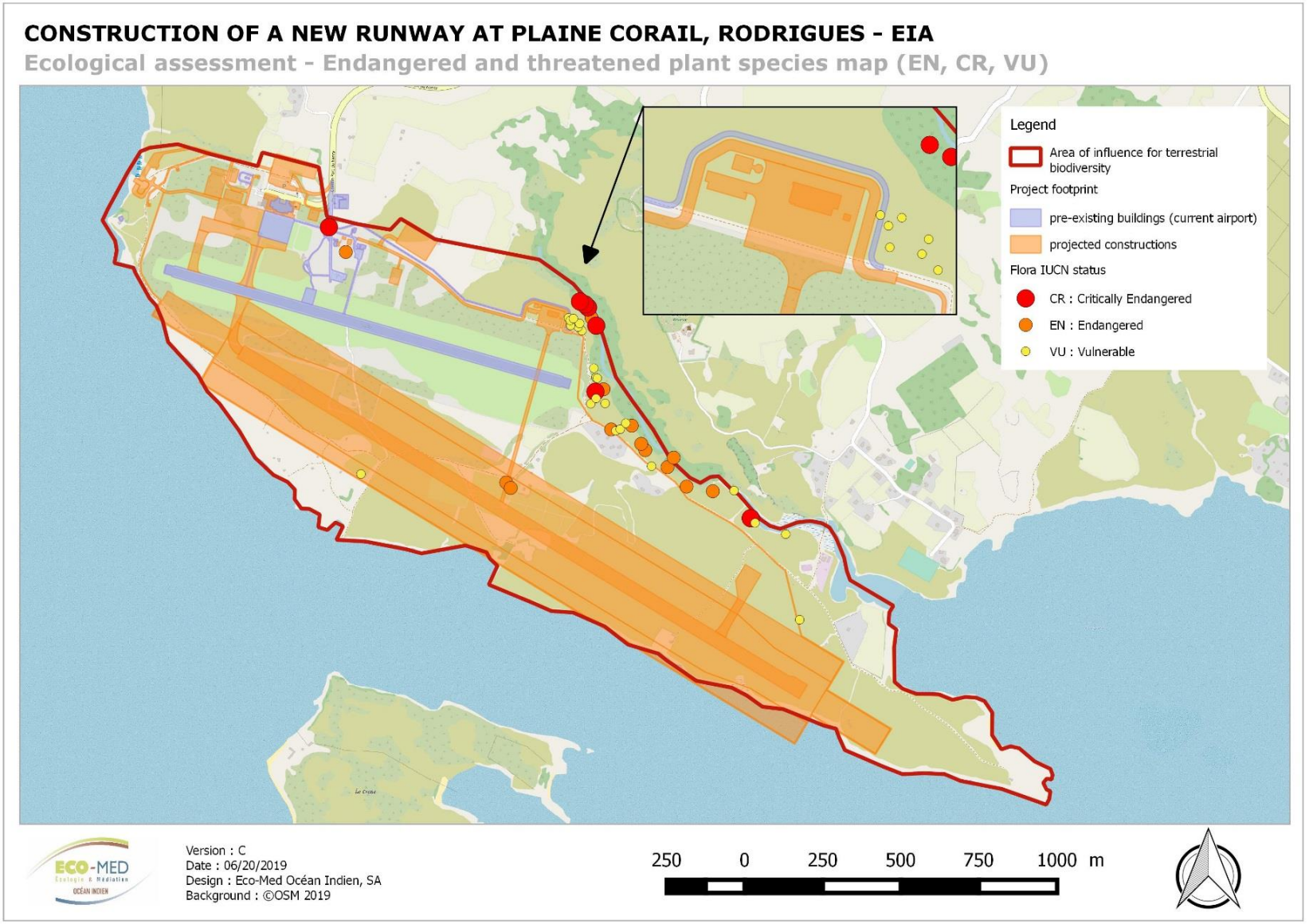


Figure 92: Endangered and threatened plant species map (status)

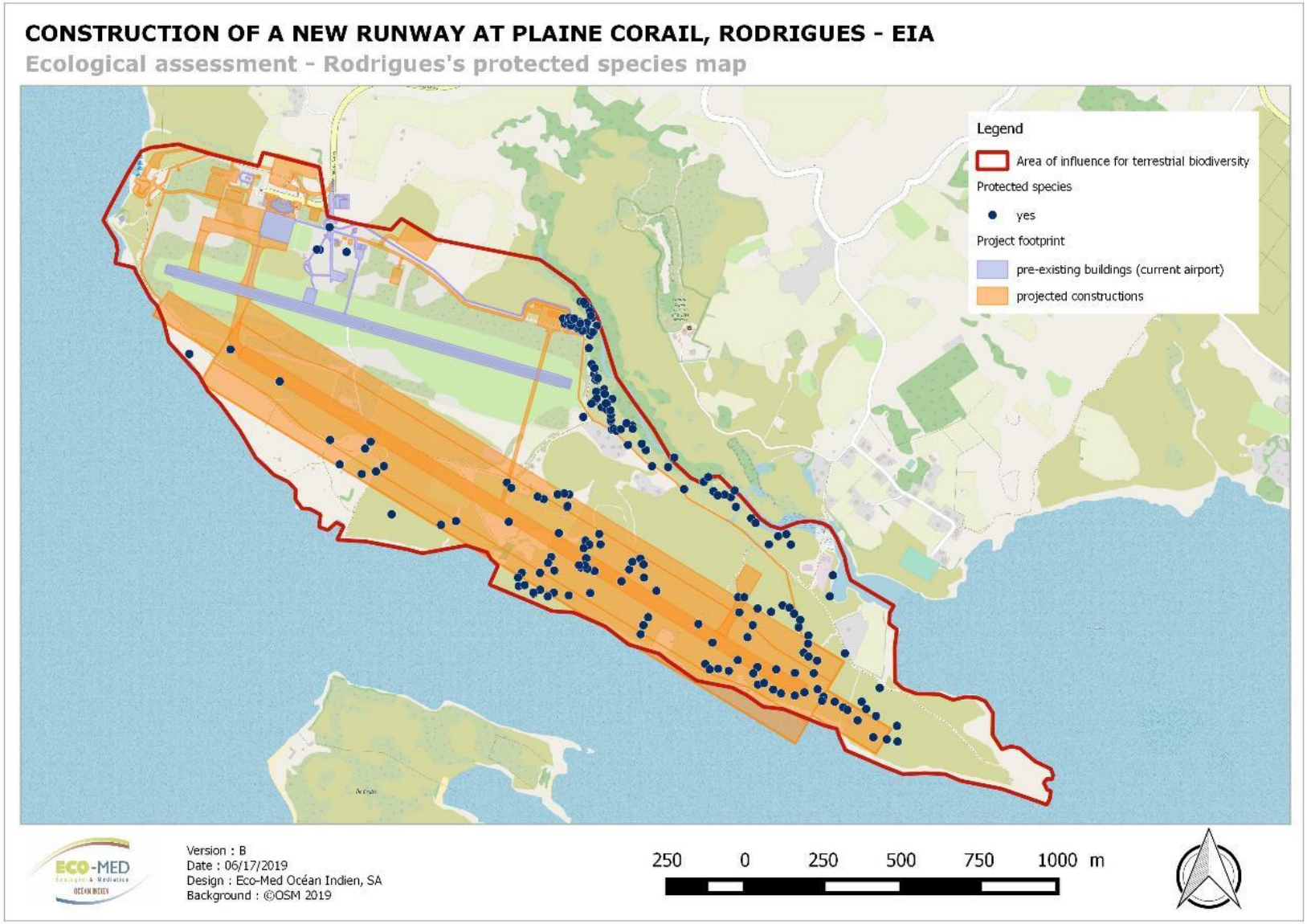


Figure 93: Rodrigues' protected species map

Table 43: List of plant species recorded on site (purple background: species recorded inside the project footprint) and sensitivity assessment for native species

Scientific name	French name	Family	Status	IUCN (status retained)	Criteria 1 Indigenous/e...	Criteria 2 Protection	Criteria 3 IUCN status	Senstivity score	Sensitivity	Protection Forestry Services	Protection Forestry Act 1983
Achyranthes aspera L.	Herbe d'Eugène	Amaranthaceae	Indigenous	LC	1	0	0	1	Negligible		
Adiantum rhizophorum Sw.		Pteridaceae	Sub-endemic	LC	2	3	0	5	Medium		yes
Alternanthera sessilis (L.) DC.	Brède emballage	Amaranthaceae	Indigenous	LC	1	0	0	1	Negligible		
Alysicarpus vaginalis (L.) DC.		Fabaceae	Indigenous	LC	1	0	0	1	Negligible		
Antirhea bifurcata (Desr.) Hook.f.	Bois goudron	Rubiaceae	Endemic	CR	3	1	4	8	Major	yes	
Boerhavia coccinea Mill.	Bécabar batard	Nyctaginaceae	Indigenous	LC	1	0	0	1	Negligible		
Bothriochloa pertusa (L.) A. Camus		Poaceae	Indigenous	LC	1	0	0	1	Negligible		
Caesalpinia bonduc (L.) Roxb.	Cadoque	Fabaceae	Indigenous	LC	1	0	0	1	Negligible		
Camptocarpus sphenophyllus (Balf. F.)		Asclepiadaceae	Endemic	NT	3	0	1	4	Medium		
Clerodendrum laciniatum Balf.f.	Bois cabri	Lamiaceae	Endemic	EN	2	1	3	6	High	yes	
Cynodon dactylon (L.) Pers.	Petit-chiendent	Poaceae	Indigenous	LC	1	0	0	1	Negligible		
Cyperus dubius Rottb.		Cyperaceae	Indigenous	LC	1	0	0	1	Negligible		
Cyperus iria L.		Cyperaceae	Indigenous	LC	1	0	0	1	Medium		
Cyperus rubicundus Vahl		Cyperaceae	Indigenous	LC	1	0	0	1	Negligible		
Dactyloctenium ctenioides (Steud.) Lorch ex Bosser		Poaceae	Indigenous	LC	1	0	0	1	Negligible		
Diospyros diversifolia Hiern	Bois d'ébène / Ebénier	Ebenaceae	Endemic	EN	2	1	3	6	High	yes	
Dodonaea viscosa Jacq.	Bois d'arnette	Sapindaceae	Indigenous	LC	1	1	0	2	Low	yes	
Dracaena reflexa Lam.	Bois de chandelle	Asparagaceae	Indigenous	LC	1	1	0	2	Low	yes	
Elaeodendron orientale Jacq.	Bois rouge	Celastraceae	Sub-endemic	LC	2	1	0	3	Low	yes	
Eragrostis tenella		Poaceae	Indigenous	LC	1	0	0	1	Negligible		
Euphorbia thymifolia L.	Rougette	Euphorbiaceae	Indigenous	LC	1	0	0	1	Negligible		
Fernelia buxifolia Lam.	Bois bouteille	Rubiaceae	Sub-endemic	EN	2	1	3	6	High	yes	
Ficus reflexa Thunb.	Ti l'affouche	Moraceae	Indigenous	LC	1	1	0	2	Low	yes	
Ficus rubra Vahl	Affouche rouge	Moraceae	Indigenous	LC	1	1	0	2	Low	yes	
Fimbristylis cymosa R. Br.		Cyperaceae	Indigenous	LC	1	0	0	1	Negligible		
Fimbristylis dichotoma (L.) Vahl		Cyperaceae	Indigenous	LC	1	0	0	1	Negligible		
Foetidia rodriguesiana F. Friedmann	Bois puant	Lecythidaceae	Endemic	CR	3	1	4	8	Major	yes	
Heteropogon contortus (L.) P. Beauv. ex Roem. et Schult.	Herbe polisson	Poaceae	Indigenous	LC	1	0	0	1	Negligible		
Hyophorbe verschaffeltii H. Wendl.	Palmiste marron	Arecaceae	Endemic	CR	3	1	4	8	Major	yes	
Ipomoea pes-caprae (L.) R. Br.	Liane batatran	Convolvulaceae	Indigenous	LC	1	0	0	1	Negligible		

Scientific name	French name	Family	Status	IUCN (status retained)	Criteria 1 Indigenous/e...	Criteria 2 Protection	Criteria 3 IUCN status	Sensitivity score	Sensitivity	Protection Forestry Services	Protection Forestry Act 1983
Latania verschaffeltii Lem.	Latanier jaune	Arecaceae	Endemic	CR	3	1	4	8	Major	yes	
Ludwigia octovalvis (Jacq.) Raven	Herbe à bourrique	Onagraceae	Indigenous	LC	1	0	0	1	Negligible		
Mathurina penduliflora Balf. f.	Bois gandine	Passifloraceae	Endemic	NT	3	1	1	5	Medium	yes	
Nephrolepis biserrata (Sw.) Schott	Fougère rivière	Nephrolepidaceae	Indigenous	LC	1	3	0	4	Medium		yes
Pandanus heterocarpus Balf. f.	Vacoa parasol	Pandanaceae	Endemic	NT	3	1	1	5	Medium	yes	
Paspalidium geminatum (Forssk.) Stapf.		Poaceae	Indigenous	LC	1	0	0	1	Medium		
Phyllanthus dumentosus Poir.		Phyllanthaceae	Indigenous	NT	1	1	1	3	Low	yes	
Phymatosorus scolopendria (Burm. f.) Pic. Serm.	Patte de lézard	Polypodiaceae	Indigenous	LC	1	3	0	4	Medium		yes
Pleurostylia putamen Marais	Bois d'olive blanc	Celastraceae	Endemic	NT	3	1	1	5	Medium	yes	
Polyscias rodriguesiana (Marais) Lowry & G.M. Plunkett	Bois blanc	Araliaceae	Endemic	CR	3	1	4	8	Major	yes	
Portulaca oleracea L.	Pourpier rouge	Portulacaceae	Indigenous	LC	1	0	0	1	Negligible		
Premna serratifolia L.	Bois sureau	Lamiaceae	Sub-endemic	LC	2	1	0	3	Low	yes	
Rhizophora mucronata	Palétuvier rouge	Rhizophoraceae	?	LC	1	0	0	1	Medium		
Sarcanthemum coronopus Cass.		Asteraceae	Endemic	NT	3	1	1	5	Medium	yes	
Sarcostemma viminale (L.) R. Br.	Liane calé	Apocynaceae	Indigenous	VU	1	0	2	3	Low		
Secamone rodriguesiana F.Friedmann		Apocynaceae	Endemic	NT	3	0	1	4	Medium		
Striga asiatica (L.) Kuntze	Goutte de sang	Orobanchaceae	Indigenous	LC	1	0	0	1	Negligible		
Terminalia bentzoe (L.) G.Forst.. subsp. rodriguesensis Wickens	Bois benjoin	Combretaceae	Endemic	VU	3	1	2	6	High	yes	
Thespesia populnea (L.) Sol. ex Corrêa	Sainte Marie	Malvaceae	Indigenous	LC	1	1	0	2	Low	yes	
Tournefortia argentea L.f.	Veloutier argenté	Boraginaceae	Indigenous	LC	1	0	0	1	Medium		
Zanthoxylum paniculatum Balf. f.	Bois pasner	Rutaceae	Endemic	CR	3	1	4	8	Major	yes	

6.4.1.2.4.1 Sensitivity assessment of native flora found in the area of influence

A number of species show a major and high level of sensitivity according to our assessment criteria (see 6.4.1.2.1Methodology). The results of the evaluation are presented in figures below.
A reassessment of the sensitivity will be undertaken when updated the baseline survey and study for the final ESIA.

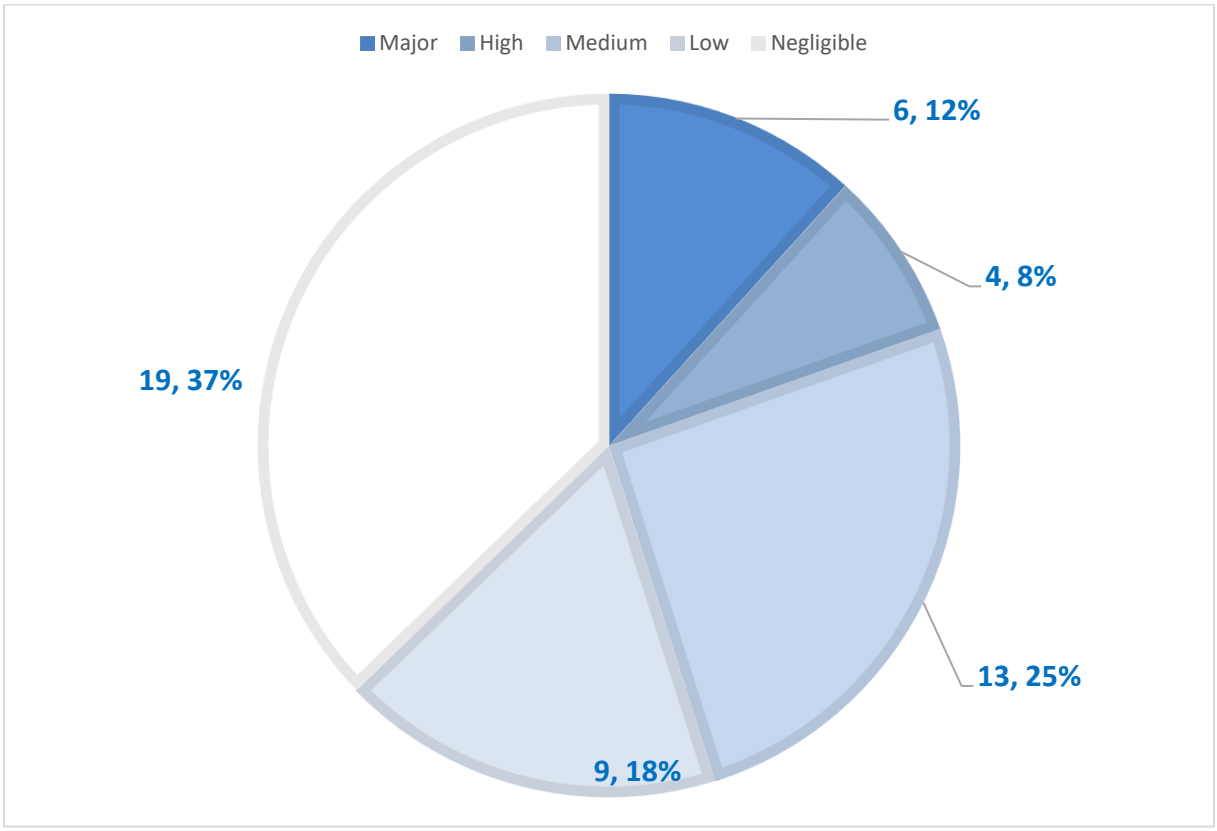


Figure 94: Assessment of the native flora sensitivity inside the area of influence

Table 44: Native flora recorded in the area of influence and sensitivity assessment

Type	Items	Sub items	Area/number of specimens inside the area of influence	Sensitivity
Flora	Plant species of major sensitivity (IUCN - CR)	*Hyophorbe verschaffeltii*	43	**Major**
		Polyscias rodriguesiana	7	
		Latania verschaffeltii	10	
		Zanthoxylum paniculatum	1	
		Antirhea bifurcata	1	
		Foetidia rodriguesiana	3	
Flora	Plant species of high sensitivity (IUCN - EN)	*Diospyros diversifolia*	2	**High**
		Fernelia buxifolia	2	
		Clerodendrum laciniatum	3	
Flora	Plant species of high sensitivity (not found in IUCN)	*Terminalia bentzoe subsp. Rodriguesensis*	28	
Flora	Plant species of medium sensitivity: 13 species	*Adiantum rhizophorum, Camptocarpus sphenophyllus, Cyperus iria, Mathurina penduliflora, Nephrolepis biserrata, Pandanus heterocarpus, Paspalidium geminatum, Phymatosorus scolopendria, Pleurostylia putamen, Rhizophora mucronata, Sarcanthemum coronopus, Secamone rodriguesiana, Tournefortia argentea.*	118	**Medium**
Flora	Plant species of low sensitivity: 9 species	*Dodonaea viscosa, Dracaena reflexa, Elaeodendron orientale, Ficus reflexa, Ficus rubra, Phyllanthus dumentosus, Premna serratifolia, Sarcostemma viminale, Thespesia populnea*	287	**Low**

6.4.1.2.4.2 Focus on the most threatened plant species

Some endemic species encountered inside the area of influence had become very rare on the island and show a very critical conservation status. To our knowledge, the following plants are on the edge of extinction and show a high or a major sensitivity:

- ⇒ *Antirhea bifurcata (Desr.) Hook.f.*
- ⇒ *Clerodendrum laciniatum Balf.f.*
- ⇒ *Diospyros diversifolia Hiern*
- ⇒ *Fernelia buxifolia Lam.*
- ⇒ *Foetidia rodriguesiana F. Friedmann*
- ⇒ *Hyophorbe verschaffeltii H. Wendl.*
- ⇒ *Latania verschaffeltii Lem.*
- ⇒ *Polyscias rodriguesiana (Marais) Lowry & G.M. Plunkett*
- ⇒ *Terminalia bentzoe (L.) G.Forst.. subsp. rodriguesensis Wickens*
- ⇒ *Zanthoxylum paniculatum Balf. f.*

The species mentioned above in red are described in more detail below. It corresponds to the species located within the project's footprint or to species assessed at a major sensitivity level.

***Hyophorbe verschaffeltii* H. Wendl.**	
Hyophorbe verschaffeltii (the palmiste marron or spindle palm) is a critically endangered species of flowering plant in the Arecaceae family. It is endemic to Rodrigues island, but is widely grown in cultivation. Fewer than 60 individuals remain in the wild, occurring in Grand Montagne, Anse Quitor and Ravine de la Cascade, St Louis. There is no evidence of regeneration and grazing pressures are strong. There is also a threat of hybridisation with the introduced *H. lagenicaulis* (Johnson, 1998).	
Family	**Arecaceae**
Local name	**Palmiste marron**
Endemicity	**Rodrigues**
IUCN Status *It has been assessed CR by the IUCN in 1998 (Johnson 1998)*	**CR ↓**
Rarity	**Very rare?**
Number of specimens in the wild (Rodrigues)	Probably less than **50** (Strahm 1989) or **60** (Johnson, 1998)
Number of specimens (Area of influence & Anse Quitor Nature Reserve)	**None** are reported from the forestry services, at least **43** recorded in Anse Quitor (Eco-Med Océan Indien) **66** specimens were planted in *ex situ* collections (Rivers et al. 2015)
Number of specimens (Project footprint)	**7** specimens are threatened by the project
Receptor sensitivity	**Major**

***Polyscias rodriguesiana* (Marais) Lowry & G.M. Plunkett**	
Mainly occurs on Plaine Corail. Less than 50 individuals exist in the wild as isolated specimens. Grows on calcarenite and basalt. Attempts at propagation have been successful and young specimens have been planted in the wild (Strahm 1998).	
Family	**Araliaceae**
Local name	**Bois blanc**
Endemicity	**Rodrigues**
IUCN Status *It has been assessed CR by the IUCN in 1998 (Strahm 1998) after having previously been assessed EN (Strahm 1989)*	**CR ↓**
Rarity	**Very rare?**
Number of specimens in the wild (Rodrigues)	Probably less than **50** (Strahm 1998)
Number of specimens (Area of influence & Anse Quitor Nature Reserve)	**7** specimens are reported from the forestry services (1999), at least **2** recorded in Anse Quitor in 2019 (Eco-Med Océan Indien) **6** specimens were planted in *ex situ* collections (Rivers et al. 2015)
Number of specimens (Project footprint)	**1** specimen
Receptor sensitivity	**Major**

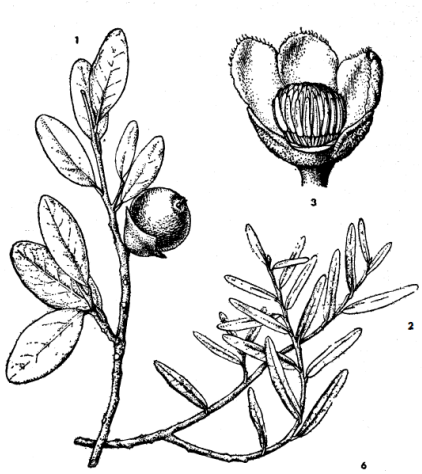
Foetidia rodriguesiana F. Friedmann

Seventeen species of *Foetidia* are recognized; one from East Africa, two from the Mascarene Islands and the remaining fourteen from Madagascar. One species is confined to forest remnants on Rodrigues island. This species is present in Anse Quitor region, Anse Baleine, Mourouk valley, Cascade St Louis, Graviers, Baie Malgache, Terre Rouge, Anse aux Anglais and have been planted in the Grand Montagne Nature Reserve. Due to the low number in propagation and the very low number of individuals that still exist, this species is potentially on a decline together with the rapid invasion of exotic species (animals and plants) in these locations (WF, pers. Com.). Wild regeneration is very rare because young trees are eaten by animals (Payandee, pers. Com). The species has a preliminary assessment of being "Critically Endangered" under the IUCN Red Listing (WF, pers. Com.).

Family	**Lecythidaceae**
Local name	**Bois puant**
Endemicity	**Rodrigues**
IUCN Status *It has been classified Endangered (EN) in 1989 by Strahm, a status confirmed in 1997 (Walter and Gillett, 1997) and in 2015 (Rivers et al., 2015). Kyrsakye et al. proposed a CR status but all evaluation criteria were not properly taken into account to validate the analysis* *Commission for Forestry in Rodrigues suggest that the species should be downgraded to VU (R. Payandee, pers. Com.). Human-aided interventions led to increase significantly the number of individuals from at least 50 in 1989 to 100 specimens today.* *EN status is retained as it is the only one to have been properly assessed in regard to IUCN criteria. It also reflects an interim evaluation between CR and VU.*	**CR ↓**
Rarity	**Very rare?**
Number of specimens in the wild (Rodrigues)	Probably between **50** (Strahm 1989) and **100** (WF, com. Pers.) **4** specimens were planted in *ex situ* collections (Rivers et al. 2015)
Number of specimens (Area of influence & Anse Quitor Nature Reserve)	**2** are reported from the forestry services
Number of specimens (Project footprint)	At least **3** specimens
Receptor sensitivity	**High**

***Antirhea bifurcata* (Desr.) Hook.f.**	
Endemic to the islands of Mauritius and Rodrigues, almost extinct in Rodrigues (Flore des Mascareignes). 2 specimens were reported in Plaine Corail in 1978 but only one was rediscovered in 1980. It seems still a fairly common species in the lowland forests of Mauritius. Differences between the individuals from Mauritius and Rodrigues might indicate that there could be an endemic variety on each of the 2 islands.	
Family	**Rubiaceae**
Local name	**Bois Goudron**
Endemicity	**Rodrigues, Mauritius**
IUCN Status *It has been classified Endangered (EN) in 1989 by Strahm, and re-evaluated "Rare" in 1997 by Walter et al. In Rodrigues, local status EN from Strahm should be kept as the species had become very rare.*	**EN**
Rarity	**Very rare?**
Number of specimens in the wild (Rodrigues)	Probably less than **10** (Strahm 1989)
Number of specimens (Area of influence & Anse Quitor Nature Reserve)	**None** are reported from the forestry services **1** specimen inside the airport area
Number of specimens (Project footprint)	**1** specimen
Receptor sensitivity	**High**

***Diospyros diversifolia* Hiern**	
Endemic to Rodrigues. Strahm reports that the species is occasionally found in many localities with regeneration, even on badly degraded slopes with practically nothing except *Elaeodendron orientale*. Conservation works were carried out very successfully by WWF and the Forestry Services (50 000 plants planted)	
Family	**Ebenaceae**
Local name	**Bois d'Ebène**
Endemicity	**Rodrigues**
IUCN Status *It has been classified Vulnerable (VU) in 1989 by Strahm, and re-evaluated and confirmed as "VU" in 1997 by Walter et al.* *Kirsakye et al. (2015) propose a re assessment to the level Endangered "EN"*	**EN ↑**
Rarity	Mauritian Wildlife): Mourouk valley, Cascade St louis, English Bay (Baie aux Anglais), Creve Coeur, Cascade Pigeon, Oyster Bay (Baie aux Huitres), Cascade Pistache, Plaine Corail, Dan Coco, Riviere Coco, Anse Raffin, Anse Baleine, Cascade Victoire, Port Sud Est
Number of specimens in the wild (Rodrigues)	**Unknown**
Number of specimens (Area of influence & Anse Quitor Nature Reserve)	**None** are reported from the forestry services **1** specimen reported inside the airport area
Number of specimens (Project footprint)	**1** specimen
Receptor sensitivity	**High**



***Terminalia bentzoe* (L.) G.Forst.. subsp. *rodriguesensis* Wickens**	
Very occasionally seen with little regeneration. Recorded from Anse Mourouk, Anse aux Anglais, Rivière Baleine, Mont Chéri, Plaine Corail and Anse Quitor, with a small population on Ile Aux Crabes (Strahm 1989).	
Family	**Combretaceae**
Local name	**Bois Benjoin**
Endemicity	**Rodrigues (subspecies)**
IUCN Status *It has been classified Vulnerable (VU) in 1989 by Strahm, and re-evaluated and confirmed as "VU" in 1997 by Walter et al. and Kirsakye et al. (2015)*	**VU**
Rarity	**Rare?**
Number of specimens in the wild (Rodrigues)	Less than 50 (Source: Mauritian Wildlife): Mourouk Valley, Cascade St louis, St Francois, Anse Ally, English Bay, Pointe Canon, Oyster Bay, Ile Aux Crabes, Plaine Corail, Anse Quitor, Anse Baleine
Number of specimens (Area of influence & Anse Quitor Nature Reserve)	**3** are reported from the forestry services **24** are recorded by Eco-Med Océan Indien in 2019
Number of specimens (Project footprint)	**3** specimens
Receptor sensitivity	**High**

***Fernelia buxifolia* Lam.**	
Endemic to the Mascarenes (La Réunion, Mauritius, Rodrigues). Found in Rodrigues in La Plaine Corail, Anse Mourouc, Cascade Saint-Louis, Grande Montagne, Mont Limon, Mont Malartic, Cascade Victoire, Mont Lubin. Populations from Rodrigues might belong to a different taxa, the leaves are less elliptical than the typical *F. buxifolia* and resembles *F. obovata* (Flore des Mascareignes). This species has still been drastically reduced in number in just over a century (Strahm, 1989).	
Family	**Rubiaceae**
Local name	**Bois Bouteille**
Endemicity	**Mascarenes**
IUCN Status *It has been classified EN in La Réunion (IUCN 2010). The same category has been applied by Kirsakye et al. (2015) and should be kept for Rodrigues*	**EN**
Rarity	**Very Rare?**
Number of specimens in the wild (Rodrigues)	Probably **a dozen** of specimens according to Strahm (1989)
Number of specimens (Area of influence & Anse Quitor Nature Reserve)	**2** are reported from the forestry services **2** are recorded by Eco-Med Océan Indien in 2019
Number of specimens (Project footprint)	**1** specimen
Receptor sensitivity	**High**

6.4.1.3 fauna

Baselines studies have been carried out on mammals, birds, reptiles, molluscs, crustaceans, insects, arachnids and myriapods. The inventories carried out and the bibliographical review reveal a rich and varied animal biodiversity, but also endangered species endemics such as *Pteropus rodricensis* and *Tropidophora articulata*. Additional studies and inventory will be conducted in 2023 during the survey update for these two endemic species of Rodrigues.

6.4.1.3.1 Mammals

Like in the whole of Rodrigues Island, the mammal populations on the site are mainly bovid (cows, goats, sheep) and other domestic (cat, dog) or introduced animals (rats).

The only native species is an endemic bat: *Pteropus rodricensis*. This species is classified as endangered (IUCN). No roost was found near the study site. Several tens of bats are observed at the end of the day, but only some individuals were seen punctually flying over the area of influence. They go up Anse Quitor to eat there, but they do not seem to be flying over the airport area. Around the Area of influence, the habitat favourable for flyingfoxes like *Pteropus rodricensis* correspond to the dry forest sectors (Anse Quitor). These habitats are rare on an island scale, but according to the local experts, *Pteropus rodricensis* is not rare and its numbers are increasing.

Ultrasonic recording devices allow us to confirm the absence of Microchiroptera species on site (no mention of such species has been reported on Rodrigues before).

Figure 95: Mammals on site: Pteropus rodricensis / Bos taurus / Capra hircus (©ECO-MED Océan Indien, 2019)

Table 45: List of mammals observed on site

Order	Family	Taxa	Status	Local protection *	Common name (ENG)	IUCN
Carnivora	Canidae	*Canis familiaris*	Introduced		Dog	NA
Carnivora	Felidae	*Felis catus*	Introduced		Domestic cat	NA
Cetartiodactyla	Bovidae	*Bos taurus*	Introduced		Cow	NA
Cetartiodactyla	Bovidae	*Capra hircus*	Introduced		Feral Goat	NA
Cetartiodactyla	Bovidae	*Ovis aries*	Introduced		Red Sheep	NA
Chiroptera	Pteropodidae	*Pteropus rodricensis*	**Endemic**	**x**	Rodrigues Flying Fox	**EN**
Rodentia	Muridae	*Rattus*	Introduced		rats	NA

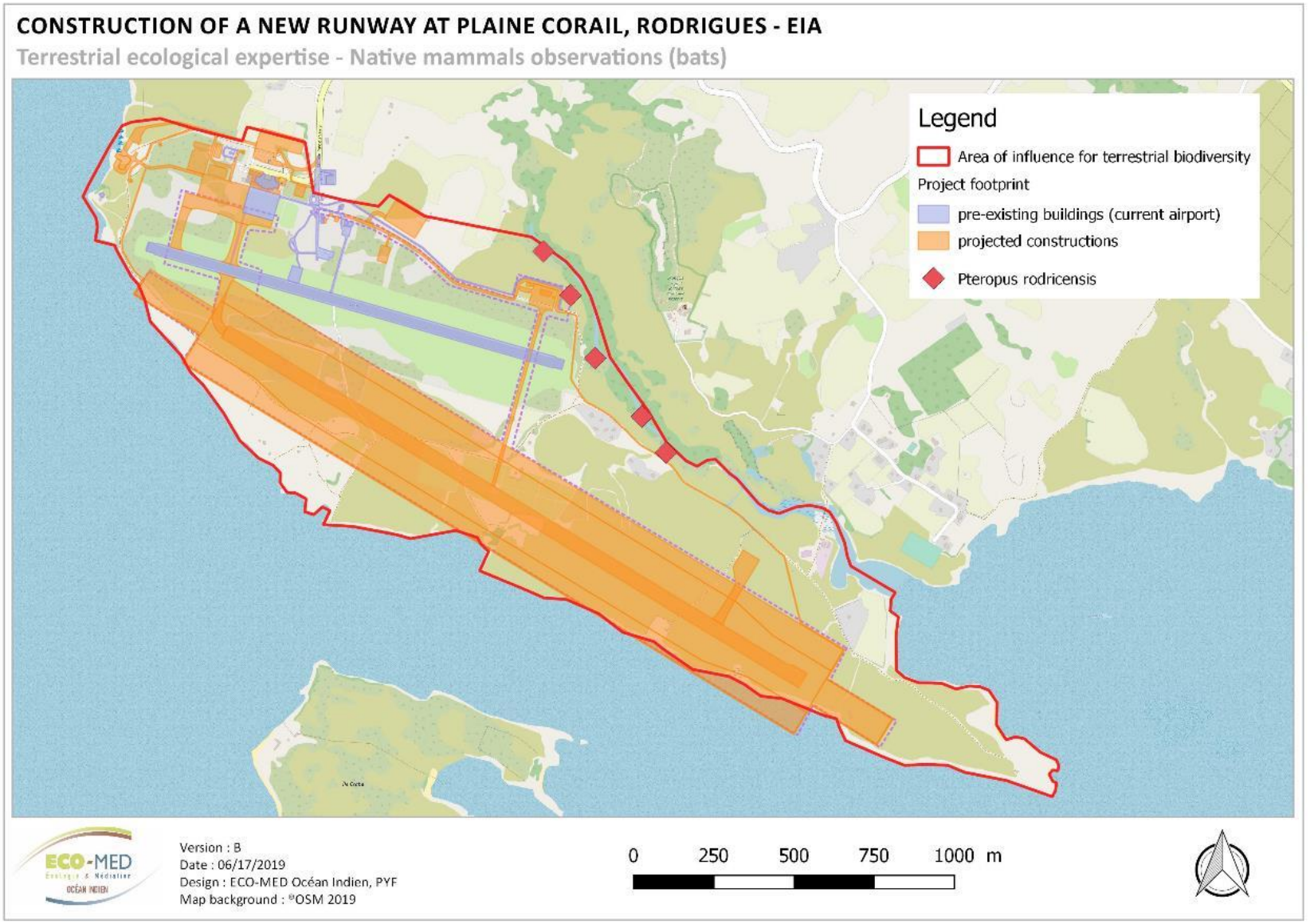


Figure 96: Native mammal observation mapping

6.4.1.3.2 Reptiles

The terrestrial reptiles observed are mainly of exotic origin. The lizard species *Hemidactylus frenatus* is the most common. It has adapted locally with a terrestrial behaviour, sheltering under the omnipresent rocks.

The only species supposedly native to Rodrigues (there is scientific controversy), is *Lepidodactylus lugubris* and was observed 3 times (see map below). Its more arboreal behaviour hinders its occurrence on the site, which is particularly devoid of trees. This species does not have an unfavourable conservation status.

Figure 97: Reptiles on site: Hemidactylus frenatus / Lepidodactylus lugubris (©ECO-MED Océan Indien, 2019)

Table 46: List of reptiles observed on site

Order	Family	Taxa	Status	Local protection *	Common name (ENG)	IUCN
Squamata	Agamidae	*Calotes versicolor*	Introduced		-	NA
Squamata	Gekkonidae	*Hemidactylus frenatus*	Introduced		Common House Gecko	LC
Squamata	Gekkonidae	*Hemidactylus parvimaculatus*	Introduced		-	NA
Squamata	Gekkonidae	*Lepidodactylus lugubris*	**Native**	**x**	Sad Gecko	NA
Squamata	Typhlopidae	*Indotyphlops braminus*	Introduced		Braminy Bling Snake	NA

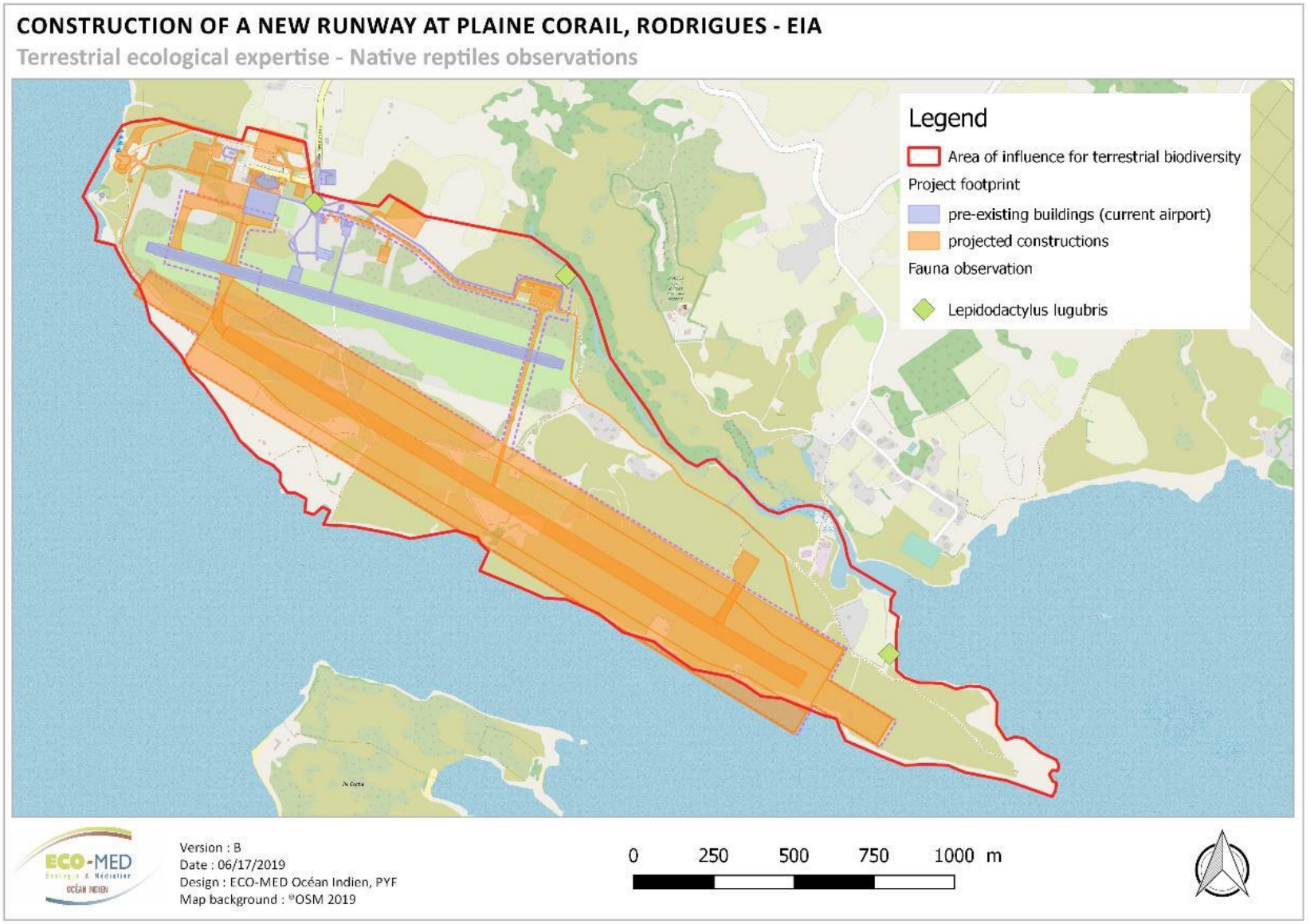


Figure 98: Native reptile observation mapping

6.4.1.3.3 Birds

The bird populations observed are mainly exotic. *Acridotheres tristis, Geopelia striata, Passer domesticus, Estrilda astrild* are the most common.

Three indigenous (or migratory) species frequent the site for their food: *Butorides striata*, *Arenaria interpres, Numenius phaeopus*. They are mainly observed on the banks of Anse Quitor and on the coast. *Numenius phaeopus* is also observed on grassy areas along the airport runways. *Butorides striata* is likely to nest in trees along the Anse Quitor River. *Arenaria interpres* and *Numenius phaeopus* are assumed to be migratory, as their nesting is not locally reported.

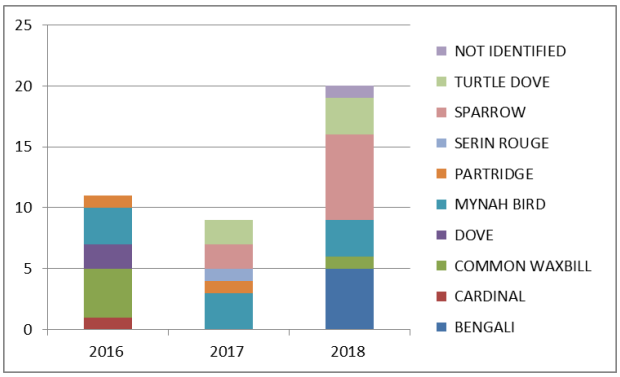
Phaethon lepturus, also native, was observed flying over the site. It is likely to nest on the cliffs of Anse Quitor.

No single bird species has a particular conservation status issue.

Two species of endemic passerines present a very strong local challenge in Rodrigues: *Acrocephalus rodericanus* and *Foudia flavicans*. Although Anse Quitor is a suitable native habitat, these species do not appear to be established at this time. However, the presence of a female *Foudia* has recently been reported (pers. comm. Aurèle Anquetil André & Mauritian Wildlife Foundation (**WF**)). The current population dynamics could lead them to gain this territory effectively adding an additional challenge to this nature reserve.

Finally, it should be noted that the site is obviously overflown by seabirds regularly observed on Rodrigues and nesting on the lagoon islets (Ile aux sables, Iles aux Cocos, Ile Frégate): *Anous ssp., Onychoprion ssp., Sterna dougallii, Ardenna pacificus, Gygis alba, etc.*

In terms of aircraft collisions with birds, the airport records the following statistics:



Species reported	Assumed taxon
BENGALI	*Estrildidae sp.?*
CARDINAL	*Foudia madagascariensis*
COMMON WAXBILL	*Estrilda astrild*
DOVE	*Geopelia striata / Columba livia / Streptopelia sp.?*
MYNAH BIRD	*Acridotheres tristis*
PARTRIDGE	*Francolinus pondicerianus?*
SERIN ROUGE	*Foudia madagascariensis*
SPARROW	*Passer domesticus*
TURTLE DOVE	*Geopelia striata / Columba livia / Streptopelia sp.?*
NOT IDENTIFIED	*?*

Figure 99: Bird strike statistics in the past 3 years

These statistics confirm the predominance of alien species and the real impact of airport activity on this group.

Figure 100: Birds on site: Butorides striata / Numenius phaeopus / Estrilda astrild (©ECO-MED Océan Indien, 2019)

Table 47: List of birds observed on site

Order	Family	Taxa	Status	Local protection *	Common name (ENG)	IUCN
Anseriformes	Anatidae	*Anser*	Introduced		-	NA
Charadriiformes	Scolopacidae	*Arenaria interpres*	**Native**	**x**	Turnstone	LC
Charadriiformes	Scolopacidae	*Numenius phaeopus*	**Native**	**x**	Whimbrel	LC
Columbiformes	Columbidae	*Columba livia*	Introduced		Rock Pigeon	LC
Columbiformes	Columbidae	*Geopelia striata*	Introduced		Zebra Dove	LC
Galliformes	Phasianidae	*Francolinus pondicerianus*	Introduced		Gray Francolin	LC
Passeriformes	Estrildidae	*Estrilda astrild*	Introduced		Common Waxbill	LC
Passeriformes	Fringillidae	*Serinus mozambicus*	Introduced		Yellow-fronted Canary	LC
Passeriformes	Passeridae	*Passer domesticus*	Introduced		House Sparrow	LC
Passeriformes	Ploceidae	*Foudia madagascariensis*	Introduced		Madagascar Red Fody	LC
Passeriformes	Sturnidae	*Acridotheres tristis*	Introduced		Common myna	LC
Pelecaniformes	Ardeidae	*Butorides striata*	**Native**	**x**	Striated Heron	LC
Phaethontiformes	Phaethontidae	*Phaethon lepturus*	**Native**	**x**	White-tailed Tropicbird	LC

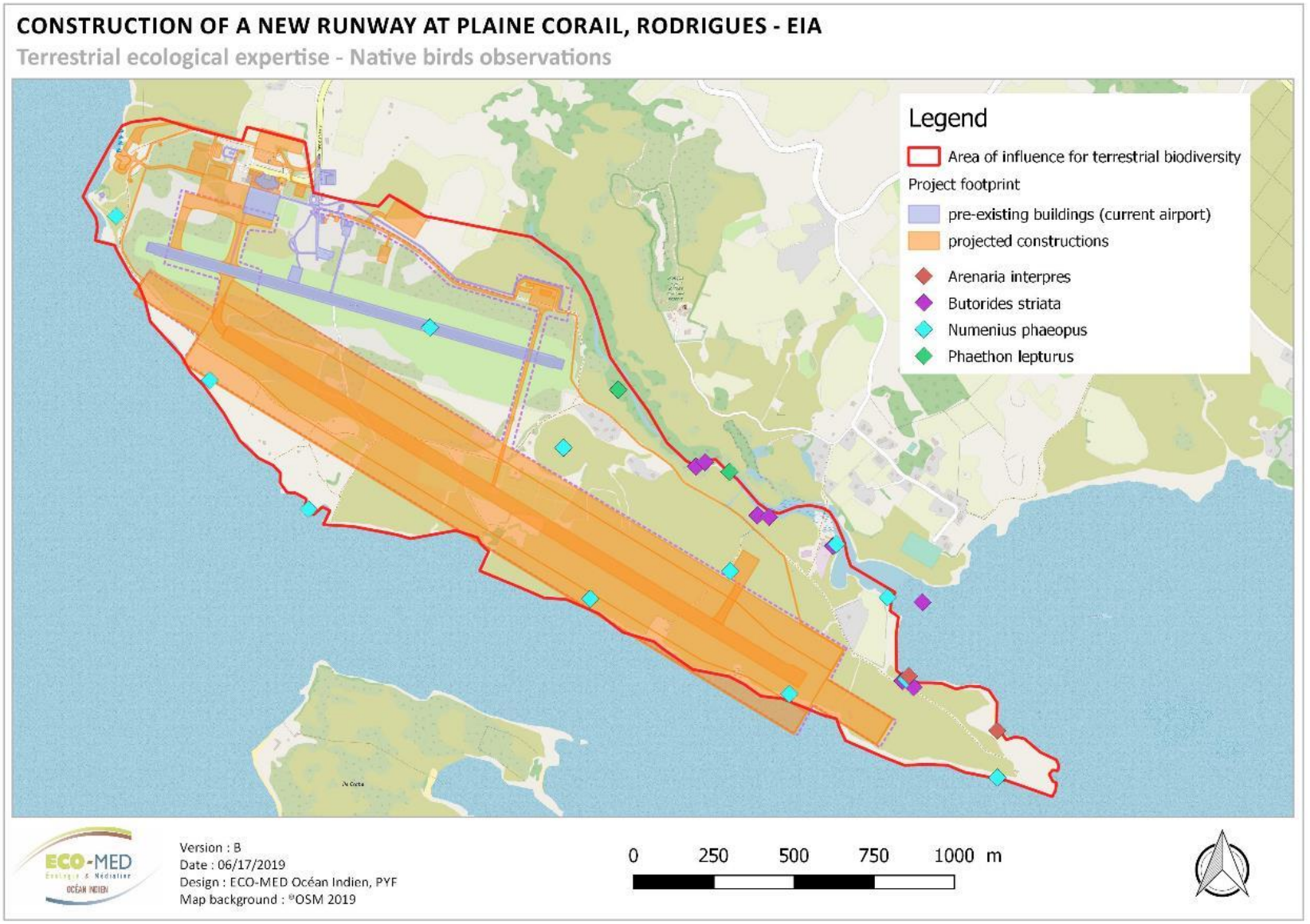


Figure 101: Native bird observations mapping

6.4.1.3.4 Molluscs

Representative of the fauna of Rodrigues, the mollusc group is well represented here by native, even endemic species. Despite the omnipresence of potentially harmful exotic species (*Lissachatina fulica*, *Euglandina rosea*), species such as *Tropidophora ssp*. are widely present in the area of influence.

The habitats favourable for *Tropidophora articulata* correspond to the calcareous substrates, which are relatively rare on an island scale. The "endangered" status of *Tropidophora articulata*, assessed by “The IUCN Red List of Threatened Species” in 1996, makes it a particularly sensitive point here. However, only empty shells were found. The *Tropidophora articulata* populations inventory will be completed in the survey update 2023, in accordance with the World Bank requirements.

Figure 102: Molluscs on site: Tropidophora articulata / T. eugeniae / Subulina octona / Melanoides tuberculata (©ECO-MED Océan Indien, 2019)

Table 48: List of molluscs observed on site

Order	Family	Taxa	Status	Local protection *	Common name (ENG)	IUCN
Caenogastropoda	Thiaridae	*Melanoides tuberculata*	**Native**	**x**	Red-rimmed Melania	NA
Littorinimorpha	Pomatiidae	*Tropidophora articulata*	**Sub-endémique**	**x**	-	**EN**
Littorinimorpha	Pomatiidae	*Tropidophora eugeniae*	**Sub-endémique**	**x**	-	NA
Stylommatophora	Achatinidae	*Lissachatina fulica*	Introduced		Giant African snail	NA
Stylommatophora	Achatinidae	*Subulina octona*	Introduced		The eight-whorled Achatina	NA
Stylommatophora	Helicarionidae	*Gen. sp.*	Native?		-	NA
Stylommatophora	Spiraxidae	*Euglandina rosea*	Introduced		Cannibal snail	NA

these

6.4.1.3.5 Crustaceans

Two taxa are observed on the site (undetermined species). No terrestrial crustacean species with an unfavourable conservation status is known to Rodrigues.

Figure 103: Crustacean on site: Isopoda sp. (©ECO-MED Océan Indien, 2019)

Table 49: List of crustaceans observed on site

Order	Family	Taxa	Status	Local protection *	Common name (ENG)	IUCN
Decapoda	Coenobitidae	*Coenobita*	Native?		-	NA
Isopoda		*Gen. sp.*	Native?		-	NA

6.4.1.3.6 Insects

The insect taxa known to Rodrigues and having a high conservation status belong to the orders Lepidoptera, Odonata and Orthoptera.

These species have been researched more specifically. For the other groups, these are more opportunistic observations.

It should be noted that the inventory period, one week after the passage of the cyclone Joaninha (26 March 2019), is not favourable to a representative vision of the usual diversity for this site. Therefore, as part of the updated ESIA study, a rapid assessment will be conducted during the finalization of the ESIA

The species identified, although some of them are native, do not present a significant challenge for this project.

The water points, rare on the site, are particularly attractive places for wildlife and in particular entomofauna: river, karst collapses, old quarry.

Figure 104: Insects on site: Junonia rhadama/Ischnura senegalensis/Gryllodes sigillatus (©ECO-MED Océan Indien, 2019)

Table 50: List of insects observed on site

Order	Family	Taxa	Status	Local protection *	Common name (ENG)	IUCN
Blattodea	Blaberidae	*Pycnoscelus surinamensis*	**Native**	**x**	Surinam Cockroach	NA
Blattodea	Blattidae	*Gen. sp.*	Native?		-	NA
Blattodea	Blattidae	*Periplaneta*	Native?		-	NA
Hemiptera	Pyrrhocoridae	*Dysdercus fasciatus*	**Native**	**x**	-	NA
Hymenoptera	Apidae	*Apis mellifera*	Introduced		Honey Bee	NA
Hymenoptera	Apidae	*Xylocopa*	Native?		-	NA
Hymenoptera	Vespidae	*Polistes olivaceus*	**Native**	**x**	-	NA
Lepidoptera	Crambidae	*Spoladea recurvalis*	**Native**	**x**	-	NA
Lepidoptera	Lycaenidae	*Leptotes pirithous*	**Native**	**x**	Lang's Short-tailed Blue	NA
Lepidoptera	Lycaenidae	*Zizeeria knysna*	**Native**	**x**	-	NA
Lepidoptera	Nolidae	*Earias biplaga*	**Native**	**x**	-	NA
Lepidoptera	Nymphalidae	*Danaus chrysippus*	**Native**	**x**	-	NA
Lepidoptera	Nymphalidae	*Junonia rhadama*	**Native**	**x**	-	NA
Lepidoptera	Nymphalidae	*Phalanta phalantha*	**Native**	**x**	-	NA
Lepidoptera	Pieridae	*Catopsilia florella*	**Native**	**x**	-	NA
Odonata	Coenagrionidae	*Ischnura senegalensis*	**Native**	**x**	Tropical Bluetail	LC
Odonata	Libellulidae	*Pantala flavescens*	**Native**	**x**	Globe Wanderer	LC
Orthoptera	Acrididae	*Locusta migratoria*	**Native**	**x**	-	NA
Orthoptera	Gryllidae	*Gryllodes sigillatus*	**Native**	**x**	-	NA
Orthoptera	Gryllidae	*Gryllus bimaculatus*	Introduced		-	NA
Orthoptera	Tettigoniidae	*Conocephalus iris*	**Native**	**x**	Yellowtail Meadow Katydid	NA
Orthoptera	Trigonidiidae	*Trigonidium cicindeloides*	**Native**	**x**	-	NA

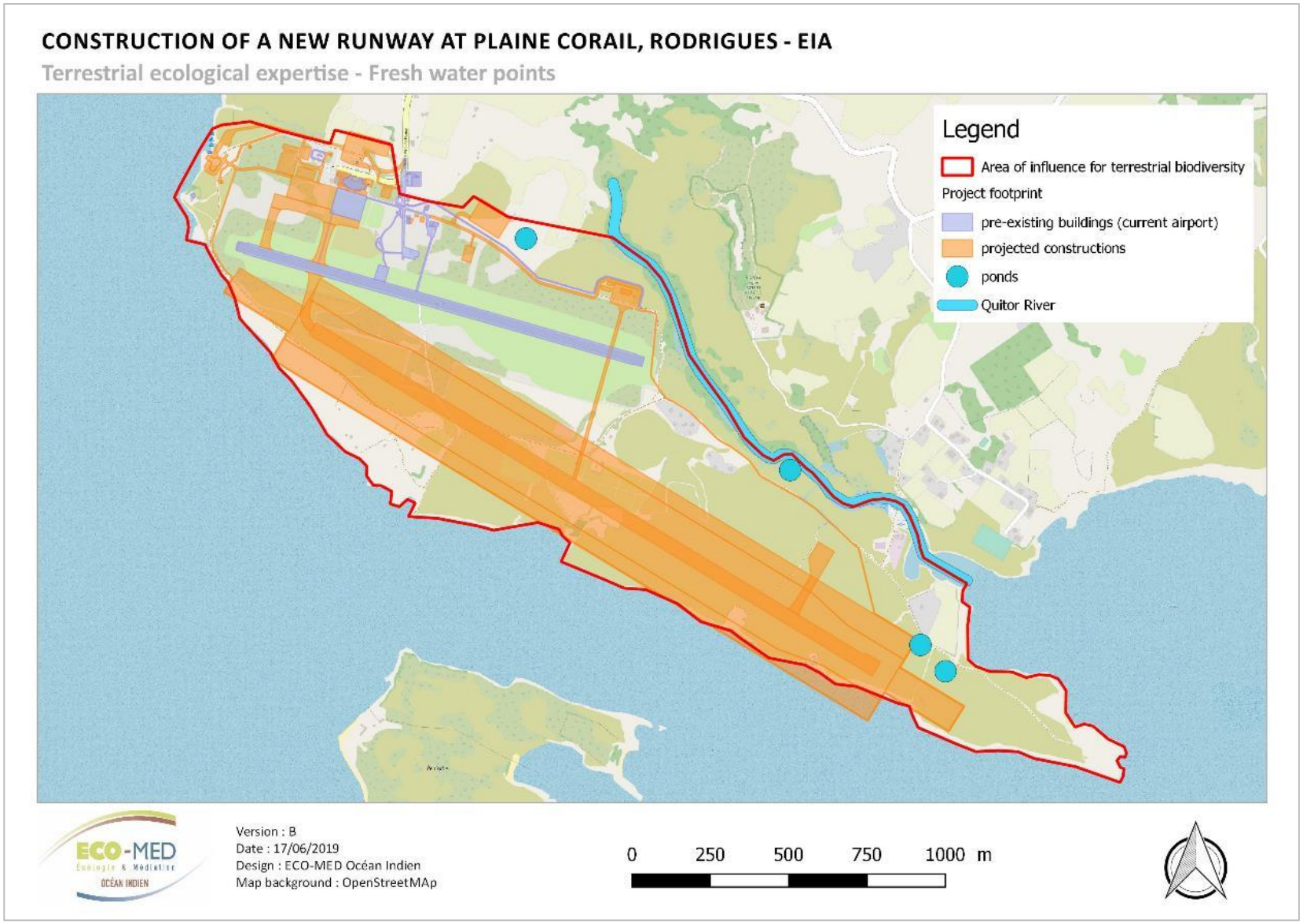


Figure 105: Fresh water point on site

6.4.1.3.7 Arachnids

The diversity of Rodrigues arachnids is poorly documented in the literature. We sighted 14 species, some of which could not be identified. In fact, endemicity and threat status are difficult to assess for this group. However, no threatened species in families including these unidentified species are known to Rodrigues to date.

Figure 106: Arachnids on site: Nephila inaurata/Salticidae sp./Smeringopus pallidus/Isometrus maculatus (©ECO-MED Océan Indien, 2019)

Table 51: List of arachnids observed on site

Order	Family	Taxa	Status	Local protection *	Common name (ENG)	IUCN
Araneae	Araneidae	*Cyrtophora citricola*	**Native**	**x**	-	NA
Araneae	Araneidae	*Neoscona moreli*	**Native**	**x**	-	NA
Araneae	Nephilidae	*Nephila inaurata*	**Native**	**x**	-	LC
Araneae	Oxyopidae	*Gen. sp.*	Native?		-	NA
Araneae	Pholcidae	*Smeringopus pallidus*	**Native**	**x**	Cellar Spider	NA
Araneae	Salticidae	*Gen. sp. (x2)*	Native?		-	NA
Araneae	Tetragnathidae	*Gen. sp. (x3)*	Native?		-	NA
Araneae	Tetragnathidae	*Leucauge undulata*	**Native**	**x**	-	NA
Araneae	Theridiidae	*Gen. sp.*	Native?		-	NA
Araneae	Thomisidae	*Thomisus*	Native?		-	NA
Scorpiones	Buthidae	*Isometrus maculatus*	Introduced		-	NA

6.4.1.3.8 Myriapods

The three species of myriapods, which were commonly observed on the site, are not of significant interest.

Figure 107: Myriapods on site: Orthomorpha coarctata/Pachybolidae sp. (©ECO-MED Océan Indien, 2019)

Table 52: List of myriapods observed on site

Order	Family	Taxa	Status	Local protection *	Common name (ENG)	IUCN
Polydesmida	Paradoxosomatidae	*Orthomorpha coarctata*	Introduced		Flatback Millipede	NA
Spirobolida	Pachybolidae	*Gen. sp.*	Native?		-	NA
Scolopendromorpha	Scolopendridae	*Scolopendra subspinipes*	**Native**	**x**	Vietnamese Giant Centipede	NA

6.4.1.3.9 Sensitivity assessment of native fauna found inside the area of influence

The sensitivity of the native fauna observed in the area of influence was assessed according to the following criteria:

⇒ Endemicity or indigenous status: indigenous = 1 point; endemic to the Mascarenes (sub endemicity) = 2 points; endemic to Rodrigues = 3 points.

⇒ Protection status: protected in Rodrigues = 1 point; protected under the Forestry Act (1983) = 3 points

⇒ Threat level according to the red list: LC = 0 point; NT = 1 point; VU = 2 points; EN = 3 points; CR = 4 points.

A maximum of 10 points can be assigned to a species. An adjustment by the expert can be made to correct deficiencies in the status of certain species. Depending on the score obtained, the species is classified according to the following sensitivity levels:

Table 53: Scale value used to assess the plant species sensitivity

Receptor sensitivity	Scale value
Negligible	**0 - 2**
Low	**2 – 4**
Medium	**4 – 6**
High	**6- 8**
Major	**8 – 10**

A total of 2 species were assessed to a high level of sensitivity inside the area of influence of the project (both Endangered): the bat *Pteropus rodricensis* and the gastropoda *Tropidophora articulata*.
However as only some individuals were seen punctually flying over the area of influence, *Pteropus rodricensis* is considered as of low sensitivity. Similary, as only empty shells of *Tropidophora articulate* were found over the area, this species is considered of memdium-high sensitivity.
A third species has been assessed to a low level of sensitivity: the gastropoda *Tropidophora eugeniae.*

Table 54: Native fauna recorded at the area of influence and sensitivity assessment

Class	Order	Family	Taxa	Status	Local protection *	IUCN	note statut	note protection	note IUCN	note total	Receptor sensitivity
Mammalia	Chiroptera	Pteropodidae	*Pteropus rodricensis*	**Endemic**	**x**	**EN**	3	1	3	7	**Low**
Gastropoda	Littorinimorpha	Pomatiidae	*Tropidophora articulata*	**Sub-endémique**	**x**	**EN**	2	1	3	6	**Medium/High**
Gastropoda	Littorinimorpha	Pomatiidae	*Tropidophora eugeniae*	**Sub-endémique**	**x**	NA	2	1	0	3	**Low**
Reptilia	Squamata	Gekkonidae	*Lepidodactylus lugubris*	**Native**	**x**	NA	1	1	0	2	**Low (↑)**
Gastropoda	Caenogastropoda	Thiaridae	*Melanoides tuberculata*	**Native**	**x**	NA	1	1	0	2	**Negligible**
Arachnida	Araneae	Araneidae	*Cyrtophora citricola*	**Native**	**x**	NA	1	1	0	2	**Negligible**
Arachnida	Araneae	Araneidae	*Neoscona moreli*	**Native**	**x**	NA	1	1	0	2	**Negligible**
Arachnida	Araneae	Nephilidae	*Nephila inaurata*	**Native**	**x**	LC	1	1	0	2	**Negligible**
Arachnida	Araneae	Pholcidae	*Smeringopus pallidus*	**Native**	**x**	NA	1	1	0	2	**Negligible**
Arachnida	Araneae	Tetragnathidae	*Leucauge undulata*	**Native**	**x**	NA	1	1	0	2	**Negligible**
Aves	Charadriiformes	Scolopacidae	*Arenaria interpres*	**Native**	**x**	LC	1	1	0	2	**Negligible**
Aves	Charadriiformes	Scolopacidae	*Numenius phaeopus*	**Native**	**x**	LC	1	1	0	2	**Negligible**
Aves	Pelecaniformes	Ardeidae	*Butorides striata*	**Native**	**x**	LC	1	1	0	2	**Negligible**
Aves	Phaethontiformes	Phaethontidae	*Phaethon lepturus*	**Native**	**x**	LC	1	1	0	2	**Negligible**
Chilopoda	Scolopendromorpha	Scolopendridae	*Scolopendra subspinipes*	**Native**	**x**	NA	1	1	0	2	**Negligible**
Hexapoda	Blattodea	Blaberidae	*Pycnoscelus surinamensis*	**Native**	**x**	NA	1	1	0	2	**Negligible**
Hexapoda	Hemiptera	Pyrrhocoridae	*Dysdercus fasciatus*	**Native**	**x**	NA	1	1	0	2	**Negligible**
Hexapoda	Hymenoptera	Vespidae	*Polistes olivaceus*	**Native**	**x**	NA	1	1	0	2	**Negligible**
Hexapoda	Lepidoptera	Crambidae	*Spoladea recurvalis*	**Native**	**x**	NA	1	1	0	2	**Negligible**
Hexapoda	Lepidoptera	Lycaenidae	*Leptotes pirithous*	**Native**	**x**	NA	1	1	0	2	**Negligible**
Hexapoda	Lepidoptera	Lycaenidae	*Zizeeria knysna*	**Native**	**x**	NA	1	1	0	2	**Negligible**
Hexapoda	Lepidoptera	Nolidae	*Earias biplaga*	**Native**	**x**	NA	1	1	0	2	**Negligible**
Hexapoda	Lepidoptera	Nymphalidae	*Danaus chrysippus*	**Native**	**x**	NA	1	1	0	2	**Negligible**

Class	Order	Family	Taxa	Status	Local protection *	IUCN	note statut	note protection	note IUCN	note total	Receptor sensitivity
Hexapoda	Lepidoptera	Nymphalidae	*Junonia rhadama*	**Native**	**x**	NA	1	1	0	2	**Negligible**
Hexapoda	Lepidoptera	Nymphalidae	*Phalanta phalantha*	**Native**	**x**	NA	1	1	0	2	**Negligible**
Hexapoda	Lepidoptera	Pieridae	*Catopsilia florella*	**Native**	**x**	NA	1	1	0	2	**Negligible**
Hexapoda	Odonata	Coenagrionidae	*Ischnura senegalensis*	**Native**	**x**	LC	1	1	0	2	**Negligible**
Hexapoda	Odonata	Libellulidae	*Pantala flavescens*	**Native**	**x**	LC	1	1	0	2	**Negligible**
Hexapoda	Orthoptera	Acrididae	*Locusta migratoria*	**Native**	**x**	NA	1	1	0	2	**Negligible**
Hexapoda	Orthoptera	Gryllidae	*Gryllodes sigillatus*	**Native**	**x**	NA	1	1	0	2	**Negligible**
Hexapoda	Orthoptera	Tettigoniidae	*Conocephalus iris*	**Native**	**x**	NA	1	1	0	2	**Negligible**
Hexapoda	Orthoptera	Trigonidiidae	*Trigonidium cicindeloides*	**Native**	**x**	NA	1	1	0	2	**Negligible**

Table 55: Fauna conservation issues inside the area of influence

ID	Type	Items	Sub items	Sensitivity	Area/number of specimens inside the area of influence
FA01	**Fauna**	Fauna species of low sensitivity	*Pteropus rodricensis (Chiroptera)*	**Low**	>10
FA02	**Fauna**	Fauna species of medium / high sensitivity	*Tropidophora articulata (Gastropoda)*	**Medium / High**	Unknown*
FA03	**Fauna**	Fauna species of low sensitivity	*Tropidophora eugeniae (Gastropoda)*	**Low**	Unknown*
FA04	**Fauna**	Fauna species of low sensitivity	*Lygodactylus lugubris*	**Low**	Unknown (at least 3)

6.4.1.4 Ecological continuities

An ecological network must make it possible to maintain and restore a network of exchanges on the territory so that animal and plant species can communicate, circulate, feed, reproduce, rest, etc. by themselves to ensure their survival.

An ecological network is composed of different elements:

- Biodiversity reservoirs. These are areas where biodiversity is the richest, they generally include areas subject to protection and heritage environments outside protected areas.
- Ecological corridors that connect (or could connect) biological reservoirs to each other.
- Obstacles to continuity, in particular by locating the artificial network (urbanization, roads, various networks, etc.).

On the site, Anse Quitor (wooded banks) could be considered as a corridor and a biodiversity reservoir at the same time, given the indigenous biodiversity it shelters and the continuous forested corridor it constitutes. We associate the caves of François Leguat Reserve with this core with regard to the ecological restoration efforts made in this area directly linked to the reserve.

The restoration parcels and plantations bordering it form a buffer zone (including the official delimitation of the Anse Quitor nature reserve, the François Leguat Reserve and the downstream portion of the river).

The axis of the river from upstream to downstream is an ecological corridor.

Finally, it should be noted that the coastline (shore and grazing lands in-shore) itself forms a specific aerial and terrestrial corridor mainly used by three indigenous (or migratory) species as a foraging habitat: Butorides striata, Arenaria interpres, Numenius phaeopus. All species and groups of species concerned by local continuities are listed in Table 56.

Figure 108: Numenius phaeopus uses the coastal and open grazing lands corridor for feeding

Table 56: List of ecological continuities included within the area of influence

Ecological continuites	Function	Species concerned
Anse Quitor river	***Terrestrial corridor***	Native breeding birds (*Acrocephalus rodericanus, Foudia flavicans*), bats (*Pteropus rodricensis*), waterbirds (*Butorides striata*), reptiles (L*ygodactylus lugubris*)
Anse Quitor river	***Aerial corridor***	Bats (*Pteropus rodricensis*), marine birds (*Phaeton lepturus*)
Anse Quitor Nature Reserve	***Biodiversity reservoir***	Native plant species, i.e.: *Camptocarpus sphenophyllus, Clerodendrum laciniatum, Diospyros diversifolia, Fernelia buxifolia, Foetidia rodriguesiana, Hyophorbe verschaffeltii, Latania verschaffeltii, Mathurina penduliflora, Pleurostylia putamen, Polyscias rodriguesiana, Sarcanthemum coronopus, Secamone rodriguesiana, Terminalia bentzoe subsp. rodriguesensis, Zanthoxylum paniculatum…* Native breeding birds (*Acrocephalus rodericanus, Foudia flavicans*), bats (*Pteropus rodricensis*), waterbirds (*Butorides striata*), reptiles (*Lygodactylus lugubris*)
Coast	***Terrestrial corridor***	Waterbirds (*Butorides striata*), waders (N*umenius phaeopus, Arenaria interpres…*)
Grazing lands		
Coast	***Aerial corridor***	Waterbirds (*Butorides striata*), waders (*Numenius phaeopus, Arenaria interpres…*), marine birds (*Phaeton lepturus, Anous ssp., Onychoprion ssp., Sterna dougallii, Ardenna pacifica, Gygis alba, et*c)
Grazing lands		

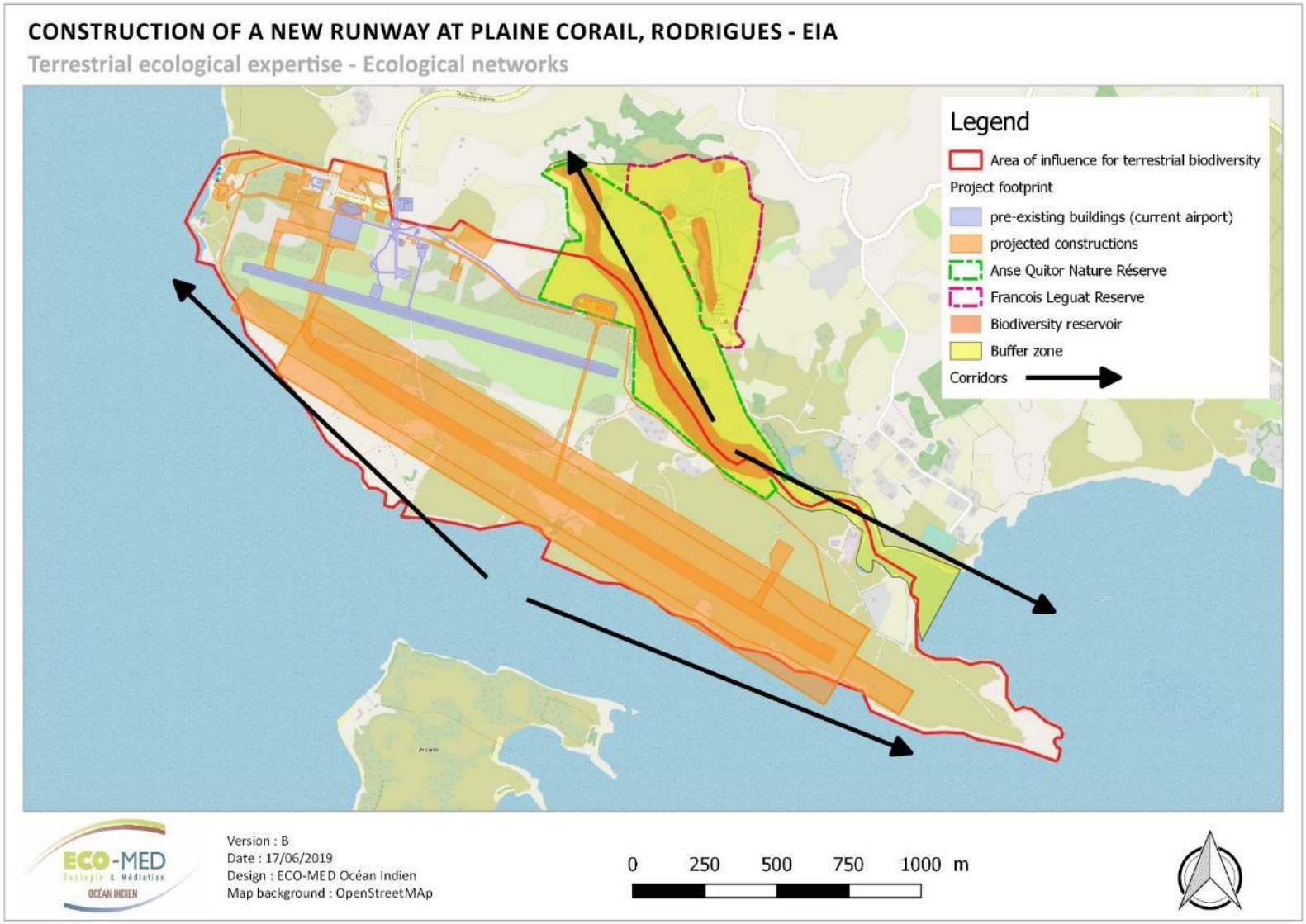


Figure 109: Ecological network mapping

6.4.1.5 Terrestrial biological environment issues

6.4.1.5.1 Terrestrial protected area

The protected area network in Rodrigues includes 4 protected sites, mentioned in the Forest and Reserves Act (1983), covering less than 1% of the total area of the island, namely: Great Mountain (30 ha fenced and 25.5 ha declared reserve), Anse Quitor (35 ha fenced and 10.3 ha declared reserve), Ile aux Sables (8 ha) and Ile aux Cocos (14.4 ha).

As shown in the previous map (Figure 109), the Anse Quitor Reserve adjoins the airport area.

This reserve has also been identified as "Key Areas for Biodiversity" by the Critical Ecosystems Partnership Fund.

Any impact on the core of the Reserve will be prohibited. Impacts on the buffer zone will be avoided as much as possible.

The extension of the airport area to Anse Quitor Reserve could weaken the acceptability of the project.

6.4.1.5.2 Protected species

Forestry Act 1983

All plants in forest land and reserves are prohibited from being destroyed by the **Forestry Act 1983**. Outside Anse Quitor, the project area does not seem to be affected. The text also lists the protected plants:

- All indigenous orchids
- Ochna mauritiana
- Hornea mauritiana
- All Diospyros species
- Sideroxylon grandiflorum
- Cordyline mauritiana
- All Tambourissa species
- All Trochetia species
- Erythroxylon laurifolium
- All indigenous ferns

The following plants are concerned within the limits of the area of influence:

- Adiantum rhizophorum Sw.
- Nephrolepis acutifolia (Desv.) Christ
- Phymatosorus scolopendria (Burm. f.) Pic. Serm.
- Diospyros diversifolia

Wildlife and National Parks Act 2016

Any person who plans to destroy native wildlife shall make a written application to the Director for a permit.

Many species, both animal and plant, are present on the site, as mentioned in the above tables.

The text mentions species of wildlife where more severe penalties are provided. Based on the field observations, the following could be impacted by this project:

- Pteropus rodricensis

- Phaethon lepturus.

Local protection of flora species (source: Rodrigues Regional Assembly, 16/04/2019)

A list of protected fauna and flora species has been sent by the Rodrigues Regional Council in April 2019. The list includes 3 species of fauna and 48 species of flora, as shown below.

Table 57: List of protected plant species in Rodrigues (Source: Rodrigues Regional Assembly, 2019): (in red, species recorded inside the area of influence; in yellow background: species recorded inside the project footprint)

Scientific name	Family	Local name	French name
Antirhea bifurcata (Desr.) Hook. f.	Rubiaceae	Bois goudron	
Badula balfouriana (Kuntze) Mez	Primulaceae	Bois papaye	
Carissa spinarum L.	Apocynaceae	Bois amer	
Clerodendrum laciniatum	Lamiaceae	Bois cabri	
Dictyosperma album (Bory) H. Wendl. et Drude ex Scheff.	Arecaceae	Palmiste blanc	Dictyosperme blanc
Diospyros diversifolia Hiern	Ebenaceae	Bois d'ébène / Ebénier	
Dodonaea viscosa Jacq.	Sapindaceae	Bois d'arnette	Dodonée visqueuse
Dombeya acutangula Cav.	Malvaceae	Mahot tantan	Mahot acutangulé
Dombeya rodriguesiana F. Friedmann	Malvaceae	Mahot / Bois Julien	
Doricera trilocularis	Rubiaceae	Bois chauve-souris	
Dracaena reflexa Lam.	Asparagaceae	Bois de chandelle	
Elaeodendron orientale Jacq.	Celastraceae	Bois rouge	Olivetier d'Orient
Eugenia rodriguesensis J. Guého & A.J. Scott	Myrtaceae	Bois fer	
Fernelia buxifolia Lam.	Rubiaceae	Bois bouteille	Fernel à feuilles de buis
Ficus reflexa Thunb.	Moraceae	Ti l'affouche	
Ficus rubra Vahl	Moraceae	Affouche rouge	Figuier rouge
Foetidia rodriguesiana F. Friedmann	Lecythidaceae	Bois puant	
Hibiscus liliiflorus Cav.	Malvaceae	Augerine	Ketmie à fleurs de lys
Hyophorbe verschaffeltii H. Wendl.	Arecaceae	Palmiste marron	
Latania verschaffeltii Lem.	Arecaceae	Latanier jaune	
Lomatophyllum lomatophylloides	Asphodelaceae	Ananas marron	
Mathurina penduliflora Balf. f.	Passifloraceae	Bois gandine	
Myoporum mauritianum A. DC.	Scrophulariaceae		
Obetia ficifolia (Poir.) Gaudich.	Urticaceae	Bois d'ortie	Obétie à feuilles de figuier
Olea lancea Lam.	Oleaceae	Bois malaya	
Pandanus heterocarpus Balf. f.	Pandanaceae	Vacoa parasol	
Phyllanthus casticum Soy.-Will.	Phyllanthaceae	Bois de demoiselle	
Phyllanthus dumentosus Poir.	Phyllanthaceae		
Pittosporum balfourii Cuf.	Pittosporaceae	Bois bécasse	
Pleurostylia putamen Marais	Celastraceae	Bois d'olive blanc	
Polyscias rodriguesiana (Marais) Lowry & G.M. Plunkett	Araliaceae	Bois blanc	
Poupartia castanea (Baker) Engl.	Anacardiaceae	Bois lubine / figue marron	

Scientific name	Family	Local name	French name
Premna serratifolia L.	Lamiaceae	Bois sureau	Premme à feuilles dentelées
Psiadia rodriguesiana Balf. f.	Asteraceae		
Psychotria balfouriana Verdc.	Rubiaceae		
Ramosmania rodriguesii Tirveng.	Rubiaceae		
Sarcanthemum coronopus Cass.	Asteraceae		
Scolopia heterophylla (Lam.) Sleumer	Salicaceae	Goyave marron	Scolopie héterophylle
Senecio boutonii Baker	Asteraceae		
Sideroxylon galeatum (A.W. Hill) Baehni	Sapotaceae		
Sophora tomentosa L.	Fabaceae		Sophore tomenteux
Syzygium balforii (Baker) J. Guého & A.J. Scott	Myrtaceae		
Terminalia bentzoë (L.) L. f.	Combretaceae	Benjoin	
Terminalia bentzoe rodriguesensis	Combretaceae	Bois benjoin	
Thespesia populnea (L.) Sol. ex Corrêa	Malvaceae	Sainte Marie	
Turraea lacinata (Balf. f.) Harms	Meliaceae	Bois balai	
Vepris lanceolata (Lam.) G. Don	Rutaceae	Patte poule	Vépride lancéolé

6.4.1.5.3 Critical habitats

As per the World Bank ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources, “Habitat” is defined as a terrestrial, freshwater, or marine geographical unit or airway that supports assemblages of living organisms and their interactions with the non-living environment.

ESS 6 requires a differentiated risk management approach to habitats based on their sensitivity and values. This ESS addresses all habitats, categorized as ‘modified habitat’, ‘natural habitat’, and ‘critical habitat’, along with ‘legally protected and internationally and regionally recognized areas of biodiversity value’ which may encompass habitat in any or all of these categories.

- AQNR is defined as a ‘critical habitat’ as per ESS6 in as such as it meets the definition below:
- Critical habitat is defined as areas with high biodiversity importance or value, including: (a) Habitat of significant importance to Critically Endangered or Endangered species, as listed in the IUCN Red List of threatened species or equivalent national approaches; (b) Habitat of significant importance to endemic or restricted-range species; (c) Habitat supporting globally or nationally significant concentrations of migratory or congregatory species; (d) Highly threatened or unique ecosystems; and € Ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d).

In the preliminary designed, the ATC tower was located in Anse Quitor critical habitat. It was recommended that, since the reserve is very well delineated by its property line, shifting the control tower a few meters to the south or west would put the project out of the critical habitat limits and avoid the destruction of the critical habitat by the project.

2022 update: the ATC tower and RFFSD have been relocated outside the critical habitat, hence reducing the impact rating.

6.4.2 Marine biological context

6.4.2.1 Regulatory context

For the Republic of Mauritius, various regulatory texts define the modalities of protection and/or harvesting for marine fauna and flora. For marine environments, the fauna and flora are protected by the following texts:

- The Environment Protection Act 2002;
- The Fisheries and Marine Resources Act 2007;
- Maritime Zone Act 2005.
- For these texts, provisions specify the habitats or species protected or regulated.

6.4.2.2 Management responses and marine protected area

The Government of Mauritius and the Rodrigues Regional Assembly have implemented various measures in recognition of the need to protect coastal and marine biodiversity such as declaring Fishing Reserves where throwing net fishing is prohibited (Fisheries Act 75 of 1984). In Rodrigues, 5 areas were created: Pointe Venus to Pointe la Gueule, Pointe la Gueule to Pointe Manioc, Baie Topaze, **Anse Quitor**, and Grande Passe.

There are also four Marine Reserves: Grand Bassin (14.1 km²), Passe Demi (7.2 km²), Passe Cabri (1.5 km²) and Rivière Banane (1.5 km²); and one multiple-use Marine Protected Area, the newest South-East Marine Protected Area (SEMPA). SEMPA is a multiple use MPA covering a total area of 43 km² including Anse Quitor and Grande Passe.

The marine environment of Rodrigues is protected by the Fisheries and Marine Resources Act signed in 2007. Several marine areas are protected as fishing and marine reserves.

Six fishing reserves have been established in the lagoon:

- Pointe Vénus;
- Pointe la Gueule;
- Pointe Manioc;
- Baie Topaze;
- Anse Quitor;
- Grande Passe.

These areas cover an area of 6 km². Their aim is to preserve the environment but also to perpetuate the artisanal fishing activity. These reserves regulate fisheries by controlling the size of fishing nets and the period of activity, and by prohibiting certain practices such as seining.

There are also five marine reserves in Rodrigues:

- Four little areas in the north of the island: Riviere Banane, Anse aux Anglais, Grand Bassin and Passe Demi;
- A large area in the south called South East Marine Protected Area (SEMPA).

SEMPA covers the entire southern coast of the island and the lagoon. It covers an area of 42.5 km². Under the responsibility of the Rodrigues Regional Assembly, SEMPA is administered in a community way by a Management Committee that brings together the RRA administration, NGOs, partners (Shoals, MRC, Terre Mer Rodrigues), fishermen, tourism stakeholders and users.

The project is located between the Topaze Bay Fishing Reserve and the South East Marine Protected Area. It is not included in any marine protected area.

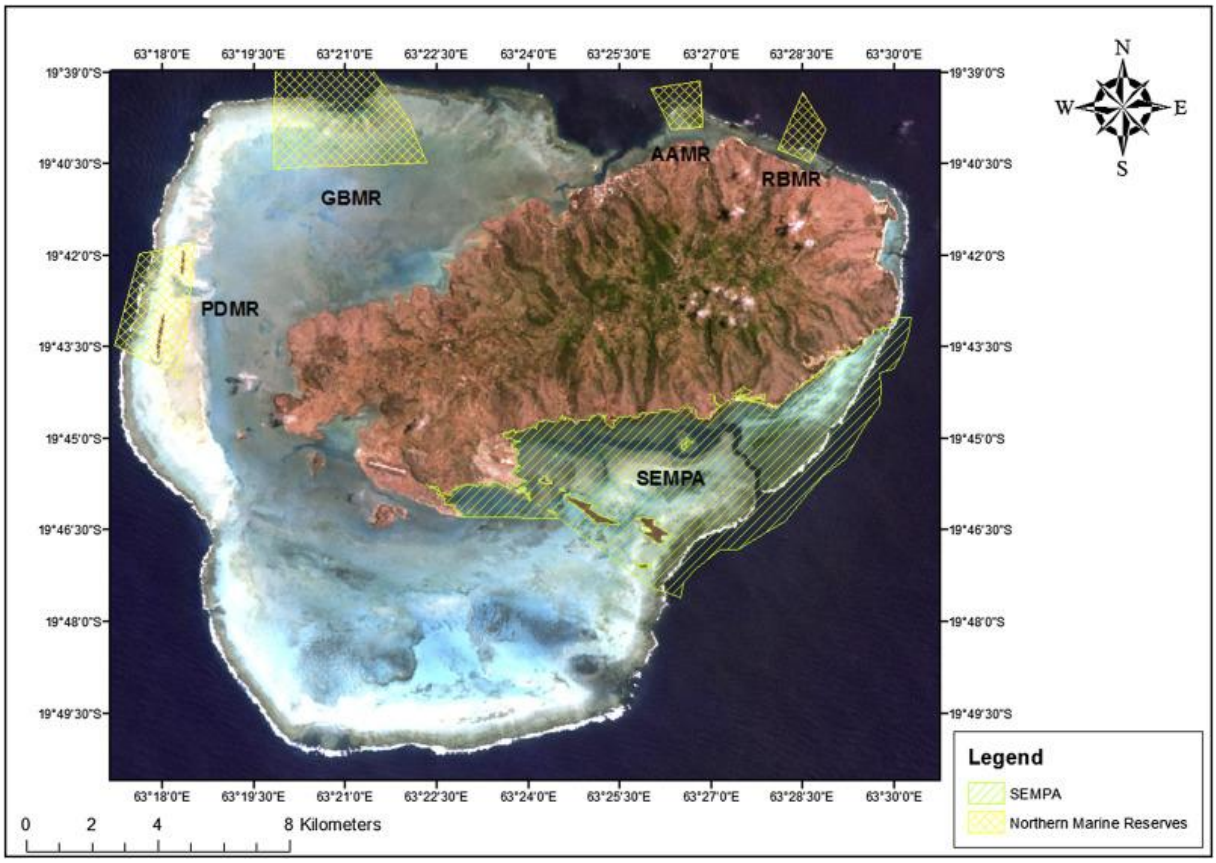


Figure 110: Marine reserves in Rodrigues (Pasnin et al., 2016)

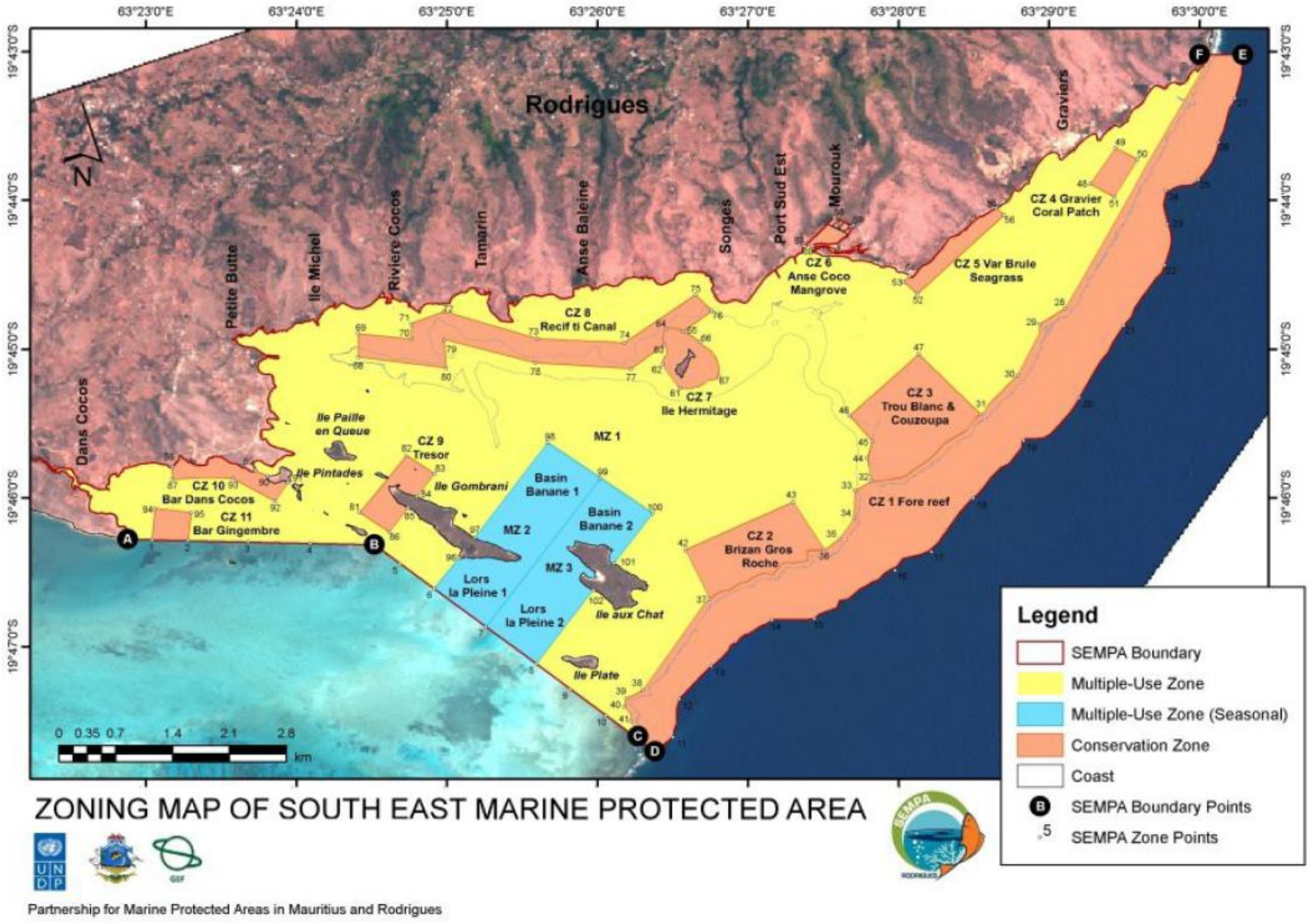


Figure 111: Perimeter of South East Marine Protected Area (Robert, 2014)

6.4.2.3 Area of influence

The area of influence for marine biodiversity is mapped on the figure below.

It includes the Topaze Bay to the north, Désirée and Frégate Islands, Crab Island to the south and the anse Patate to the east.

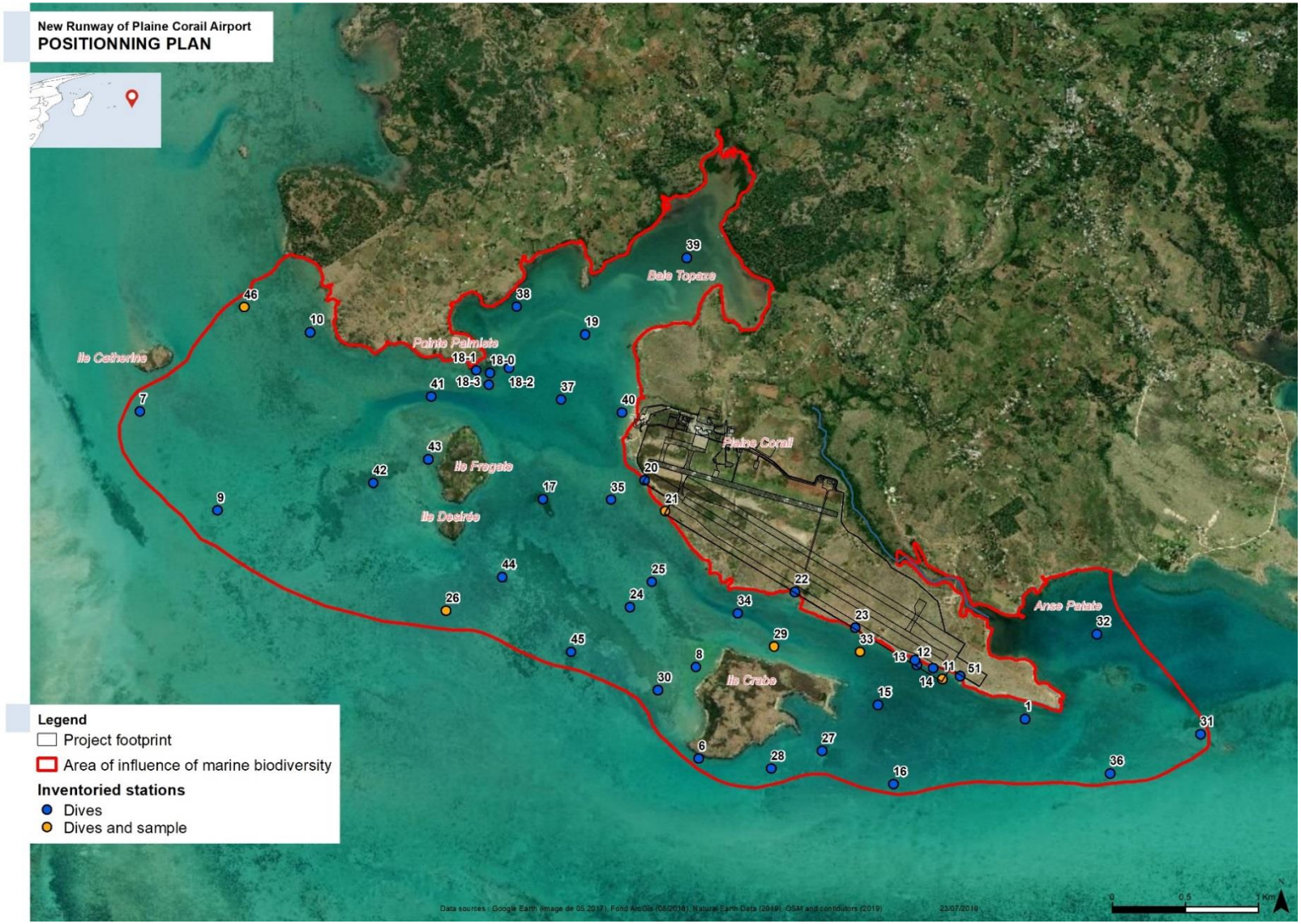


Figure 112: Area of influence for Marine biodiversity

6.4.2.4 Methodology

First, the charts related to the preliminary results of the turbid releases modelling were used to determine the field of influence of the turbid plume, i.e. the investigation area.

A first sea bottom charting was achieved based on available bibliographic data and on aerial photography on the project website (Google Earth Pro 2017). This charting consisted in an approach associated with the differentiation of the various sea bottom types by means of clipping the different bodies presenting similar structures and colors.

Thus, so as to confirm the different delimited facies, forty-six (46) points (or stations) were defined to verify the sea bottom nature and describe the existing habitats.

The whole stations identified were sampled on the 10th and 11th of July 2019, at depths ranging from 0.5m to 4.5m. They are located on the Figure 112.

6.4.2.5 Marine habitats

This section describes the habitats recorded in the area of influence for marine biodiversity and briefly outlines the relative ecological ranking for each. The habitats characterization was realized thanks to scuba diving surveys.

Results mention three (3) important habitats typologies sampled during this study, for which descriptions are proposed within the different parts of this section. The habitat HAM2 is divided into 5 sub-habitats.

The marine habitats are presented on the figure below.

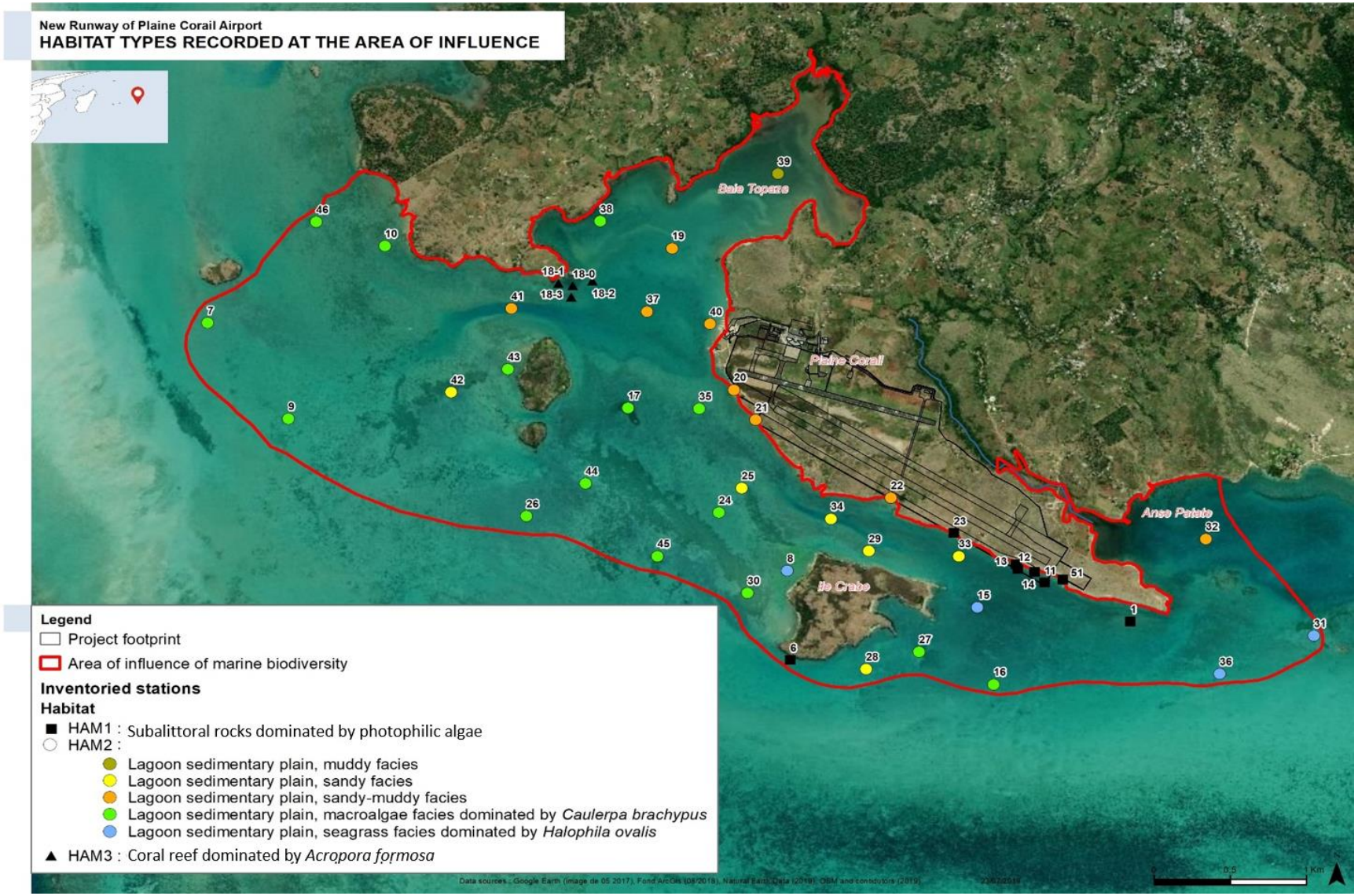


Figure 113: Marine habitat types mapping

Topaze Bay is defined as a muddy sandy intertidal area colonized by sparse to moderate marine vegetation (Chapman, 2000). Beyond the opening zone of the bay, vegetation becomes denser (meadows) and muddy areas are observed. The inner areas of Topaze Bay are dominated by fine sediments (>75%). This type of habitat is particularly occupied by mobile invertebrates, in particular holothurians (such as *Holothuria atra*) (Hardman et al., 2006a; Lynch et al., 2005).

In this sector, the bay is therefore mainly characterized by soft substrates, formed by a detrital sandy zone with coarse sediments, and covered with macroalgae (e.g. *Halimedea opuntia, Caulerpa spp., Udotea sp.*).

At "Pointe Palmiste", a coral formation developed at the entrance of the bay, with a medium coral cover (*Acropora* sp. for a coverage of 1 to 10%).

6.4.2.5.1 HAM 1: Infralittoral rocks dominated by photophilic algae

The infralittoral rocks habitat dominated by the photophilic algae correspond to the rocky shallow areas, covered by sand or not, which were investigated at eight (8) different stations (n°1, 6, 11, 12, 13, 14, 23, et 51).

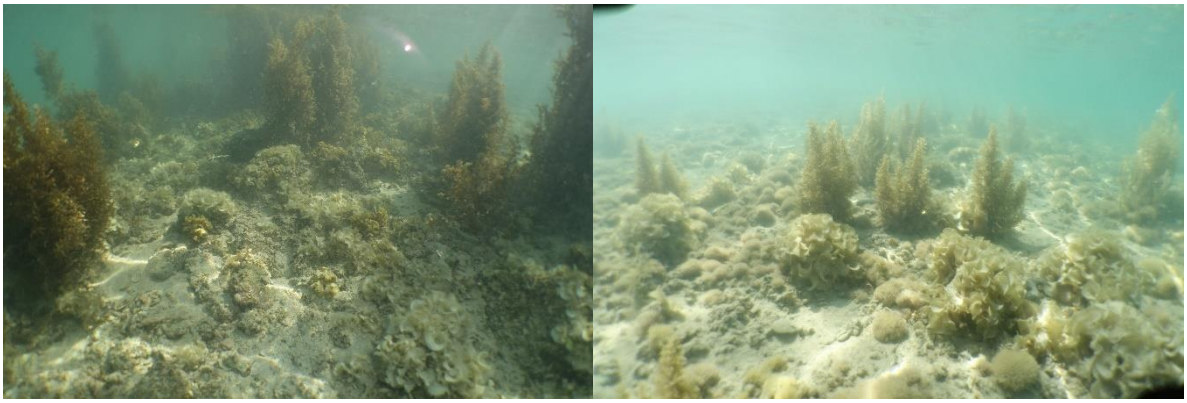


Figure 114: Photophilic algae, station n° 06 (on the left) and station n°14 (on the right)

This habitat is characterized by the presence of many filamentous or encrusting green, brown and red algae, and species typically found in shallow areas: *Udotea palmetta, Padina* sp, *Turbinaria ornata, Codium spongiosum* but also *Neomeris annulata*. Long sargasso were also observed at station n°6 (southeast of Crab Island).

In addition, these shallow rocky areas facilitate the development of some isolated coral colonies in the whole stations (excepted station n°23) with many associated mobile species but with a weak species richness (*Epinephelus merra, Gymnothorax griseus, Cheilodipterus quinquelineatus, Ostracion cubicus* for fishes).

Figure 115: Gymnothorax griseus, station n° 12

The sublittoral rocks dominated by photophilic algae are of a low sensitivity.

6.4.2.5.2 HAM 2: Lagoon sedimentary plain

The most common profile of the study area is undeniably the lagoon sedimentary plain. Globally, this lagoon habitat is composed of sand, with lower proportions of coral debris and isolated cobbles of coral rocks (Orr, 2008). The soft seabed of the study area presents areas of bare substratum, intermittently covered by green macroalgae and brown algae, by seagrass, by carpets of algae, by cyanobacterias, by isolated clusters of coral colonies. Therefore, it is possible to define five (5) main facies for this habitat.

Sandy facies:

The lagoon sedimentary plain sandy facies is the main facies encountered out of the Topaze Bay. Although it is only represented here by six (6) sampled stations (n°25, 28, 29, 33, 34 and 42), it is important to understand that it corresponds to the sea bottom types mainly present out of the macroalgae and seagrass overlapping areas.

Figure 116: Station n°33 and isolated coral

Figure 117: Station n°29 and small isolated coral (Turbinaria sp.)

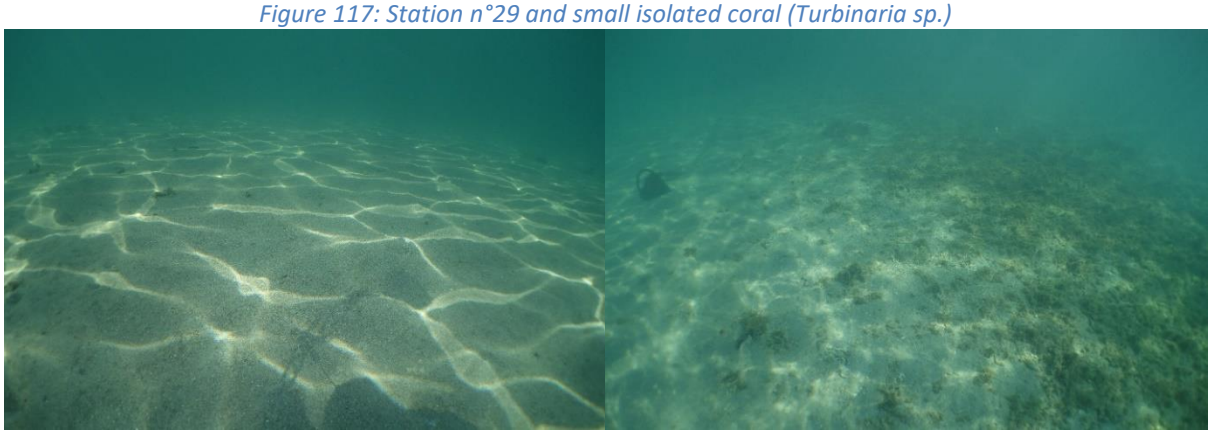


Figure 118: Sandy facies of station n°28 and at the interface with brown algae beds

This formation is not very original, except for the presence of numerous burrows and *tumuli*, testifying of the sediments high reworking activity and surface layers oxygenation by the seabed fauna activity (bioturbation). This fauna, living buried in the ten (10) first centimeters of the sediments, may be composed of shellfish, annelid polychaete sandworms or even bivalve molluscs. The presence of numerous burrows in the sand, a symbiotic type gobie *Amblyeleotris* living in symbiosis with pistol shrimps (*alpheus* sp.), the presence of several species of holothuriae with notably *Holothuria atra* and *H. leucospilota*, and a low density of small clusters of coral (*Porites* sp., *Turbinaria sp*.) should be noted.

Very few fishes were observed. Most of the observations were done on isolated clusters of coral (notably *Epinephelus merra*).

The sandy facies of the lagoon sedimentary plain is of a low sensitivity.

<u>Sandy muddy facies:</u>

The sandy muddy facies present in the sedimentary plain lagoon was observed in eight (8) sampled stations (n°19, 20, 21, 22, 32, 37, 40 and 41) with fine sediment fraction rate relatively variable according to the stations. The proportion of mud seems to be less important in the neighbourhood of the Anse Patate bay (station 32) and of the channel straight of Pointe Palmiste (station 41) which naturally presents stronger currents. The other stations are located in the three (3) embankment areas of the project (stations 20, 21 and 22), in the Topaze Bay, straight to the Port Safety area (stations 37 and 40) and in the middle of the bay (station 19).

Figure 119: Burrows and tumuli at the stations n°41 (on the left) and n°32 (on the right)

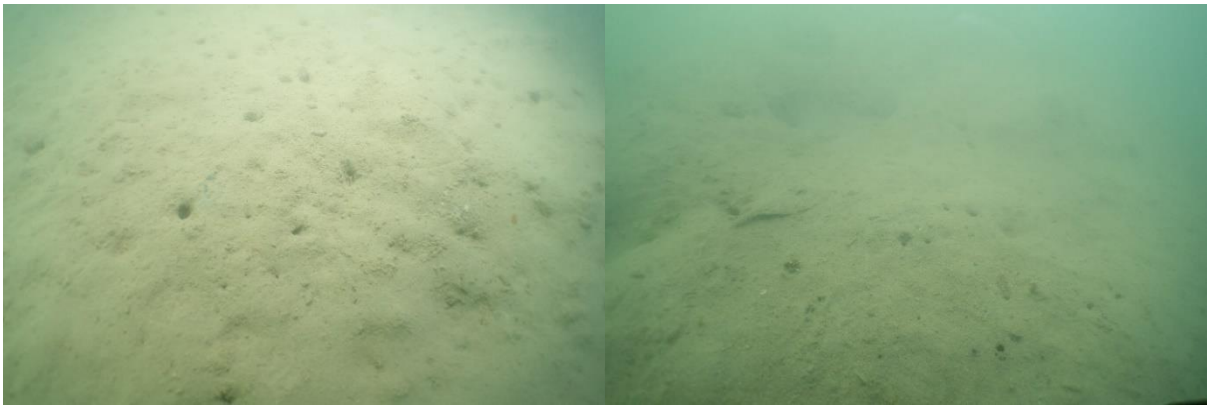


Figure 120: Station n° 19 (on the left) and station n°37 (on the right)

Figure 121: Burrow, holothuriae and spot of Caulerpa brachypus at station n°22

Similarly to the previous facies, numerous burrows and *tumuli* are present, testifying of the ground fauna high activity (bioturbation). Among the whole investigated stations, only scattered holothuriae were observed, except at station n°22 which shows a higher density of this species and some spots of macroalgae dominated by *Caulerpa Brachypus* seawards. In addition, there was no coral colony and few fishes observed in these stations.

The sandy-muddy facies of the lagoon sedimentary plain are of a low sensitivity.

Muddy facies:

This facies is only observed at station n°39 on the seabed of the Topaze Bay. This station is directly influenced by terrigeneous inputs originated by gullies and rivers, and it benefits from a weaker hydrodynamism than in an open area. The ambiant turbidity is very important based on the local poor visibility, and the sedimentation rate is likely to be elevated too, knowing the high fine particle fraction in presence.

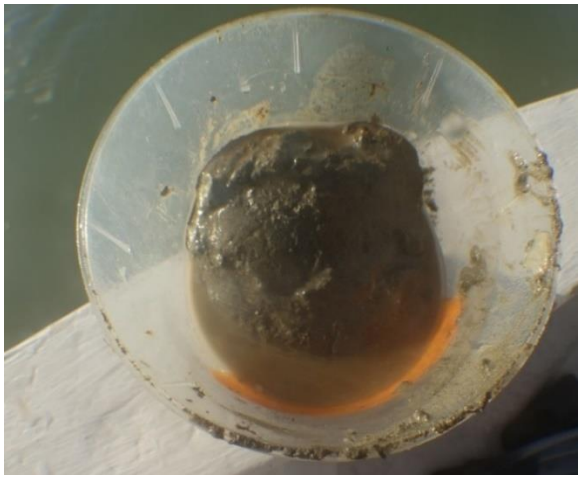


Figure 122: Sediment sample at station n°39

Macro-algae facies dominated by Caulerpa brachypus

The macro-algae facies dominated by *Caulerpa brachypus* in the lagoon sedimentary plain is one of the two (2) main facies met in the survey area, with the sandy facies. It is present here in fifteen (15) samples stations (n°7, 9, 10, 16, 17, 24, 26, 27, 30, 35, 38, 43, 44 et 45).

Figure 123: Meadows of Caulerpa brachypus, station n° 09 (on the left) and station n°17 (on the right)

It is the most frequent Caulerpa species in Rodrigues water, forming dense meadows over huge surfaces in different biotopes. Fishermen use it as bate and it is frequently collected for this purpose. Its morphology varies in size and branch shape (Coppejans et al., 2004). Its assimilators are rather fleshy. Most of the populations are single leaves (or scarcely only branched) with smooth margins, almost 5cm high. In other populations, leaves are very long (up to 20-25cm in length), repeatedly dichotomously branched, with (partly) dentate margin. All intermediates between those two forms are existing.

In the studied area, the smallest form is mainly present (between 5 and 10cm high) and it covers all types of substratum. Thus, it can be found on sandy and sandy silty seabed, but also over coral reef located at Pointe Palmiste, without being the dominating species.

As the dominating species of this facies, *Caulerpa brachypus* is visible locally with very variable overlapping rates, possibly reaching almost 90%, according to experts.

Other macroalgae species are present in this facies in more or less important amounts, such as green algae *Udotea palmetta* et *Halimeda opuntia* for example, which are two (2) calcareous algae originating sands, but also *Neomeris annulata* which is very frequent, and sporadically other types of Caulerpae.

Among the most distinctive brown algae, there is to notify the presence of *Padina* sp. and of the *Turbinaria ornata* algae from the Sargasso family. Many types of red algae, typical of infralittoral seabed, are also observed.

The phanerogame *Halophila ovalis* is also visible with a low density at the stations n°7 and 27.

Concerning the associated benthic fauna, holothuriae are the most represented with notably *Holothuria atra* and *H. leucospilota*, and the spotted Synapte called *Synapta maculata.* Some seastars are also encountered, like *Linckia sp.* and various small gastropods.

Figure 124: Linckia sp (on the left), station n°06 and Synapta maculata (on the right), station n° 33

Some corals are also visible on isolated tiny rocks, among them the Porites (probably *P*orites lobata*), a* Merulinidae (*Platygyra sp.*), a *dendrophylliidae* from gendus Turbinaria.

Few fishes were observed out of the symbiotic Gobies from genus *Amblyeleotris* in the soft sediments burrows. A weak species richness and a low species abundance were observed, with notably *Arothron stellatus* (1 ind.), *Hemiramphus far* (1 ind.) in deep water, and concerning the species associated to isolated rocks, only some wrasses, a pipefish (*Corythoichthys flavofasciatus*), several moray eels (*Gymnothorax griseus*) and a grouper (*Epinephelus merra*) were sheltering there.

A seahorse (*Hippocampus sp.)* and many sea slugs (*Oxynoe viridis*) were observed within the macroalgae.

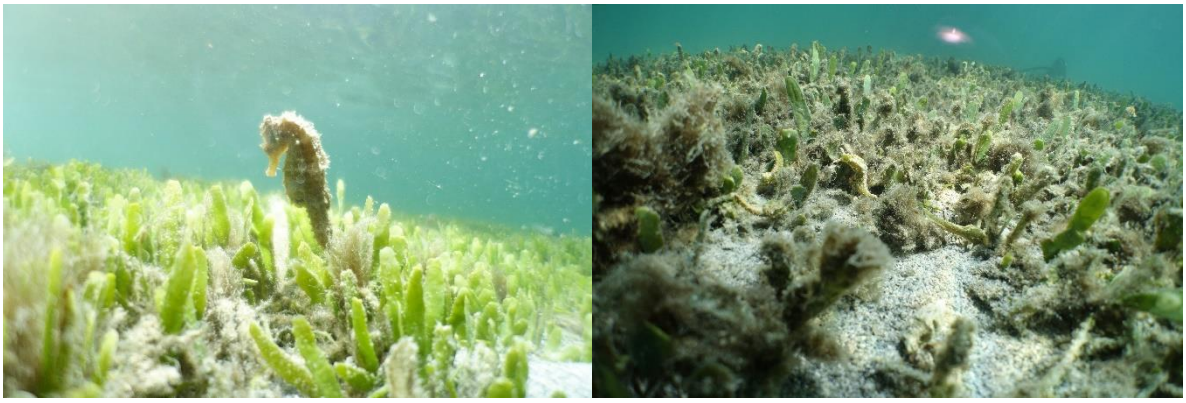


Figure 125: Hippocampus sp (on the left), station n° 45 and Oxynoe viridis (on the right), station n°16

The macroalgae facies dominated by *Caulerpa brachypus* found in the lagoon sedimentary plain are of a low sensitivity.

Seagrass facies with *Halophila ovalis* (phanerogam)

This last facies was observed in four (4) stations, on either side of the Crab Island (stations n°8 and 15) and at the easternmost part of the studied area (stations n°31 and 36). According to Coppejans et *al*. (2004), only two (2) phanerogames are present as seagrass around the island, *Halophila ovalis* (classified as "least concern" on the IUCN Red List (www.iucnredlist.org)) and *Halophila stipulacea.* However, the latter was not observed during the survey.

Despite its small size, seagrasses can play several important roles. It can be a source of food for herbivorous animals, notably the marine turtles, and it can also be used as shelter by some juvenile species. Phanerogam meadows serve as habitat and shelter for specific fauna, nursery for reef species, high primary production and protection for potential adjacent coral communities as they retain sediments and use nutrients.

The observed leaves densities are very variable, ranging from very low (isolated leaves) for station n°8 to medium for station n°31.

Figure 126: Halophila ovalis, station n° 08 (on the left) and station n°31 (on the right)

Many types of green, brown and red algae and cyanobacteriae are associated to these seagrasses. Globally, the observed seagrasses did not present a strong vitality.

The observed associated fauna is mainly represented by holothuriae, from genus Holothuria, inside the seagrass. Like previously, the fauna is concentrated in the isolated clusters of corals. *Apogon cyanosqoma*, *Epinephelus merra*, *Stethojulis bandanensis* and *Plotosus lineatus* are notably visible on a rock at station n°36.

The seagrass facies with *Halophila ovalis* found in the lagoon sedimentary plain is of a medium sensitivity.

6.4.2.5.3 HAM 3: Coral reef dominated by *Acropora formosa*

This habitat is only found at Pointe Palmiste, at stations n°18. It is a relatively large reef consisting mainly of the species *Acropora formosa* (classified as "near threatened" on the IUCN Red List. It is also protected locally[7].

It shows many signs of degradation, probably due in large part to fishing activities on foot and the passage of fishing boats or sand transport boats that use a stick to move around.

Station n°18-1 has a very degraded reef, mainly composed of dead acropora branches. Nearby station n°18-3 has a dead coral substrate colonized by brown and red algae. Stations 18-0 and 18-2 are in better condition. It should also be noted that the turbidity of the site is relatively high due to its proximity to Baie Topaze.

However, this reef also shows some vitality with the presence of many signs of growth.

Figure 127: Coral reef, station n° 18-0

[7] The Fisheries and Marine Ressources Act, 2007 and The environnement protection Act, 2002.

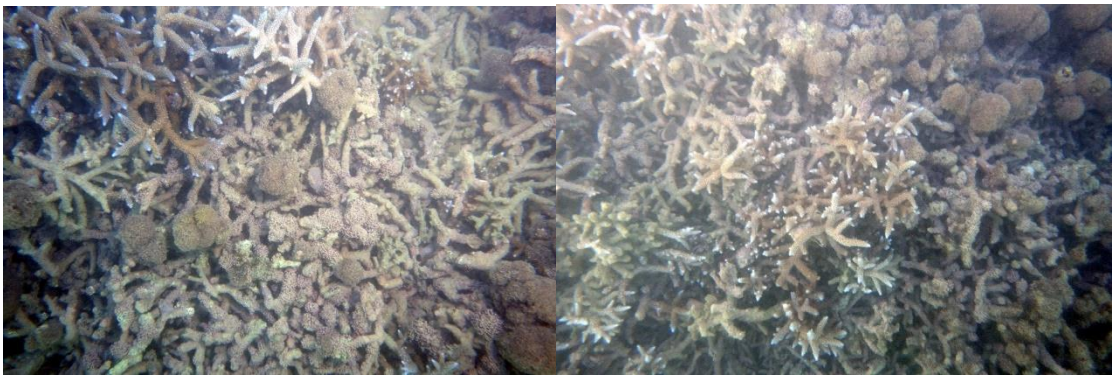


Figure 128: Coral reef, station n° 18-1

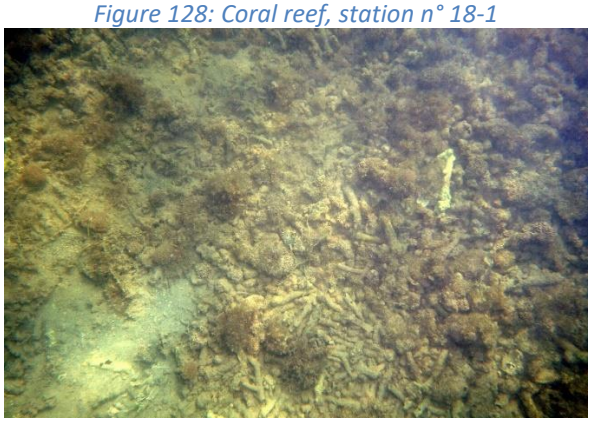


Figure 129: Coral reef, station n° 18-3

Within the study area, this reef is the most important, and certainly the most sensitive, area of ecological interest. Indeed, it is on this site that the highest specific richness and abundance are observed. The ecological functions provided to the environment are very important since it is the only complex habitat in the study area.

The ichthyofauna observed consists of a total of 16 species belonging to 13 families. All the species recorded were composed of bony fish (osteichthyans). The best represented species were *Sphyraena flavicauda* (yellowtail barracuda) with about 100 individuals, then Yellowfin goatfish and Yellowstripe goatfish (*Mulloidichthys vanicolensis* and *Mulloidichthys flavolineatus*) and snappers (2 species) with about 100 individuals also for each family. Then comes the *Scissortail sergeant* (*Abudefduf sexfasciatus*) with about twenty individuals and of lesser importance *Chrysiptera glauca* (damsel), *Chaetodon* sp and *Chaetodon auriga*, *Cheilodipterus quinquelineatus*, *Sargocentron diadema*, *Arothron immaculatus*, *Ephinephelus merra*, *Gnathodentex aureolineatus*, *Zanclus cornatus* and *Labridae undetermined.*

Coral reef dominated by *Acropora formosa* is of high sensitivity*.*

6.4.2.6 Mobile fauna

6.4.2.6.1 Ichtyofauna

Ichthyological populations are quite different depending on the nature of the habitats. Coral formations support the richest and most diverse populations, while meadows or soft areas, such as in the area of influence, are poorer.

A dominance of Scaridae, Siganidae and Labridae is observed, as traditionally in tropical phanerogam seagrass. On the periphery of the seagrass, at the edge of the sand, we generally find Nemipteridae, Mullidae and Dasyatidae. At the root system level, many juveniles evolve.

On the coral reef, the fish community is dominated by damselfish. Emperors, snappers, trevally and groupers are rare or absent and no triggerfish (ballistids) are observed. The lack of large fish predators suggests fishing pressure is high.

The area of influence, which consists of soft ground and grass beds, has a low diversity of fish. In Rodrigues lagoon, fishing pressure on predators is high.

Five Fish Landing Stations are present in the vicinity of the airport on coastal line.

The following table presents yearly record of catch for the post live years in metric tons.

Year	FISH	OCTOPUS	OFF LAGOON	TOTAL
2013	1750	561	293	2604
2014	1158	502	363	2023
2015	1347	503	408	2258
2016	1257	603	420	2280
2017	1347	630	440	2417
2018	1340	605	402	2347

Catches are dominated each year by fish and to a lesser extent by octopus. The common fishes and crustacean caught are:

- Parrot fish,
- Coastal Travelly,
- Shoemaker spinefoot,
- Goatfish,
- Unicorn fish,
- Honey comb grouper,
- Blue spot mullet,
- Tenpounder blue line surgeon fish,
- Trigger fish,
- Shark,
- Wrasse,
- seobream,
- Spangled emperor,
- lobster,
- Crab,
- Needle fish.

The Ichtyofauna is of a low sensitivity.

6.4.2.6.2 Marine turtles

Six species of marine turtles are present in the Indian Ocean. The green turtle (*Chelonia mydas*) and the hawksbill turtle (*Eretmochelys imbricata*) were the two species initially found in Rodrigues.

They were heavily exploited during the 18th century and became very uncommon from 1950 onwards in Rodrigues where it seemed that they were no longer landing.

In recent years, hawksbill turtles have been observed occasionally in the lagoon or on reef slopes. This species is classified as “critically endangered” on the IUCN Red List (www.iucnredlist.org). A comprehensive survey was carried out and we now know that turtles still nest in Rodrigues, but at a very low level. The survey also showed that Rodrigues still has a good number of beaches that can attract the nesting of marine turtles (figure below). There have been fairly recent yet unconfirmed reports of new-born turtles on Crab Island off the west coast of Rodrigues, turtle traces on a beach in the Saint François Bay area and turtles landing on Baladirou beach. However, poaching on these protected species is still common on the island.

No turtle was observed in the area of influence during the dives in July 2019.

Marine turtles (hawksbill turtle) occasionally visit Rodrigues. The study area does not regularly host marine turtles. Their observation in Topaze Bay remains occasional. However, the marine turtles are of a high sensitivity.

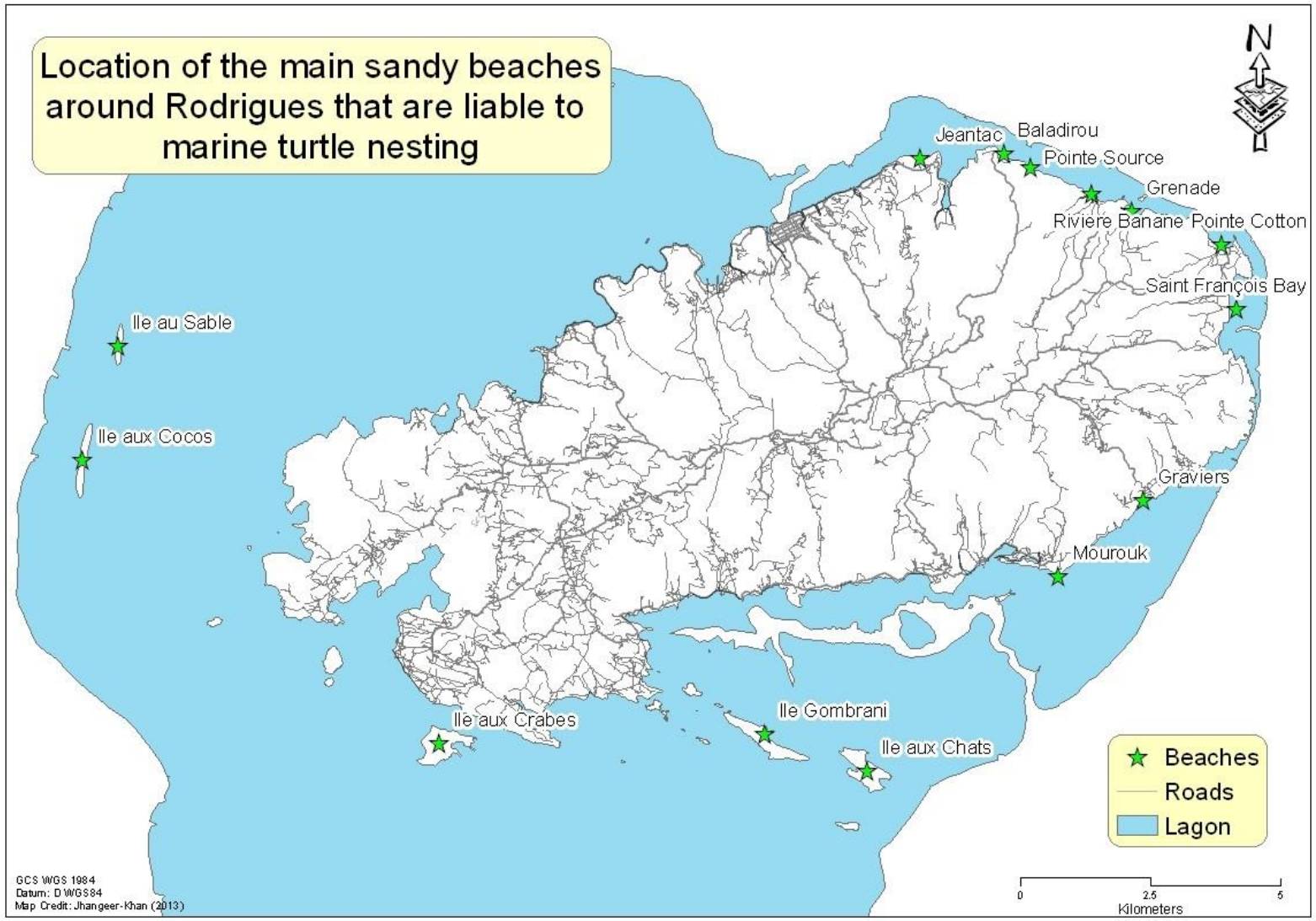


Figure 130: Location of potential egg-laying areas for marine turtles

6.4.2.6.3 Marine mammals

Five main species are observed in the coastal waters of Rodrigues:

- The spinner dolphin (*Stenella longirostris*): These small dolphins (2.00 m long and 75 kg) live in groups of 25 to 100 individuals. Feeding exclusively on small fish and squid, they go hunting in the open sea at the end of the day and at night. They come close to shore in the early morning to rest and socialize. We can then see them perform spectacular jumps, which is their speciality.
- The pantropical spotted dolphin (*Stenella attenuata*): Pantropical spotted dolphins are relatively small, reaching lengths of 2 m and weighing approximately 100 kg at adulthood. They usually occur in groups of several hundred to 1,000 animals. They are considered quite social, often schooling with other dolphin species. They spend most of their day in shallower water between 100 and 300 m deep.
- The common bottlenose dolphin (*Tursiops truncatus*): Common bottlenose dolphins get their name from their short, thick snout (or rostrum). They are found in both offshore and coastal waters, including harbours, bays, gulfs, and estuaries.
- The Indo-Pacific bottlenose dolphin (*Tursiops aduncus*): These dolphins can reach 2.50 m in adulthood and weigh up to 200 kg. Near the coast, they live in very small groups of a few individuals. Of a curious and not so shy nature, they often visit boaters.
- The humpback whale (*Megaptera novaeangliae*): The humpback whale is one of the most impressive marine mammals. With a length of 12-16 meters and a weight between 25 and 33 tonnes, this baleen whale is also called a humpback. Very expressive, the humpback whale produces melodious songs in deep waters as well as jumping out of the water. Close to extinction in the early 20th century, the humpback whale is now the most studied and best-known cetacean.

In the study area, there is no data to certify the presence of cetaceans in Topaz Bay. Considering the bathymetric characteristics of this area, it seems that the Indo-Pacific bottlenose dolphin is the most likely species to frequent the area, as this cetacean frequents shallow coastal waters (between 0 and 60m). However, with a shallow lagoon, its presence is still possible and certainly occasional. Outside the lagoon, all species are potentially present.

No marine mammal was observed in the area of influence during the dives in July 2019.

Occasional presence of Indo-Pacific bottlenose dolphins in the lagoon due to the bathymetric characteristics. In the study area, there is no data to certify the presence of cetaceans in Topaz Bay. **For this reason, marine mammals are of a low sensitivity.**

Figure 131: Stenella longirostris and Megaptera novaeangliae (http://www.mmcs-ngo.org/en/marine-environment/cetaceans.aspx)

6.4.3 Summary: Biological environment sensitivity

Table 58: Biological environment sensitivity

Theme	Sub-theme	Receptor	Sensitivity
Biological environment	Terrestrial habitats	Grazing lands on basaltic resurgences	Medium
		Grazing lands on calcarenic substratum	Medium
		Coastal vegetation dominated by Ipomoea pes caprae (shore-line community)	Medium
		Dry forest	Major
		Riparian vegetation	Medium
		Estuarine habitat	Medium
		Calcarenic dry lawns of anthropogenic origin	Medium
		Coastal grasslands dominated by secondarized thickets (Lantana camara)	Low
	Terrestrial flora	*Hyophorbe verschaffeltii, Polyscias rodriguesiana*	Major
		Antirhea bifurcata, Clerodendrum laciniatum, Diospyros diversifolia, Fernelia buxifolia, Foetidia rodriguesiana, Latania verschaffeltii, Terminalia bentzoe subsp. Rodriguesensis, Zanthoxylum paniculatum	High
		Adiantum rhizophorum, Camptocarpus sphenophyllus, Cyperus iria, Mathurina penduliflora, Nephrolepis biserrata, Pandanus heterocarpus, Paspalidium geminatum, Phymatosorus scolopendria, Pleurostylia putamen, Rhizophora mucronata, Sarcanthemum coronopus, Secamone rodriguesiana, Tournefortia argentea.	Medium
		Dodonaea viscosa, Dracaena reflexa, Elaeodendron orientale, Ficus reflexa, Ficus rubra, Phyllanthus dumentosus, Premna serratifolia, Sarcostemma viminale, Thespesia populnea	Low
	Terrestrial fauna	*Pteropus rodricensis, Tropidophora articulata*	High
		Tropidophora eugeniae, Lepidodactylus lugubris	Low
	Marine habitats	Sublittoral rocks dominated by photophilic algae	Low
		Lagoon sedimentary plain, muddy facies	Low
		Lagoon sedimentary plain, sandy facies	Low
		Lagoon sedimentary plain, sandy-muddy facies	Low
		Lagoon sedimentary plain, macroalgae facies dominated by Caulerpa brachypus	Medium
		Lagoon sedimentary plain, seagrass facies with Halophila ovalis	Medium
	Marine fauna	Coral reef dominated by Acropora formosa	High
		Ichtyofauna	Low
		Marine turtles	High
		Marine mammals	Low

6.5 Transport network, electricity supply and waste management

6.5.1 Area of influence

Considering the fact that Rodrigues is an island with a volcanic topography aspect, the development of transport networks is specific.

The main way of moving is to use the road network. Roads serve cities as well as more dispersed hamlets.

Obviously, the consequence of this insular aspect is also the relative importance of the airport and the sea port infrastructures for supplying the island, allowing people transit, and easing the development of economic activities like trade, tourism, fishing, etc.

The realization of this project demonstrates the importance of the interrelationship between these different means of transport networks.

For example, the supply of materials on the island could potentially be done by air or by sea. In the second case, it will be necessary to transport them from the sea port to the construction site by road.

Therefore, it is necessary to describe the transport network of the entire island.

6.5.2 Transport network

6.5.2.1 Road

The road network is the main way of moving around the island.

The main road crosses the island along a northeast-southwest axis. In the northeast, it starts from the coastal village Pointe Coton, then, passes through Mont Lubin in the centre of the island, before serving La Fourche Corail further to the west. It is finally connecting this town to Plaine Corail airport from the north. This road is entirely paved.

The road network is completed by a secondary network which is represented in Figure 132 by “secondary roads” and “residential roads”. A road runs along the north and the south coast (it’s called Island Road), and some other ones enter deeper into the island. It serves Rodrigues’ towns and allows people to move across the island. This network also connects the various municipalities spread over the island to the main central axis. Therefore, the secondary network is mainly oriented from the north to the south. This secondary network consists of asphalt and dirt roads.

Finally, dirt roads serve small hamlets or more isolated dwellings.

Near the airport, the network consists of the Road which allows residents to reach it from La Fourche. Earthen tracks allow walking around it and reaching the nearby houses and beaches to the west, the south and the east.

These different roads allow journeys by cars, motorcycles, bikes, as well as public transport like taxis and buses.

Road transport for both passengers and goods is the sole mode of inland transport in Rodrigues. The primary and secondary networks comprise approximately 190km of track roads and paths which service towns, scattered villages and agricultural plots in river valleys.

The density of the road network is 1.06km/km2. The low number (55) of vehicles per kilometre of road makes traffic flow fluid on the entire network. The rate of traffic accidents either per 100,000 populations or per 1,000 registered vehicles is not currently monitored. Only a 50% of the Roads are un-surfaced and are mainly accessible by 4x4, mountain bike and on foot. The public bus service consists of 56 buses (with seating capacity of 20-40) that stop service at 6.30 pm. Four taxis offer a limited service ([KPMG, July 2009).

6.5.2.2 Rail

The size and the topography of the island mean that the development of railway infrastructure is not consistent. Therefore there is no railway network.

6.5.2.3 Air

Plaine Corail Airport, also known as Sir Gaëtan Duval Airport, is located in the southwest of the island. It allows the Mauritius - Rodrigues (or La Réunion – Rodrigues) link in 90 minutes with 2 to 5 daily flights.

6.5.2.4 Maritime routes

The island can be reached by sea via mixed cargo and passenger ships from Mauritius. It serves Rodrigues with an almost weekly frequency.

The port is located in the capital, Port Mathurin.

The journey takes 1 to 2 days by sea.

There are also many fishing boats, or leisure boats like catamarans, which can be used for hiking, diving, and many aquatic activities.

Ferry service operates every fortnight by MV Mauritius Pride between Rodrigues Island and Mauritius. The journey takes 24 hours and the ship has a capacity of 250 passengers.

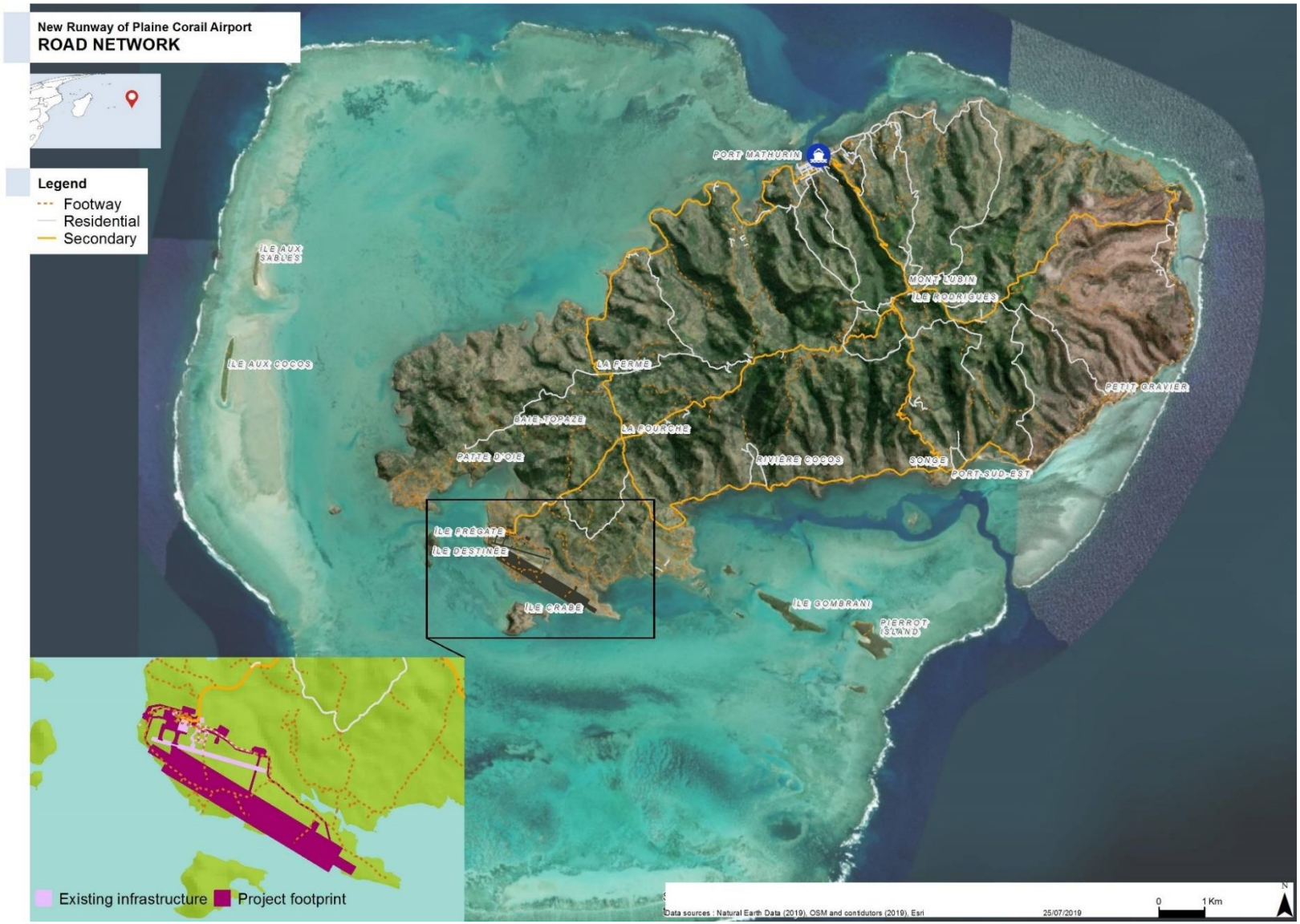


Figure 132: Transport network of Rodrigues

6.5.3 Electricity supply

Mauritius depends on imported petroleum products to meet most of its energy requirements. There is potential to increase the use of local and renewable energy sources such as biomass, hydro, solar and wind energy (Country Strategy 2008-2013).

All households in Rodrigues are now electrified.

The cost of the provision of electricity to domestic consumers is high due to the dispersed settlement patterns in Rodrigues. Unlike Mauritius where 25% of electricity energy generated come from renewable sources, the share is less than 10% in Rodrigues.

The Island relies solely on the Central Electricity Board (CEB) to meet the current demand of around 27.1 GWh with light and heavy oil. Solar water heating has a very low penetration although there is good potential. The CEB supplies electrical energy through the combustion of heavy and light oil at the two power stations situated at Port Mathurin and Pointe Monnier, with a total capacity of 10 MW installed capacity and 9.4 MW effective capacity. The total installed capacity at Port Mathurin is of 6 MW comprised of six 500 KW and three 1 MW units; while the first phase of the Pointe Monnier development provided for the installation of two 1.9 MW internal combustion engines that run on heavy fuel oil.

The distribution network emanates from the Port Mathurin power station from where electricity is distributed through four feeders operating at a voltage of 22 kV. The shortest feeder is 5 km long and serves the Port Mathurin area.

The other three feeders average 25 km in length and provide electricity services to all parts of the Island. Each of the four feeders is secured by another feeder line to provide security in the event of faults occurring on the primary distribution network. The 22 kV network comprises a total of about 130 km of overhead lines. Underground networks exist at Roche Bon Dieu and at Songes.

6.5.4 Solid waste management

Actually an amount of 86 tons of solid wastes are produced per week in Rodrigues. Since the year 1990 an open dump has been set up at Roche Bon Dieu but same is nearing saturation and other options had to be considered thereto.

The construction of a proper landfill is still under consideration as the site has already been vested thereto. A cell of size 50 m x 50 m has already been constructed to start receiving wastes.

The construction of the proper landfill rest on availability of funds.

Since the beginning of 2022 waste segregation at household levels has started and actually the following wastes are temporarily collected at a material recovery centre at Grenade which is under construction. It will be equipped with appropriate equipment and infrastructures such as conveyors, weighbridge, bailer machines, wheelie bins. During the actual phase, a levelled and fenced platform of area 80 m x 100 m has been constructed to receive the following segregated wastes:

- PET bottles and cans (food and drinks) -

- Glass bottles

Electronic wastes are collected through regular campaigns and temporarily stored for making available to local exporters.

Scrap metals are also collected by local exporters for shipment to Mauritius.

Actually green wastes are shredded and made available to planters for agricultural purposes. The population is sensitised on the adoption of composting at household levels; composting bins have also been granted to some families as part of a National project.

Glass bottles are shredded in view of minimising spaces and preventing eyesores; RRA is now considering the application of the shredded glasses in construction work, decoration and art work.

Construction wastes are disposed at Mt Plate which is a rock quarry site. Same upon approval of the Commission for Environment view the inert nature of such wastes.

Legal measures are also in project :

- Ban on use of plastic bags in Rodrigues
- Ban on use of polyethelene containers being considered
- Regulation of waste disposal being worked out

6.5.5 Summary: Transport, electricity supply and waste management sensitivity

Table 59: Transport, electricity supply and waste management sensitivity

Theme	Receptor	Sensitivity
Transport network, electricity supply and waste management	Transport network	Low
	Electricity supply	Low
	Waste management	Low

6.6 Social environment

6.6.1 Methodology and area of influence of the socio-economic study

6.6.1.1 Objectives

Rodrigues Island is a territory of the Republic of Mauritius, autonomous since October 2012, located about 650 km east of the other two Mascarene Islands: Mauritius and Reunion. The island, small in size (110 km2), however, is tasked with developing its economy in a reasoned manner while preserving cultural values strongly linked to the sectors of agriculture, fishing and tourism. The latter sector is encouraged by local authorities to be part of a sustainable development axis in order to radiate the reputation of the island as an ecological and exemplary destination for environmental protection.

Rodrigues, in particular by its small size, rests on an economy that remains fragile and the island remains dependent on regular imports by sea. In a very small proportion, imports take place by air. As such, the Rodrigues Plaine Corail Airport is currently equipped with a fairly small landing strip of 1,280 m which can accommodate aircraft of type ATR 72. Operational and technical reasons due to the LON of the runway, mean that the airport cannot operate at full capacity. This situation inexorably leads to some pressure on the carriers during peak periods, a higher rate application for airline tickets, and an inability to promote the viability of air cargo.

In response to this situation, the Rodrigues airport, which wishes to register significantly among the development actors of Rodrigues, is now proposing the construction of a new runway of a length reaching approximately 2,100 m. This new infrastructure would allow larger carriers to also be opened to non-Mauritius routes.

It should be noted that the project to equip Rodrigues with a new and longer airstrip comes from a political will shared by the Rodrigues Regional Assembly (RRA) and the Government of Mauritius to consolidate the economy of Rodrigues in order to better accompany the island in its socio-economic development, always with the aim of making Rodrigues an exemplary island in terms of sustainable and sustained management of its scarce resources.

6.6.1.2 Methodology

6.6.1.2.1 Area of Social Influence

The extension of the airport's runway spreads over the area that runs from Pointe L'herbe to Pointe Corail. From an administrative point of view, the area straddles two village constituencies: Corail Anse Quitor and Cascade Jean-Louis.

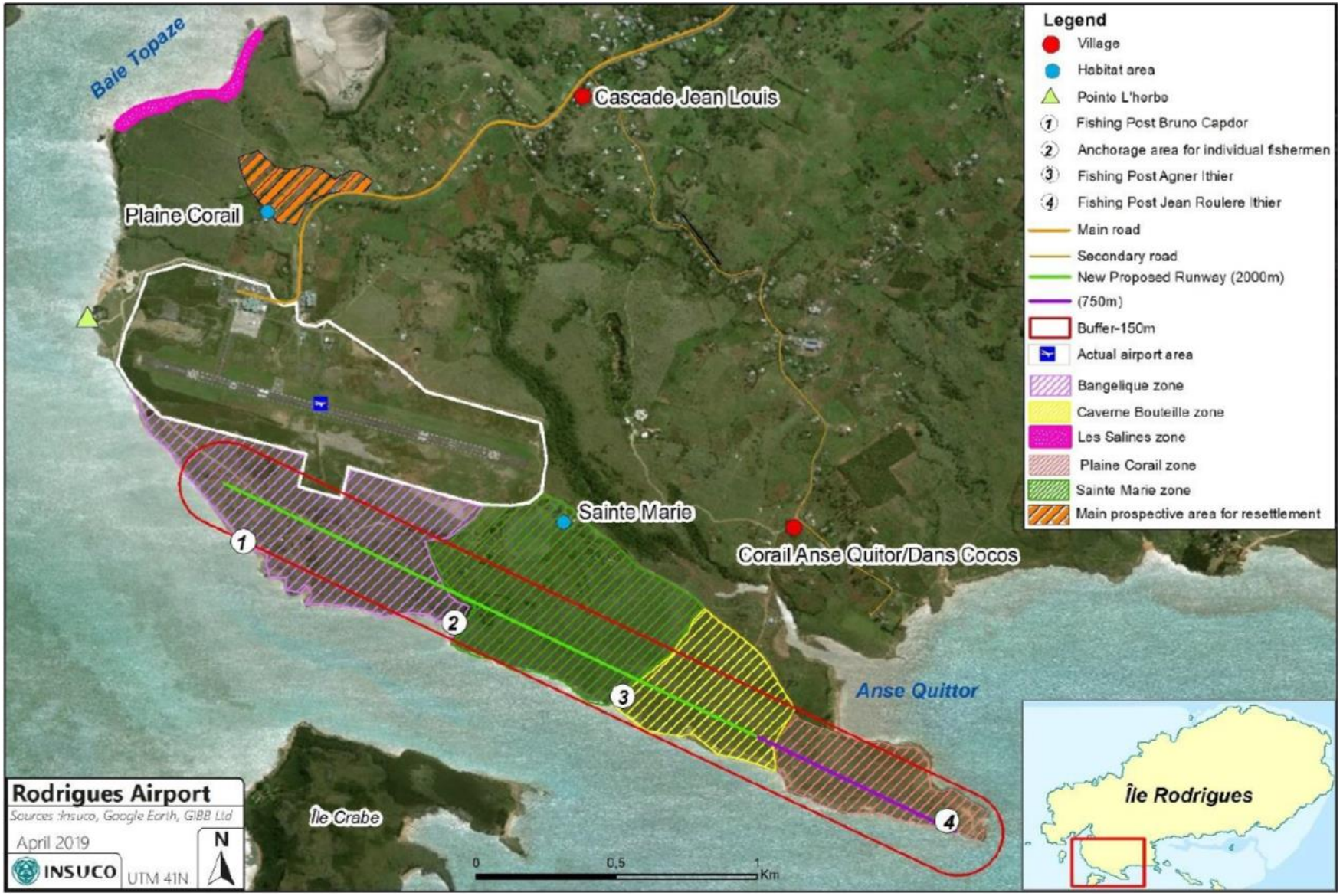


Figure 133: Area of influence of the Rodrigues Airport Extension Project

The project's social area of influence includes:

- The area of direct influence;
- The neighbouring areas, likely to accommodate the physical and economic relocations caused by the project.

6.6.1.2.1.1 Direct Project Control Zone

Depending on the local name, the geographical areas affected by the airport are: Pointe L'herbe, the plain of Bangélique, the Hill Sainte Marie, Caverne Bouteille and Pointe Corail.

Figure 134: Landscape of the project's direct control area

The area directly impacted by the project's right-of-way presents two typologies of space:

- A residential area: the village of Sainte Marie, located on the hill locally called "Sainte Marie Hill" or sometimes “Sikolet hill”. The village has about fifteen resident families;
- Spaces dedicated to productive activities.

As for the production areas, the first characteristic to emphasize is that the territory has a very strong integration between three sectors of activity: livestock, fisheries and agriculture.

Farming is practiced on the well-known band of Bangélique of Plaine Corail. Grazing is a resource subject to an open access regime. Both the residents of Sainte Marie and non-resident breeders keep their herds in the area. The herds are left in divagation, usually without guarding.

Figure 135: Bangélique breeding area

Along the Bangélique Strip, up to the Pointe Corail, are located 4 fishing infrastructures: 3 fishing posts and a mooring. Anchorage is mainly used by professional fishermen residents in the area. Fishing posts belong to non-resident fishers and are a major economic activity. The extension of the airport runway will prevent access to these 4 infrastructures.

Agriculture is practiced mainly in the vicinity of the houses of Sainte Marie. All the families in the village have access to a portion of cultivated land. The size of the plots is relatively small and has remained constant over the years.

The following are considered as directly affected areas:

- The residential area of Sainte Marie and the cultural fields operated by the inhabitants of Sainte Marie;
- The grazing areas of the Bangélique band and – to a lesser extent – Caverne Bouteille;
- The areas of access to the stations and anchorage that are located in Bangélique and Pointe Corail.

6.6.1.2.1.2 Direct Impact Zone

Following the launch of the airport extension project, since July 2018, a discussion was opened by the Rodrigues Regional Assembly concerning resettlement plans for the affected populations and sites for the relocation of families.

The Plaine Corail area is being approached to accommodate the resettlement of affected families. In particular, the identified area corresponds in large part to the habited area known locally as the village of Plaine Corail.

From an administrative point of view, it is a small settlement of about eight houses, close to the airport road.

The coastal zone known as Les Salines, near the village of Plaine Corail, is also being approached to accommodate the relocation of fishing activities.

6.6.1.2.1.3 Population taken into account in the study

In conclusion, the basic social study takes into account:

- The population of the village of Sainte Marie, directly affected, and its agricultural production area;
- The fishing professionals who gravitate around Bangélique and Pointe Coral. Most of them do not reside in the impacted area, but do conduct their fishing activities there;
- The users of the pastoral space of Bangélique and to a lesser extent Caverne Bouteille;
- The population of the village of Plaine Corail.

6.6.1.2.2 The quantitative approach: socio-economic household survey

The collection of quantitative data is used to establish an encrypted database, in a twofold objective:

- Characterizing the current socio-economic situation of households: demographic profiles, available resources, strategies for mobilizing these resources (in terms of investments, consumption, food needs coverage);
- Developing a baseline database, which can be used as a basis for the design of an instrument to monitor future developments.

The quantitative component of the study was conducted through a questionnaire survey on the socio-economic situation of households.

6.6.1.2.2.1 Sample determination

The survey was administered on two sites: the most directly impacted site – the village of Sainte Marie – and the site being considered as a place of physical and economic resettlement of the people affected by the project.

Regarding the village of Sainte Marie, given the size of the population concerned, it was not appropriate to proceed with a sampling process. The objective was therefore to interrogate all resident households.

Regarding the site identified for resettlement, the following approach was followed: for the area closest to the resettlement areas, the objective was to collect socio-economic data by questionnaires from all households. As the population indirectly impacted by resettlement is not limited to this sector, the administration of some questionnaires has also been extended to other households further away from the impacted zone. The intention was thus to confirm or reverse the general trends observable at the level of the population of Plaine Corail. These few complementary interviews were administered to heads of households identified in an opportunistic manner by seeking door-to-door interviews to those who are available to answer questions.

6.6.1.2.2.2 Sample size

The size and final composition of the sample are shown in the following table:

Table 60: Summary of the number of households interviewed per site

Location	Estimated population size (number of households)	Number of households responding to the questionnaire	Population/sample ratio (%)
Sainte Marie village	15	14	93%
Plaine Corail Sector	8	7	87.5%
Area bordering Plaine Corail sector	6 to 8	2	25 to 33%

6.6.1.2.2.3 Questionnaire

A questionnaire was developed to collect quantitative data from households. The questionnaire was conceived after a first phase of field visits. This has made it possible to identify and formulate in the most appropriate manner the relevant issues for the survey and to propose significant indicators of the socio-economic situation of households, their trajectories and the parameters to consider in terms of vulnerability.

Figure 136: Household survey conducted in Sainte Marie Village

The objective was also to produce a lightweight tool, with which key data could be obtained during short interviews. The average duration of the interviews was 30 to 40 minutes, which is an important guarantee of a good level of attention of the investigator and the respondent, throughout the administration of the questionnaire.

The questionnaires were administered and registered directly on Smartphones, according to a process already tested by Insuco on many other projects. To produce the data the ONA.io/geo Open Data Kit (ODK) system has been used. This platform is used by the statistical departments of the World Health Organization (WHO) and the World Bank (WB).

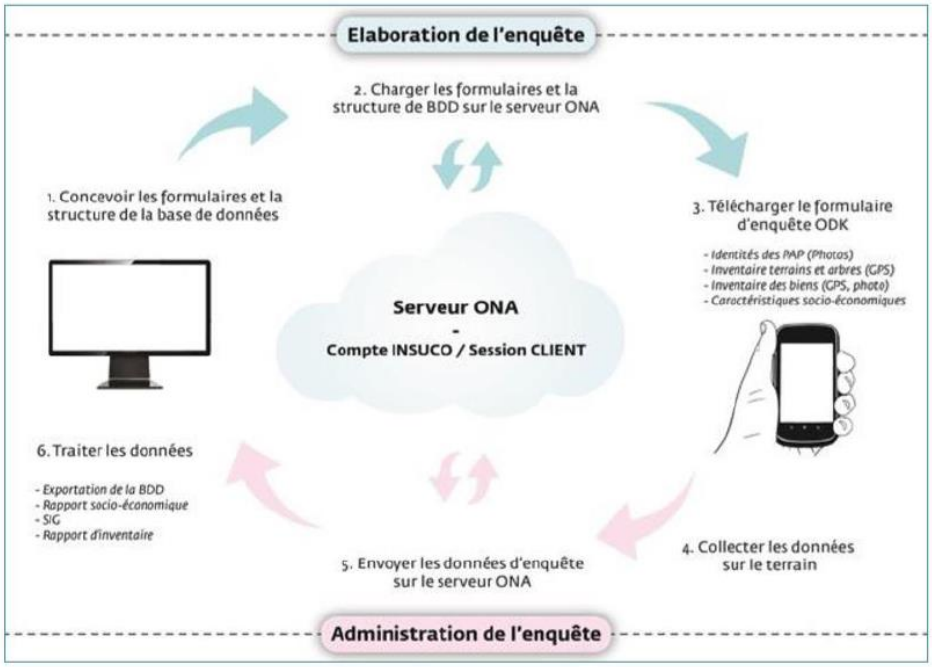


Figure 137: 2 Operational diagram of the ONA system

This system has made it possible not only to make the time of data recording and transfer faster and easier, but also to correct errors. The questionnaire is presented in Appendix 2 and is structured in three sections:

- Socio-demographic characterization (including dynamics of mobility and vulnerability);
- Household resources;
- Resource mobilization and consumption.

6.6.1.2.3 The qualitative approach

The qualitative approach was used for the collection and analysis of data:

- From the history of the local settlement, with special attention to:
- kinship structures;
- demographic changes and mobility phenomena;
- the principles of intergenerational transmission of rights over resources (land, natural resources, real property);
- Principles and practices for managing land resources and natural resources;
- Deepening of household economic practices and strategies, with particular attention to the following topics:
- agrarian practices;
- livestock and pastoral practices;
- economy and organization of fisheries;
- integration between these different areas of activity;
- From the presence of cultural heritage sites on the direct impact area of the project, and all the practices, uses, representations of the inhabitants in relation to these elements of the heritage.

6.6.1.2.3.1 The history of local settlement - local stories and genealogical approach

The history of the local settlement has been documented through two data collection techniques: the collection of historical narratives about site installation and landmark events in local history; and the rebuilding of genealogies of resident families since the time of the first installation.

Figure 138: Individual interview about the history of the families of Sainte Marie village

The reduced size of the study population and the relatively limited historical size of the settlement (at least in the current phase) have allowed a systematic application of the genealogical approach. It was through semi-structured interviews, usually individual, but

sometimes carried out in the presence of several informants, to record the narratives of the first stage of installation. This approach has many advantages:

- First, the active involvement of the interviewees. It is a technique that stimulates effective participation in the sharing (and sometimes research) of information. The informant generally appreciates the fact that the investigation is concerned with the social dimensions which he considers important: the documentation of the ancestors' deeds and the individual situations of kinship;
- Secondly, it is a technique that allows, for a small community, to carry out an exhaustive census, which also relates to the situation of the absent and which allows, therefore, to quantify the dynamics of mobility (towards the village and from the village), not only for the current period but also for the periods of past generations;
- Above all, the genealogical survey provides an empirical and diachronic database, which is used to analyse the principles and practices of intergenerational transmission of rights over local resources (land, real estate).

During the investigation, all the lines of the village of Sainte Marie were documented (three segments of a lineage and two segments of another lineage); as well as a Plaine Corail line (a reinstallation area).

6.6.1.2.3.2 Principles and practices of natural resource and land management

The objective was to understand the local principles that govern the distribution of rights over natural resources, particularly with regard to land resources.

The study takes into account the formal framework for the exercise of land rights. Rodrigues has a legal framework that regulates the rights of access and use of land resources. Nevertheless, each local society integrates the system of norms by attaching legitimacy to them in accordance with its own societal values: intergenerational justice, intra-family justice and inter-linear justice. In order to understand these aspects with the micro companies that are the subject of the study, two particular aspects of land management have been studied:

- The conditions for the creation of land law: to understand how an investment Act (clearing, fencing, landscaping, development) creates (or has historically created) an administrative right, locally recognized as such, on a portion of space, transforming the land status of the commune resource into free, individual or even exclusive access;
- The conditions for the transmission of rights to land resources, in particular from an intergenerational perspective: the principles of inheritance of land rights, inclusion and exclusion and fragmentation of land heritage between generations.

The intention was thus to understand how the organization of local rights over the resources of the territory structures the other social relations. Specifically, to understand how the system:

- Encourages the maintenance of the population in the area (especially the younger generation) and the integration of other members; or, if the reverse is likely, causes expulsion dynamics;
- Integrates women in access to resource management (referring to women from the lineage, as well as women integrated by alliance);
- Is likely to create potential situations of marginalization or vulnerability, or, on the contrary, guarantees equitable access to resources.

To document these aspects, semi-structured interviews were conducted with key informants-heads of household (men and women)-and genealogical diagrams were used to obtain empirical data on the status history of land resources. The local status of the cultivated land has been taken into account, but also the organization of access to pastures and fish mooring.

6.6.1.2.3.3 Focus on productive activities

A qualitative approach has been applied to the study of the main economic and productive activities practiced in the area of influence. The objective was above all to complement and put into perspective the data collected through the socio-economic survey of households.

Agriculture, livestock and fishing have been taken into account. Thematic focuses have been articulated around the following areas of documentation:

- The techniques mobilized (and the justification of the different technical options adopted);
- The organization of the activity, particularly in the case of collective enterprises (such as net fishing) which require the implementation of a model of cooperation and contractualisation between different economic operators;
- Business-related economic circuits: value creation, profit sharing mode, investment;
- Possible forms of integration between different fields of activity (fisheries/livestock; livestock/agriculture).

To collect this data, semi-structured interviews were conducted with different economic actors, such as residents in the area or those operating in the area without actually being residents. Direct observations and informal conversations made it possible to complete the framework.

Figure 139: Individual interview with a fisherman in Sainte Marie village

6.6.2 Administration and Governance of Rodrigues Island

Rodrigues Island obtained its status as an autonomous territory of the Republic of Mauritius in October 2002. Its administration consists of a Parliamentary Assembly known as the Rodrigues Regional Assembly (RRA) and an Executive Council that frames and implements socio-economic policies. The Rodriguan autonomy is based on the Rodrigues Regional Assembly Act of 2001, voted in the National Assembly of the Republic of Mauritius.

Figure 140: Rodrigues Island and project zone location

6.6.2.1 Constitution of the Executive Council

The Rodrigues Regional Assembly consists of 17 members whose current distribution is 10 elected representatives of the Government and 7 elected representatives of the opposition. The Executive Board consists of 7 Commissioners who take over the management of various commissions or offices in charge of the various social, economic and environmental activities of the island.

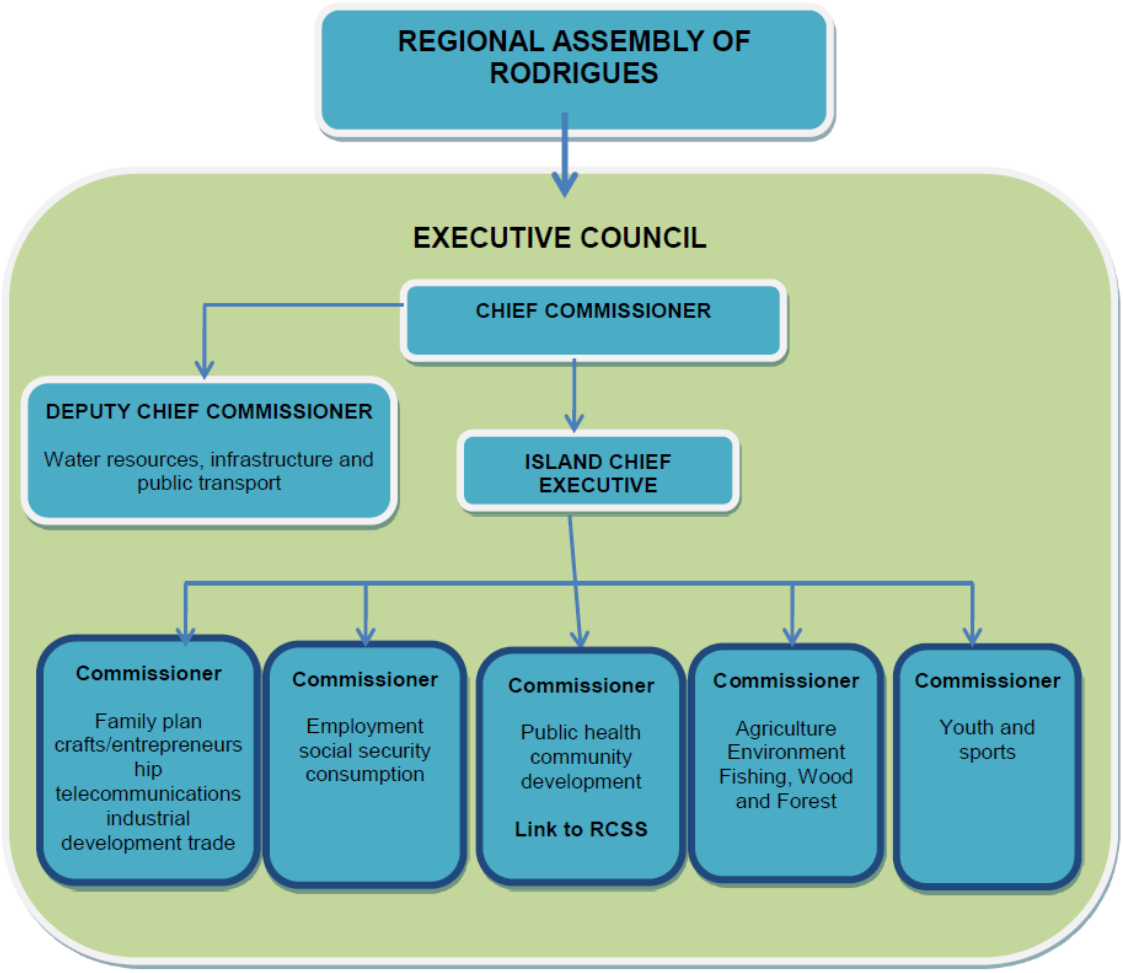


Figure 141: Rodrigues Regional Assembly (RRA) organizational chart

6.6.2.1.1.1 The Chief Commissioner

The Chief Commissioner represents the main authority of the island. He is responsible for key positions such as finance, land tenure, civil aviation, and education. 90% of the territory of Rodrigues Island belongs to the State. Thus, the Chief Commissioner governs the Cadastre Bureau and represents the ultimate signatory for the granting of residential, commercial and industrial leases after analysis by the State Lands Committee.

6.6.2.1.1.2 The Deputy Chief Commissioner

The Deputy Chief Commissioner has the primary role of acting in the absence of the Chief Commissioner but is also in charge of the island's water resources and public transport and infrastructure.

6.6.2.1.1.3 The Island Chief Executive Officer

A key position as Secretary of the Executive Committee is defined as the Island Chief Executive. Its mission is to ensure the implementation of all the measures taken at the meetings of the Executive Committee by each of the Commissioners.

6.6.2.1.1.4 The Commissioners

Five Commissioners each oversee a different committee, namely:

- The Commission on the development of children, women, family plans, prison and reform institutions, crafts, industrial development, cooperatives, technology and telecommunications, trade, etc.;
- The Social Security Commission, the Office of employment and consumer protection;
- The Commission on health and community development. The special purpose of this Committee is to carry out the link with the Rodrigues Council of Social Services (RCSS), a parastatal organization whose role is to ensure the link with all village officials of the island;
- The Committee on agriculture, environment, timber and forestry, fisheries, etc.;
- The Youth and Sports Commission.

6.6.2.1.2 The Rodrigues Council of Social Services (RCSS)

The RCSS is an entity not dependent on the Regional Assembly of Rodrigues but which comprises all the villages of Rodrigues and acts as a facilitator between the different stakeholders in community projects namely the communities of the Regional Assembly, donors, private companies, etc.

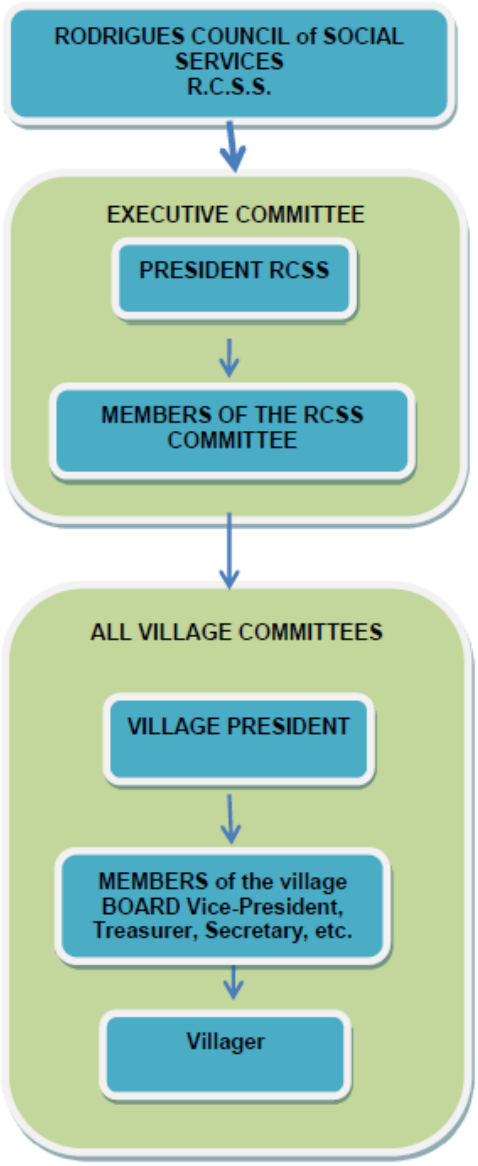


Figure 142: Rodrigues Council of Social Services (RCSS) organizational chart

The RCSS consists of an Executive Committee headed by a President and its members are responsible for the successful implementation of the various international donor-funded community development projects or development funds from private companies. The RCSS Executive Committee is responsible for the proper organization and operation of the RCSS by maintaining the communication link between the various village communities between them and the RRA.

The President of the RCSS is democratically elected by the Village Presidents following their election to the head of the Village Committees.

Each village registered and identified by the RCSS is headed by a Village Committee under the direction of a democratically elected President by the villagers every two years.

6.6.3 Demographic and local governance

In this section, the demographic characteristics and the history of the settlement of the village of Sainte Marie, which is the habited area most directly affected by the project, is first described.

It then presents the case of the village of Plaine Corail, which is in the centre of the area for the resettlement of the people affected by the project.

6.6.3.1 The village of Sainte Marie

The village of Sainte Marie is the result of two settlement histories that took place independently: the installation of two families.

6.6.3.1.1 The first family of Sainte Marie

At the origin of the settlement of Sainte Marie are three brothers. They settled in 1962 on the hill now known as the Hill of Sainte Marie, with the intention of practicing agriculture. Only one fisherman/breeder lived in the area at the time. No steps have been made locally to obtain permission to settle. On the other hand, the colonial administration demanded that the three brothers build their homes and reside in a stable way on site to grant the operating permits.

6.6.3.1.1.1 First brother's lineage

Buildings and houses transmission

The first brother, who has remained in Sainte Marie, had four sons and two daughters. The two daughters live elsewhere, while the three oldest brothers had already built their own houses when their father died. Only the youngest brother now lives in his father's house. If one of his sisters wishes to relocate to Sainte Marie, he should do his best to share the house with her or help her to relocate.

This is to underline the fact that, in generational passage, women are not a priori excluded from the inheritance of immovable property. But in practice, since the combination of the principles of exogamy and virilocality is applied in a systematic way, the case is not present.

Intergenerational transmission of agricultural land resources rights

The first brother had cleared three portions of land ("Karo"). In his lifetime, when age no longer allowed him to work the land and his sons began to form their own families, he took the initiative to share his Karo between his sons. Two of the four sons became responsible for each parcel. The elder shared the main Karo with the younger. The dwelling place of each of the four brothers is close to the exploited parcel.

With regard to the livestock, the first brother gave up, during his lifetime, his animals to each of his sons. This assignment allowed each of them to form their own individual herd.

6.6.3.1.1.2 Second brother's lineage

The second of the three brothers settled in 1962, and had a daughter and four boys.

His widow occupies the house built by her husband. Three of their sons have each built and registered their own house as cadastral. One of his grandsons has built a second floor on his father's house.

When the family house is no longer occupied, the first children of the 3rd generation will move into it.

In his lifetime, the second brother divided his only Karo into four parts and attributed one to each of his sons. The latter were married and were required to manage their productive activities autonomously. Since his last son does not live in Sainte Marie, the assigned party is operated in turn by each of his brothers, depending on the needs and abilities. The Karo license is still registered in the name of the second brother's widow.

6.6.3.1.1.3 Third brother's lineage

The youngest brother had three sons and eight daughters. None of them remained in the village. Only two of his grandsons still live in the village. There is also the wife of one of his sons who remains in the village, but her husband just works casually in Sainte Marie as a fisherman when he is not working as a mason in Mauritius.

Intergenerational transmission of rights to home and agricultural land resources

The field cleared by the youngest brother is now operated only by his daughter-in-law. Before that, two of his daughters exploited the plot. No internal divisions have been made within the parcel, which is still registered in the name of the youngest brother's widow.

In total, the group of descendants of the third brother has only three houses.

6.6.3.1.2 The second family of Sainte Marie

Two cousins were behind the installation of the second family in Sainte Marie.

6.6.3.1.2.1 The lineage of descendants of the first cousin

The installation process of the first cousin follows a trajectory independent of the first family and it is only by the neighbourhood relationship, established in the following years, that the two large families began to consider themselves as inhabitants of the same village.

During his installation (in the first half of the sixties) his intention was to get closer to his cousin's fishing post in Bangélique. His cousin ceased working in Bangélique shortly thereafter, moved to construct the first airport and relocated to the vicinity of Plaine Corail.

He had five daughters and three sons. His five daughters now live elsewhere with their respective husbands. Only his older son remained in Sainte Marie.

Of all the descendants only a 2nd generation adult man resides at this location. He built his own house, and he resides there presently. The widow of the first cousin had a house that she rebuilt after her husband's death.

He cleared a Karo and practiced agriculture. The Karo has not been exploited for a number of years. No one in the family has dedicated themselves to agriculture and the plot has become essentially a pasture area.

6.6.3.1.2.2 The lineage of descendants of the second cousin

He settled in the area of Sainte Marie in 1975, after his cousin. His paternal uncle ceded to him the house and the parcel he had cleared. After settling here, he quickly found a job at the airport, which had just been built, and abandoned fishing.

He had three daughters and one son. Today, only he, his son and his son's family reside there. His son earns a living mainly from fishing.

His cattle have suffered significant losses due to foot-and-mouth disease. He is the only operator of his father's former field.

His son built his own house nearby. These are the only two houses belonging to members of the second cousin's descendants.

6.6.3.1.3 The demographic evolution of Sainte Marie

Quantitative household surveys have established the following demographic profiles for the village of Sainte Marie.

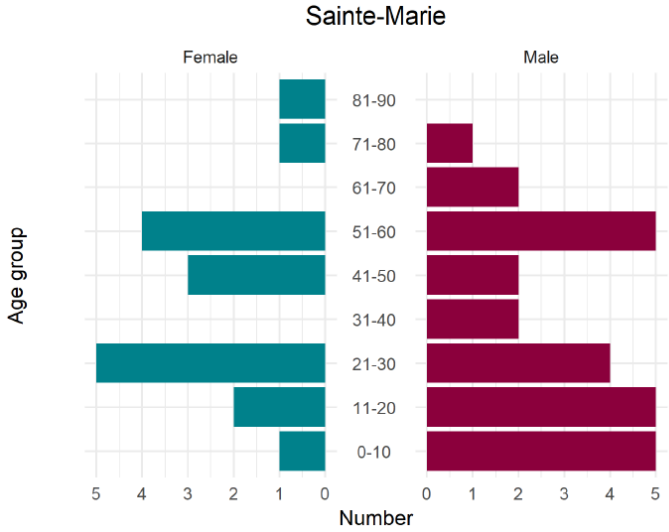


Figure 143: Age pyramid of Sainte-Marie

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- The total population counted is 43 persons;
- Gender distribution is 17 women (39%) and 26 men (61%); and,
- The average age of the inhabitants of Sainte Marie is 35 years. The average age of women is almost 40 years, while that of men just exceeds 32 years.

The genealogical analysis makes it possible to formulate some hypotheses in relation to the future demographic evolution of the village of Sainte Marie.

The first observation concerns the lines of the two first brothers of the first family.

It is noted that, at the second generation level, one of the older brother's sons is still in the village and continues to exploit the resources created and passed on by his father. We also note that, of his four sons, three remained in the village. The intergenerational transition represents, for these two lines, a significant growth in terms of number of households: from two first-generation heads of household to seven in the second generation (out of eight potential). On the other hand, the transition to the next generation corresponds to a remarkable demographic decline. Of all the descendants of the two brothers, only two young heads of household remained at this location. And a total of four young unmarried adults are still in Sainte Marie.

In the case of the last brother's lineage, the conservation of a presence has already represented a major difficulty with the passing of the first and the second generations. His three sons reside elsewhere. The lineage is conserved by matrilineality.

The second family represents a younger lineage, since no one from the 3rd generation is currently of marriageable age. Here too, the conservation of a workforce is difficult, considering that for each lineage, only one adult male of the second generation stayed with his family.

We therefore observe that the number of households has increased in the second generation, thanks to the children of the two brothers of the first family lineages. But then the situation remained, in the best of cases, stable. Observation of life in Sainte Marie demonstrates that the number of boys and girls who are younger than 15 years old is very low.

6.6.3.1.4 Local governance in Sainte Marie

Sainte Marie is a small family community. Village-related issues are settled mainly through internal family mechanisms. It should be noted that in this aspect the two families present assert themselves as one large family when important decisions concerning the village are necessary.

From an administrative point of view, Sainte Marie is not a village: it is an area of the Anse Quitor Village to which it is attached. However, the inhabitants of Sainte Marie do not participate in the public life of the connecting village: for example, they do not participate in the elections of the President of the village. De facto, they consider Sainte Marie as an autonomous socio-territorial entity. It should also be emphasized that even when the regional authorities began to discuss with the inhabitants about the airport extension project – with a first information meeting in July 2018, and then over the multiple meetings about prospects and resettlement options – they did so by communicating directly with the inhabitants of Sainte Marie. The administrative level of Corail Anse Quitor has not been associated, as a territorial institution of guardianship, with the process of concertation.

In a very pragmatic way, the inhabitants say that Sainte Marie can be considered as a village in its own right, since during the electrification work of the area, in 1993, the officials of the electrical company validated the fact that the site was called Sainte Marie, by inscribing the toponym in the documents. This is locally considered the birth certificate of the village of Sainte Marie.

A member of the first family is the spokesman who represents the village with the institutions and the administration. This is not an official charge, of course, but in practice this is the closest there is to the function of village chief. Any decision is made within the Group of Heads of households, which brings together the men of the second generation of the two families. It is an informal Council that is the central backbone of the village's governance.

6.6.3.2 Proposed area for the reception of displaced people: the village of Plaine Corail

The Group of dwellings known as Plaine Corail village is the result of a history of successive installations exclusively based on kinship relationships.

Figure 144: Dwellings in Plaine Corail village

6.6.3.2.1 The family of the village

In 1980, a couple from the village of Sainte Famille, settled in Plaine Corail. At the time, the place was very little inhabited. The families present in 1980 left the premises thereafter.

In 1985, the couple was joined by two of their daughters, with their respective husbands.

In the late 1990s, their third son settled next to his sisters, with his wife.

At the beginning of the 2000s, another brother installed nearby, with his wife. All of their children live in Mauritius.

Around 2004, the mother's sister joined the rest of the family. She lives with her disabled son. Her daughter has also moved nearby.

6.6.3.2.2 Distribution of dwellings

The inhabitants of Plaine Corail are distributed across eight dwellings.

6.6.3.2.3 Data on the demographic composition of Plaine Corail

Quantitative household surveys have established the following demographic profiles for the village of Plaine Corail. Unlike for the village of Sainte Marie, almost no households were able to be consulted. The majority of the demographic study (especially for the total population) is based on an estimate derived from field observations and data collected.

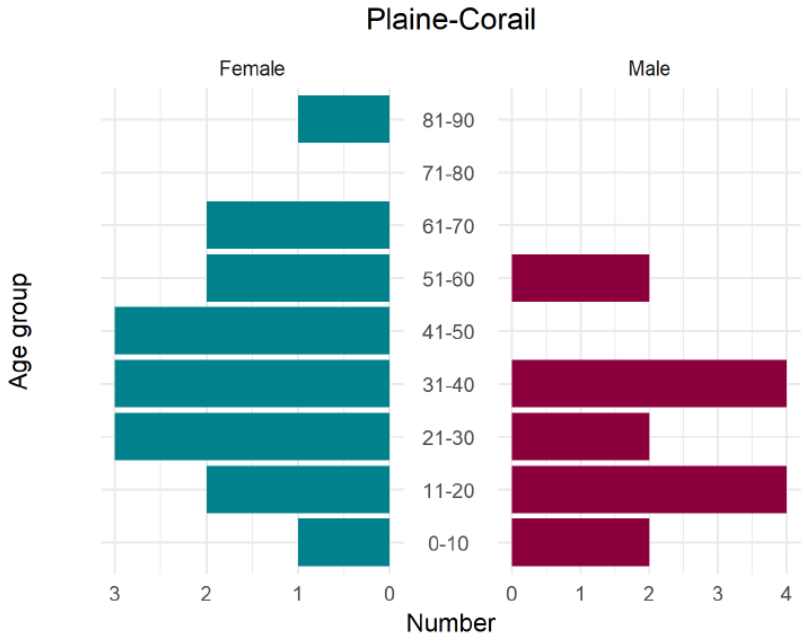


Figure 145: Age Pyramid of Plaine Corail

-
- The estimated total population is 40 persons (31 counted);
- The gender distribution of the counted population is 17 women (55%) for 14 men (45%); and,
- The average age of the inhabitants of Plaine Corail is almost 34 years. The average age of women is almost 40 years, while that of males is between 26 and 27 years.

6.6.3.2.4 Social relations and governance in Plaine Corail sector

From a social point of view, one son-in-law is the leader of the group. The respect that the small family community carries is related, among other things, to its pious character and its ability to refer to biblical teachings. It is noteworthy that the community of Plaine Corail is very strongly structured around a religious affiliation. Family members refer to different churches, but they are all part of the Protestant Congregational Nebula. It is a microcosm where the fear of the Devil is very present. The son-in-law is, because of his family and personal history, considered as a protector of the community against the threats of witchcraft.

At the beginning of the 1980s, in the early days of the arrival of the couple, Plaine Corail was considered to be haunted.

6.6.3.2.5 Land use in Plaine Corail

The main economic vocation of the inhabitants of the small community of Plaine Corail is breeding livestock. Fishing also plays an important role in the household economy. The capture of octopus is practiced by women.

During his installation in 1980, the man cleared a Karo for which he had obtained an operating permit. Before his death, he divided the Karo into two parts, attributing one to each of his daughters residing in Plaine Corail.

The land heritage has not undergone any variation in terms of expansion.

6.6.3.3 Local principles of land resource management

The data collected by researching and reconstructing the history of the settlement of Sainte Marie and Plaine Corail provide a fairly precise picture of the local principles that govern the transmission of land rights, especially from an intergenerational perspective. The following sections present the analytical elements relating to rights with respect to real estate resources: cultivated land and plots for habitation.

As far as the rights to pastoral resources are concerned, as explained above, these are common free access resources (Commons). Access and use rights are not transferable, insofar as each individual is a possible user.

6.6.3.3.1 Intergenerational transmission of land rights

6.6.3.3.1.1 The case of Sainte Marie

The following principles govern land rights locally:

- As a general rule, the transmission of rights to land follows a patrilineal, individual and male trajectory. The third brother of the first family of Sainte Marie lineage is a notable exception. The departure of the sons created a situation where land rights were, de facto, transmitted in two ways focused on women. In one case, user rights were transmitted to a girl, and following her death, to the girl's sons. In another case, the rights of use were acquired by the wife of a son (absent). Clearly, the principle of patrilinearity has been easily adapted to the economic situation and the demographic history of the lineage. On the other hand, in this case, the land assets do not belong to an individual but are retained as a common resource.
- The transmission of land rights is not strictly linked to the change in the young man's status (for example, on the occasion of marriage). The timing of transmission is decided on the basis of two factors: the ability of the older generation to continue working; and, the need for the next generation to become self-sufficient in meeting the needs of their own households.
- The transfer of rights to land is not conditional on the death of the older generation. In all the cases observed, the decision to delegate rights to cropland to members of the next generation is made during their father's lifetime. Death is therefore not a real mechanism for inheriting land rights; intra-family transfers occur inter vivos. It should be noted that in the cases observed, the widow of the first tenant holds the formal rights to the plot of land (the name on the operating permit) after the death of her husband.
- From one generation to the next, the land heritage does not change in size. In no case have we observed the extension of a Karo after the intergenerational transmission process.
- A land estate can change vocation in the event of non-use, but it is still recognized as the fallow land of the former owner. In fact, the undeveloped Karo is an open access resource for pastoral needs, but no member of another family could take the initiative to reclaim the fallow land and to cultivate it without the authorization of one of the former owner’s descendants.

6.6.3.3.1.2 The case of Plaine Corail

The principles of intergenerational transmission of rights to land that are observed in Plaine Corail seem different from those we have documented in Sainte Marie. In the case of Plaine Corail, the transmission of rights on the land does not follow a patrilinear trajectory by father-son route, but a patrilinear trajectory by female way (father-daughter). The father divides during his lifetime his plot between his daughters. This is probably due to the low interest of his sons for agricultural activity. This confirms that the intergenerational transmission rules are not

applied rigidly. On the contrary, transmission rules adapt to the preferences and the economic requirements of the family. For this family, encouraging the installation of their daughters – and their husbands – at Plaine Corail was a primary goal to ensure the continuation of the settlement of the site.

6.6.3.3.2 Principles of real estate transfer

In Sainte Marie, the transmission of the house is not subject to particular rules of intergenerational transmission (e.g. inheritance in primogeniture). The transmission is decided pragmatically, according to the needs of the young men of the next generation. In general, the older sons will have already built their own house, so the beneficiaries of the inheritance of the property will more likely be a younger son or even a grandson.

Women are not excluded from the rules of transmission of real estate. In practice, following the principles of exogamy and virilocality applied in a systematic way, girls settle down with their husbands in other places of residence. In case of divorce or as a result of other events that cause the return to the village, the woman will be associated with the rights to the property and the property resources administered by the father or, in the event of the death of the latter, the brothers. The uterine nephews – the sons of a sister – are in principle in the same situation as their mothers regarding access to rights to local resources.

6.6.3.4 The role of women in the management and transmission of family resources

The data collected on the internal and intergenerational functioning of the families of Sainte Marie and Plaine Corail have highlighted some interesting elements, which it is useful to summarise. Of particular interest are the principles and practices of inclusion and exclusion of women in the management and transmission of family resources and property.

The two case studies we have documented (Sainte Marie and Plaine Corail) represent two different models of family organization.

- Sainte Marie, as mentioned above, is a perfect example of a virilocal exogamy system. Women from the families of Sainte Marie marry men from other villages (it could not be otherwise, since most of the inhabitants are from the same patrilineal line) and leave to reside in the village where the husband was born.
- Plaine Corail, at least according to the data collected from the family, represents a different model. The settlement of the small area was made possible by the arrival of the spouses of the daughters. Plaine Corail represents, therefore, an exogamous system that is not necessarily virilocal.

An understanding of these two different models is useful if one wants to understand the principles that regulate women's access to the resources of the lineage.

In the case of the village of Sainte Marie, the transmission of goods and resources (access to land, above all) has followed – if one relies on an empirical observation – an exclusively patrilinear trajectory by male way. This would suggest that the system excludes women from the intergenerational transmission line of resource rights. However, as has already been presented above, this approach is far from being a founding and exclusive principle. In fact, the rights to resources are retained by those who remain on the land (which is rarely the case of women). A return of a woman from the lineage or one of the children of a woman born from the lineage would result in access to the same property rights (the land, the house, etc.) that the men of the lineage enjoy. To summarize, there is no specific local rule intended to exclude the women of the lineage and their sons (the uterine nephews of the resident men) from access

to resources. However, in practice, as the demographic configuration of the village imposes a very strict application of the principle of exogamy, it is very rare to register cases of the exercise of these rights.

A comparison with the case of Plaine Corail is useful to enrich and to confirm the hypothesis formulated above. In a situation of non-application of the principle of virilocality, where we find therefore women from the line who reside in Plaine Corail with their husbands, it is interesting to note that the transmission of rights to the land was made directly to the benefit of the girls. This allowed their husbands to rely on a fundamental resource to provide a stable and permanent settlement in the area. Formally, women retain land rights.

It is worth repeating, in this respect, that the principles of management and transmission of rights over family resources are made to adapt to different situations, according to the requirements and preferences of the family group members. Empirical observation enables us to assert that for all of the sites studied there exists no mechanism for internal social regulation of the family that would be likely to exclude women of the family from access to resources.

This observation can be linked to other data on the place of women in the local economy. As will be seen in the description of the sectors of economic activity and the sources of household incomes, the women of Sainte Marie and Plaine Corail have safe access to sectors of activity that allow them to manage both their work and the resulting income autonomously. Octopus fishing – practiced by the women of Plaine Corail – is the most significant case of typical female activity, whose social, economic, and also institutional status (the accreditation of professional fisherwoman) is recognized. Especially for the younger generations, the generalization of access to a good quality educational services in Rodrigues has helped to reduce the possible gaps in the distribution of opportunities between men and women.

6.6.4 Access to basic public services

6.6.4.1 State and distribution of infrastructures and services

Public infrastructure for civil status and administrative records management are mainly located in Port Mathurin, the regional capital of Rodrigues, or in the vicinity. Any request to public services must be carried out through the competent office and depends on a particular regional commission.

Access to these services requires the movement of the concerned people by private or public transport (buses). Access for the inhabitants of Sainte Marie is a little more complicated, because the village is located in an area connected to the main road by a roughly two-kilometre long trail that is in a deteriorated state. This trail leads to the bus station located right next to the airport. Access to the paved road for the inhabitants of Plaine Corail is very easy, the village lying about 200 meters away.

Figure 146: Access to basic public services (health, education) in the project area

The preceding map shows the locations of local facilities. Note that some services are represented for the entire Rodrigues territory; others refer only to the area of proximity of the project zone. The criterion chosen to draw the map is that of the attendance of users residing in the project area:

- For primary schools, only proximity is to be considered as a condition of access;
- For colleges and high schools, the proximate variable is not exclusive: the families of students who have a good success may decide to send their children to colleges that are commonly considered more prestigious. They are distributed throughout the territory; and,
- Similarly, the dispensaries cover exclusively a pool of local users, while the hospital and health centres are intended to cover the demand of all users of the island.

6.6.4.2 Access to education services (State of supply)

The Rodrigues school system is not specific to the island; it follows the same system as that of the Republic of Mauritius, namely: the same distribution of school levels, the same school curricula and the same examination systems. All establishments are public.

6.6.4.2.1 Pre-primary schools

33 nursery schools are registered on Rodrigues, all public. Education is compulsory from the age of three years and takes place over two years. The choice of the nursery school is free, but usually the one that is closest to the dwelling is chosen.

Nursery schools still required payment of fees a few years ago. Today, parents must pay a sum of Rs 50 per month and per child to be handed over to the teacher.

About 1 450 pupils are welcomed each year in pre-primary schools. This number has remained stable over the years. The number of teachers, slightly higher in recent years reached 78 in 2017, or a ratio of 19 pupils per teacher in the same year.

With regard to the households surveyed, 3 children, approximately 4 years old, go to kindergarten: 2 from the village of Sainte Marie and one from the village of Plaine Corail.

6.6.4.2.2 Elementary Schools

There are 15 primary schools in Rodrigues, the closest to the area of Plaine Corail being those of Anse Quitor and Grand La Fouche Corail. The class distribution is done over 6 years, from grade 1 to grade 6. The curriculum concludes with an examination for obtaining the Primary School Achievement Certificate (PSAC) which is a requirement for secondary education.

The teaching staff consists of heads of department (Head Teachers), teachers (Teachers General Purpose) and sometimes assistants (School Clerks). Only teachers are the direct teachers of the pupils.

Access to primary schools is completely free and free of choice but it is usually the closest school to the dwelling that is chosen. Textbooks and school transportation are also free.

The number of pupils enrolled in primary classes went down by 11.5% over the 2013-2017 period with just over 4 600 pupils. In 2017, the number of teachers, which remained more or less stable in recent years, was 236 or a ratio of 20 pupils per teacher in the same year.

The results for the Primary School Achievement Certificate PSAC appear to be increasing in recent years, reaching almost 82% success in 2017 (against 71% in 2013 and even 55% in 2008).

For the villages of Sainte Marie and Plaine Corail, only two children go to primary school, one from each of the two villages. The young boy from Sainte Marie is in grade 6 at the Anse Quitor elementary school closest to Sainte Marie. He will take the examination for his PSAC Examination this year. The young boy from Plaine Corail attends the primary school of Grand La Fouche Corail.

6.6.4.2.3 Colleges

There are 7 colleges in Rodrigues. Secondary education is done over 5 years (grades 1 to 5) with an additional 2 years (lower 6 and upper 6). The end of the grade 5 year is marked by a review for the Cambridge School Certificate (SC) that conditions access to the last 2 years. Secondary education is completed by obtaining the Cambridge Higher School Certificate (HSC).

Access to high schools is completely free. Textbooks and school transportation are also free. However, the choice of the school is not completely free; choice is limited by the level obtained at the PSAC. A ranking of colleges has been established over the years according to the success rates obtained on the exams in the different establishments. Students who have obtained good results from the PSAC exam will not necessarily choose the institution closest to their home, but rather the one with the best reputation (for example Rodrigues College of Port Mathurin is the establishment the most coveted on the island). On the other hand, the integration of a pupil into a College may be subject to the Director's acceptance following a review of the student's academic record. Pupils who do not get the PSAC are redirected to pre-vocational education and at a later date potentially to a technical education.

The 7 colleges brought together 4 455 pupils in 2017 (+ 11% compared to 2013) for 261 teachers (also increasing), a ratio of 17 pupils per teacher.

The results for SC and HSC have remained relatively stable in recent years with success rates slightly higher than 70% for each exam.

Among the children of the villages consulted, 8 are enrolled in College, 4 from each locality. 3 of the young people of Sainte Marie are enrolled at Marechal College while only one goes to Rodrigues College in Port Mathurin. Regarding students from Plaine Corail, 3 go to the College of La Ferme (in Pistache) while only one goes to the College of Le Chou.

6.6.4.2.4 Pre-vocational schools

There are 7 establishments providing a pre-vocational educational program. These schools are not necessarily physically disconnected from institutions providing the academic curriculum.

Pre-vocational schools offer appropriate education for children who have not succeeded in obtaining their CPE. This school support often allows students to be guided towards a path of technical learning and, above all, limits early school dropout.

The number of pupils registering for this type of specialized education at the end of primary school has been declining steadily since 2013 reaching 431 pupils in 2017 (-21% compared to

2013) for 44 teachers against 28 in 2013. This led to smaller pupil/teacher ratios, with 10 pupils per teacher in 2017.

Among the children of the villages of Sainte Marie and Plaine Corail, no child has entered the pre-vocational education curriculum.

6.6.4.3 Access to health services (supply status)

The health service in Rodrigues is completely free and there are no private clinics. The hospital service is comprised of one hospital, two health centres and 14 dispensaries in villages across the island.

6.6.4.3.1 Queen Elizabeth Hospital

The Queen Elizabeth Hospital is located in Creve Coeur near Port Mathurin. This health centre is the largest and most comprehensive of the island; it also has the most modern facilities.

The hospital is the only one on the island to offer emergency, ambulance, surgical, intensive care, dialysis, gynaecological, dental and orthopaedic services. It also offers services in general medicine, maternity, post-natal care (nursery) and paediatrics.

The capacity of the hospital (all services combined) was 145 beds in 2017.

It should be noted that the Queen Elizabeth Hospital, while equipped with a panoply of medical equipment, lacks certain medical devices. Sometimes patients must go to Mauritius to receive care or further analysis.

6.6.4.3.2 Health Centres

There are two health centres in Rodrigues. They provide access to the decentralized care of Port Mathurin and allow for quicker health management for all the inhabitants of Rodrigues. These health centres are open 24 hours a day.

The health centre of Mont Lubin, in the centre of the island, is the largest of the two and thus represents the second largest health establishment of the island with 22 beds for general medicine and maternity services. It also has an emergency room and ambulance service, as well as dental care.

La Ferme health centre, further west, is smaller in terms of capacity. It offers the same services as the Mont Lubin health centre with the addition of post-natal care services and paediatrics.

6.6.4.3.3 Dispensaries

14 dispensaries (or community health centres) are scattered on the island to allow access to first aid as close as possible to the villages. The closest dispensary to the Plaine Corail area is located at Cascade Jean-Louis.

Dispensaries are not open every day; they open at specific days and times. On days when the dispensaries are open, a nurse is on call and a doctor is present (a generalist or a specialist depending on the specific appointments scheduled for that day).

The villagers visit the dispensaries for follow-ups related to chronic diseases.

6.6.5 The local economy

6.6.5.1 The production sectors

This section presents qualitative data on the organization of the main sectors of production (fishing, livestock and agriculture) in the area of social influence of the project.

6.6.5.1.1 Fishing

In the project area, different types of artisanal fishing are practiced inside the Lagoon (artisanal fishing at the bottom line or trawling that are practiced outside the lagoon are not practiced inside). Each type involves a different technique, equipment and organizational mode and is presented in the following sections. Each section presents the main characteristics and social and economic dimensions of net fishing, individual fishing in traps and fishing for octopus.

6.6.5.1.1.1 Net fishing and the Organization of fishing posts

Net fishing in the lagoon is a highly regulated fishery on Rodrigues. A fishing season is established and spreads over a period of seven months, from March to October. During this period, registered fishermen are obliged to go to the nearest fishing services office each month to sign an activity register and to obtain a stamp on their fisherman's card, which ensures the renewal of their fishing rights for the following month and allows the authorities to calculate the amount of compensation to be received during the closure period of the fishery. According to the fishermen encountered, this practice is rather restrictive because it is too frequent. At the end of the fishing season, the nets (also registered) are sealed. The breaking of seals in March is the signal of the opening of the net fishing season.

Net fishing has a relatively complex mode of organization, as the use of the net implies a system of cooperation between several boats and crews.

It is organized around a production unit called a fishing post. The fishing post is both a management mode and a physical structure. It may have a status as a private company or cooperative, but, as will be seen, in practice this does not have a great influence on the mode of management of the activity.

The fishing technique

In the ideal model, net fishing, locally called Sen, requires five boats that work in perfect coordination.

Preferably, net fishing is practiced under sail, but depending on the wind conditions, the days and the seasons, crews can use outboard engines. In general, the boats bring 2 to 3 engines and in case of necessity they moor or tow the boats without engine.

The fleet of five boats is composed as follows:

- Two boats carry nets (NET boat or bato-la-Sen, in Creole);
- Three boats push the fish towards the nets (bato-bater, or boat that makes the threshing).

The first two boats carry the nets. They place them at sea and moor them (marry the Sen) in order to obtain a "U" or semi-circular form. During this operation, the crews of the other three boats, positioned along the side where the net is open, hit the water with bamboo and the edge of the boat with a thick piece of wood (bataz Mayos), in order to scare the fish and push them towards the nets. The operation is repeated at least a dozen times during the day, in different

places. Caught fish are loaded into one of the drummers. In case of success and good catches, the filled beater boat can bring the fish back to the fishing post.

Figure 147: Back from fishing in Bangélique

Fishing post structure

The fishing post, as a physical structure, is the building (or small group of buildings) located at the beach and which covers several functions:

- Storage of fishing equipment;
- Fishermen's living space during the week (Monday to Friday evening): the fishing post works as a dormitory/refectory and kitchen;
- Workshop for maintenance and repair of equipment;
- Weighing point and sale of fish; and,
- Mooring boats.

In Bangelic, the walls of the older structures are built out of carved coral blocks and are covered with a sheet metal roof. The more recent ones are made of cinder blocks. The biggest concern of fishermen is to prevent rats, attracted by salt, from entering the fishing post and causing damage to nets.

Figure 148: Fishermen's dormitory and canteen

Crew organization

The composition of the crews is related to a rather precisely codified role distribution system. However, depending on the availability of fishermen and weather conditions, small variations can be made, particularly in relation to the number of sailors on the drummers.

The distribution of crews and individual roles is as follows:

In each of the two boats in charge of the nets there are 4 sailors: the Grand Chef (at the bow, ensuring the right direction of the boat), the Patron or helmsman, and finally 2 sailors managing the nets in the middle.

3 sailors are positioned in each beater boat: the sail Chief (at the bow, in charge of manipulating the sail, the Patron or helmsman, and finally the bater mayos in the middle. The skipper and the sail leader beat the water with bamboo when the boat is positioned.

Thus, for the daily fishing season, the sailors are divided according to the functions of 2 Grand Chiefs, 5 Patrons (helmsman), 4 sailors managing the nets, 3 sailing chiefs and 3 bater mayos. The table below illustrates the positioning of the crews:

Table 61: Crew organization on net fishing vessels

		STERN			PROW
Net Boats	1	Patron (helmsman)	Responsible of net	Responsible of net	Top Chef
	2	Patron (helmsman)	Responsible of net	Responsible of net	Top Chef
Treshing boat	1	Patron (helmsman)	Bater mayos (batter)	Chief Sailor	
	2	Patron (helmsman)	Bater mayos (batter)	Chief Sailor	
	3	Patron (helmsman)	Bater mayos (batter)	Chief Sailor	

The Great Chiefs are the first to be responsible for the fishing strategy, for navigation decisions and for the choice of nets. They coordinate the whole operation from their respective boats. They are the most experienced sailors.

The sailor called "Patron" is not necessarily the owner of the boat (the case is possible, but rare): it is the qualification of the helmsman. The bosses of the first two boats are normally more experienced than those who sail the drummers.

Sailors in charge of nets are usually a workforce that does not yet have much experience. The same is the bater mayos charged with scaring the fish on the other three boats. Sail managers are generally more experienced and lead the drummers.

In total, such an an organization involves the mobilization of 17 people at sea, when the crews are all here. Two additional people complete the net fishing team, but they stay ashore at the fishing post:

- The "meter-piece", responsible for the maintenance of boats and fishing equipment;
- The stage manager, in charge of the "base-life" of fishermen and the kitchen.

At the head of the whole organization is the "boss", Director of the fishing post. Depending on the case, and according to his age, he can be at sea with the others – he will then have the position of one of the Great Chiefs – or manage the business ashore.

Fishing post direction

As explained above, the fishing post may be a private company, but in most cases, it is registered, at least formally, under the status of a cooperative. Three fishing posts are recorded on the area of influence:

- The fishing post of Bruno Capdor in Bangélique;
- The fishing post of Agner Ithier in Caverne Bouteille;
- The fishing post of Jean-Roulere Ithier (brother of Agner) in Pointe Corail.

The fishing posts of Bruno Capdor and Jean-Roulere Ithier are both registered under the name of Rodrigues fishermen multi-purpose co-operative Society Ltd. Agner Ithier, meanwhile, is a private company simply registered as individual head fisherman. Agner Ithier holds a net fishing licence (broad net licence) like the others except that he owns all the equipment of his fishing post: the five boats, three engines and the nets. Jean-Roulere Ithier and Bruno Capdor, the managers of their fishing post, are not the owners of all the equipment of the fishing units for which they are responsible. For example, Bruno Capdor has only the nets, three boats and an engine. So other owners associated with him make their boats and engines available (if necessary) and receive in exchange a larger part in the sharing of revenue. The fishermen are not necessarily members of the cooperative.

The project to focus the organization of artisanal fishing on an exclusively cooperative model dates from the 1980s and, according to the fishermen encountered, it was not very successful.

Sale, cost recovery and revenue sharing

The principles that govern the sharing of revenues from the sale of fish are quite common to different fishing posts. However, the practices vary from one structure to another.

The fish is sold as soon as the boats return from fishing, usually every afternoon around 4 pm. The fish are weighed at the fishing post and immediately recovered by small buyers (bayan), who will immediately sell them on the squares of the urban centres of the island. The presence of wholesalers has not been ascertained. The prices are more or less fixed, as well as the margins of the bayans. The fish is purchased in cash and the money counted under the eyes of the fishermen, it is then kept by the "boss" until the day of sharing. The frequency of sharing is once per week in some cases, and in other cases once every two weeks. This frequency is adjustable according to family requirements and the period of the year (for example during the holidays).

Figure 149: Fish weighing

The amount to be shared is divided into shares. Each fisherman, according to his experience and the abilities recognized to him, is entitled to an entire share or a fraction of a share. In the different fishing posts, the principle is applied with different variants.

At Bruno Capdor, before making the division, the current costs of the week are deducted from the overall amount. These are the costs for food, fuel, candles, tea, etc. Then, a fairly complex calculation is made: knowing that each fisherman will be entitled to 4/4 per share, to 3/4 per share, or to 2/4 per share, the amount is divided into quarters of units. Then everyone gets their shares:

- The "boss" is entitled to 2 whole shares. It is thanks to this more important amount that the “boss” supports the maintenance costs and the investments in the fishing post;
- The great chiefs of the bato-la-Sen are entitled to one whole share each;
- The patron (helmsmen) are entitled to 3/4 per share or part, depending on their experience (usually the boss of the batter earns 3/4 on the other hand);
- Manoeuvers that pull nets and bater mayos are entitled to ½ part;
- Sailing chefs are entitled to 3/4 in general;
- The meter-piece is entitled to 1 full part;
- The stage manager is usually entitled to 1/2 shares;
- The one who puts his own boat and the engine at the disposal of the crews will also have a share.

This configuration is slightly different in the fishing post of Agner Ithier. Current expenses are taken care of with a regularly stocked cash register. They are not substracted from the total amount collected before sharing.

The amount is shared in whole units between the members of the crews (and personnel ashore). As at Capdor, some fishermen are entitled to a whole share and others to a fraction (3/4 share or 2/4 share). For those who are only entitled to a fraction, the difference is retained by Ithier, who uses it to supply the Fund of the company.

This Fund is used to support current costs – fuel, food – and to support expenses for maintenance and renewal of equipment.

It should be noted that this sharing system is based on the recognition of the individual expertise of fishermen (and not on their actual role in the crew, although very often the two elements overlap). This recognition is established by peers and by the most expert, including the Grand Chef. The status of the fisherman determines his part in the distribution of the winnings. This suggests that a delicate balance must be constantly maintained within the fishing post between, on the one hand, the necessity of the collective enterprise to be able to rely on the individual expertise of the members of the crew (the experience of some increases safety and the chance of success at sea), and, on the other hand, the need to provide funds for maintenance and investment in order to make the company thrive (and, therefore, all those who work there). The analysis of the sharing system shows, finally and in both cases, that the entrepreneur himself (private, or head of the cooperative) is far from maximizing the profit of his own capital. The individual’s remuneration (based on the recognition of experience) seems to be of equal value to the capitalization of the company.

6.6.5.1.1.2 Individual professional fishermen

Individual professional fishermen operate under the Individual fishermen's license, which differentiates them from net-specific fishing. It is not uncommon for net license holders to also hold this type of license in order to continue fishing during the off-season of the net fishery, because individual professional fishers are not subject to a fishing season.

The fishing technique

The fishing technique mainly used in the lagoon for individual fishermen is the fishing trap. Angling is also practiced but to a lesser extent.

Trap fishing is an individual activity. Fishermen usually own their boats and depart regularly during the week to pick up the traps they deposited at various locations in the lagoon. The boats are, as much as possible, used with a sail to limit the fuel costs (most fishermen are however equipped with a small engine). The distance between the place of anchorage and the place of deposit of the traps is economically decisive.

Locations where the traps are placed

There are two main deposit locations: in the lagoon and in the reef:

- The lagoon: the lagoon represents a rather sandy area of the lagoon with some scattered coral heads. It is a less densely populated area but more frequented by large fish, which can be sold at a better price. Another advantage of the lagoon area is that the traps can be more easily recovered if they are carried away when the currents are strong, especially during cyclones;
- The reef: the reef area is the part of the lagoon closer to the coral reef. Unlike the lagoon, it is much more heavily populated, but the fish are of smaller size (usually placed in the category of a lesser-rated fish known as “grade 3”). Though the catches can be better in terms of quantity, the reef remains an area at risk for the traps because of rougher seas. During high tides, episodes of strong currents or cyclonic storms, the loss of traps can be a substantial problem.

The anchoring of the impacted area

The location of the mooring of the individual fishermen of Sainte Marie lies at the edge of the village of Sainte Marie along the coastal strip of Bangélique, directly across from Crab Island.

The mooring serves as a pier for 9 professional fishermen.

Figure 150: Anchorage used by individual fishermen in Sainte Marie

Their fishing area lies behind Crab Island, one of the areas where the lagoon is the largest, and the coral reef can be up to eight kilometres from the coast. The distances travelled can therefore be large. The location of the individual fishermen of Sainte Marie can therefore be considered strategic, considering the distances related to the size of the lagoon at this location of the island.

6.6.5.1.1.3 Octopus fishing

The octopus fishery (ourite in Creole) is one of the most renowned activities in Rodrigues and is therefore a full-fledged profession. It is very often women who practice this activity and who then have a particular type of fishing license called professional fisherwomen. According to official statistics (Digest of statistics on Rodrigues, 2017), 187 octopus fishing vessels were registered in 2017. A number that has remained constant in recent years.

The amount of octopus fished each year exceeds 600 tons, a trend that seems to be increasing according to statistical data.

The octopus fishery has been regulated in Rodrigues for some years through periods of fishing closures that correspond to the breeding periods of the octopus. Closures take place twice in the year generally over a one-month period over February and March, and a two-month period over August and October. If the system of closure of the octopus fishery was delicate to put in place considering its importance to the population, it seems that today this is a success, in particular because of the increase in fishing volumes realized in recent years.

The fishing technique

Octopus fisheries are better known as “pickers ourite”. On some areas of the island where the lagoon is less deep, they walk from the coast and they harpoon the octopus in the vicinity. In other areas, they are brought by boat to favourable areas, still shallow, and walk in the lagoon, in boots, to find the marine molluscs that lurk beneath the rocks and coral.

The spike used is a simple stick at the end of which is attached a trident-shaped harpoon. The octopuses are harpooned without a mask (underwater fishing is forbidden) and then threaded

one by one on a long metal hook. The amount of octopus fished per day and per person exceeds 12 kilograms on average.

The ourite are usually eaten fresh on the spot but can also be dried, placed in a fan on wooden frames installed above the waterfront water to be preserved and subsequently exported to Mauritius. Nearly six tons of dry ourite were exported to Mauritius in 2017.

6.6.5.1.2 Breeding

Breeding, alongside fishing, is known to be one of the economic pillars of the island. Until 2016, more than 90% of bovine, ovine and caprine production was exported by boat to Mauritius (Digest of statistics on Rodrigues, 2017). Swine and avian production remains local, due to the lack of a sufficiently large market in Mauritius.

In addition, breeding is heavily represented in society and even has a cultural dimension in Rodrigues. It is very common for families to have one or more types of livestock which, while providing a portion of the household's annual incomes, also provide a significant food resource.

While there are few forms of intensive rearing of laying hens on the island, it should be noted that breeding in Rodrigues remains extensive. Breeding is particularly common in the project area.

6.6.5.1.2.1 Cattle breeding

The very extensive form of livestock farming in the village of Sainte Marie

In the village of Sainte Marie, cattle breeders have been very rare since the outbreak of foot-and-mouth disease in Rodrigues in 2016, during which a large part of the cattle herd had to be eliminated. According to the village spokesman, one breeder still possesses any cows.

The rearing of cows (and other animals, in general) in Sainte Marie remains very extensive. Cows graze freely in the village area. There is no particular delineation of grazing areas; the cows go where they want. In the evening, the breeders go looking for them and attach them for the night to the place where they find them or move them if they are too close to a dwelling or a cultivated field. The animals are released the next morning for a new day of free grazing (divagation).

Cows freely drink in the afternoon from a water-desalination unit located at the mouth of the Anse Quitor River.

The water was previously pumped into a cavern of this karstic formation region that bears the name of Caverne Bouteille. "Caverne Bouteille" is the name given by the inhabitants to the area located between the village of Sainte Marie and the village of Point Corail.

For the villagers of Sainte Marie, there is no specific interest in the sex of the animal. Females are considered to be genitor and are kept for up to 15-20 years. Males are kept for 2 ½ to 3 years and then sold according to their mass. There is no specific planning or agreement between breeders on breeding. The animals being free during the days, the couplings occur naturally and are not guided.

The sale of animals is constantly carried out on site with the regular passage of buyers (always Mauritian) possessing a vehicle suitable for their transport. The sales system is usually "old fashioned" by estimating the weight of the animal and agreement on the price between breeder and buyer. However, since the outbreak of foot-and-mouth disease in 2016, a specific animal

weighing system for the meat sector has been set up in Port Mathurin. At that time and until the end of 2018, a form of embargo remained in Rodrigues concerning beef. While a large proportion of the Rodriguan cattle herd was slaughtered at the height of the crisis, only one sales circuit was authorized through the Rodrigues Trading & Marketing Company (RTMC) and the Mauritius meat authority (MMA).

A similar breeding method for Bangélique breeders

The breeders of the so-called Bangélique zone, unlike those of the village of Sainte Marie, do not reside on site but in the surrounding villages of Cascade Jean-Louis, Anse Quitor or Grand Lafouche coral. They use abandoned fishing stations as shelter and rallying point for their animals.

All told, these non-resident breeders come in the morning to Bangélique to release their cows that they attached to the rope the previous evening.

As with the breeders of Sainte Marie, cows circulate freely throughout the area. There is also no grazing sequencing, and even if a new breeder wishes to bring his herd, there would be no objection. A newcomer would not even have the obligation or the need to warn other breeders of his arrival in the area:

Bangélique breeders are more distant from the desalination unit and the watering trough than the Sainte Marie breeders. Equipped with “pick-up” vehicles, they themselves carry the drinking water to the cattle at the end of the day. Knowing the ritual, the cows go to the fishing station by themselves in order to drink, which allows the breeders to tie them for the night.

Breeding in the village of Plaine Corail

Unlike the areas of Sainte Marie and Bangélique, Plaine Corail is an area closer to the main road that joins the airport. The houses are also more numerous, and the agricultural plots are not all protected.

Thus, the mode of rearing cattle is significantly different in Plaine Corail, as the animals do not circulate freely. The pasture requires guarding and therefore a person is required to prevent the animals from approaching too close to the road axis, plots of vegetable production or even dwellings.

6.6.5.1.2.2 Goat and sheep breeding

The breeding in Sainte Marie

In general, as with cows, the inhabitants of Sainte Marie let their sheep and goats circulate freely throughout the area. In the evening, the animals return by themselves to the dwelling of the breeder to be kept there for the night. If it happens that some heads are missing, the breeder searches for the missing animals, knowing full well that other inhabitants of the village will soon have pointed out the position of the stray beasts.

Goats and sheep are penned up at night in order to protect them against stray dogs that regularly attack herds during the night.

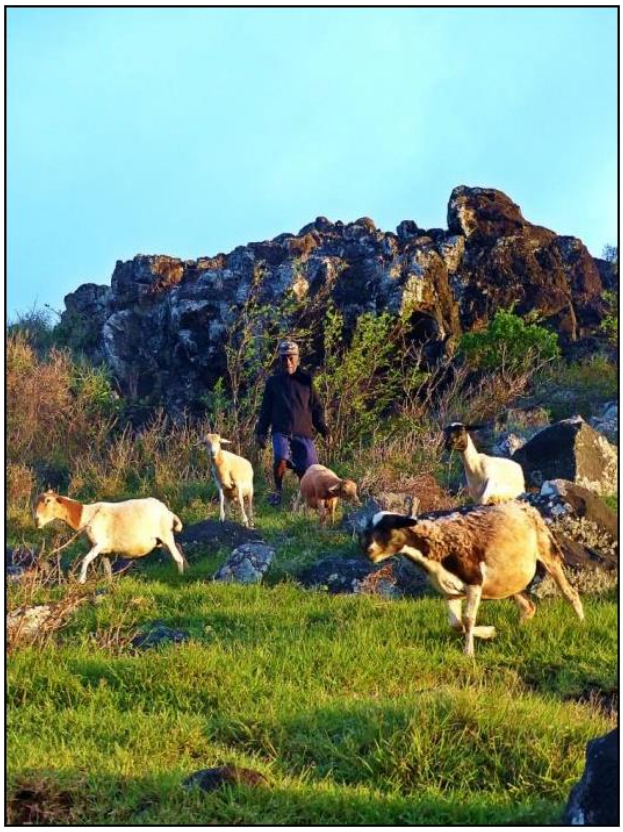


Figure 151: Herds gathering in Sainte Marie village at sunset

Part of the livestock relocated to Eau Vert

Some breeders have more substantial herds of sheep and goats. The majority of their livestock is located in Eau Vert, a large area dedicated to livestock and recognized as such by the Regional Assembly of Rodrigues (RRA). This pasture area is located on the north side of the island's west coast, overlooking the Bay of the Lascars. It is necessary for the village spokesman to go there several times a week on a motorbike.

The zone of Eau Vert brings together a large number of breeders who leave their animals to graze freely but who also possess a pasture if they want to gather their herds for observation or when it is necessary to provide care. There are no permits specifically issued by the authorities for land use.

The breeder has between 30 and 40 goats and more than 40 sheep. The animals are destined for the export of meat to Mauritius. Potential buyers contact the breeder regularly to inquire about the availability of the animals. The breeder then transfers the desired number of animals to the village of Sainte Marie and keeps them there to allow their fattening using specific foods produced in Mauritius. This practice occurs particularly during the dry period at the end of the calendar year. Otherwise, the fattening is carried out by distribution of cut grasses.

The breeder noted, that, according to him, the Eau Vert breeding area would no longer be viable within 3 to 5 years because of the growing invasion of acacia nilotica, locally called “Pikan Loulou", an extremely invasive plant that poses real environmental problems on the island. This is a major concern because this breeding area remains a strategic place in

Rodrigues, and, according to him, the RRA will never have sufficient means to eradicate the "Pikan Loulou", given the level of invasion achieved to date.

Bangélique breeders' practice

Just like the inhabitants of the village of Sainte Marie, the breeders of the Bangélique area, which lies between the runway of the airport and the coast, let their sheep and their goats circulate freely. The mode of rearing is thus the same as the only difference that they have made use of the abandoned fishing stations by creating a pen that allows them to leave their animals during the night.

The Bangélique breeders come in the morning to their breeding area to release their animals from night parks. Then return at the end of the day to bring them water and to secure them by penning them up.

Figure 152: Goat breeding in an old fishing station

Breeding in Plaine Corail

Outside the areas of Sainte Marie and Bangélique, a different rearing method was found in the village of Plaine Corail. This major difference is reflected in the fact that animals are constantly penned.

The perimeter of a breeding area is delimited by a fence (fencing). This area is then separated into two parts. The first, the smallest, is used to keep animals. The second is maintained so as to regularly remove the shoots from "Pikan Loulou" and allow the grass to grow properly to mow and supply the herd with fodder.

Moreover, this demarcated area is the subject of a farm permit and a resident of Plaine Corail, this method is encouraged by the authorities because they subsidise the supply of the fence for breeders without parallel employment.

6.6.5.1.2.3 Pig farming

Unlike cattle, sheep and goats, pork is the only animal bred, slaughtered and consumed on the island, due to a lack of a major market on Mauritius for cultural reasons. In Rodrigues, pork is a non-negligible source of protein and various processed products (hams, sausages...).

When it is destined for self-consumption, the pig is slaughtered on the spot. A portion of the meat or some of the cuts are then sold by the owner of the animal.

When the pork is purchased by a third party, it is sold to the purchaser following an agreement on the price and brought by the purchaser to his area to be slaughtered in the nearest slaughterhouse. As such, the slaughter of 3 127 pigs was registered by the authorities in the year 2017 (Digest of statistics on Rodrigues, 2017).

6.6.5.1.2.4 Poultry breeding

Poultry farming is still unreliable in Rodrigues in general and specifically on the areas of Sainte Marie and Plaine Corail. Animals (hens, geese, Guinea fowl, ducks, etc.) are left to roam freely around the houses. They represent an intake of eggs and a little white meat. If it plays a role in the small local economy, this type of breeding seems to be more recreational than subsistence.

To feed their poultry, the locals give their leftover food or cooked rice mixed with the bran they buy from the neighbouring villages of Cascade Jean-Louis or la Fourche Corail. While some locals use industrially manufactured foods, the majority refuses to buy them, citing doubts about the ingredients used.

6.6.5.1.3 Agriculture

Agriculture in Rodrigues is extensive and provides for part of the island's subsistence needs in terms of vegetable production. While produce from Rodrigues exists, a large part of agricultural products are imported by boat from Mauritius.

Unlike in Mauritius, synthetic chemical inputs or pesticides are not widely used in agriculture, which is one of the arguments made by the local Government when it claims the island of Rodrigues is exemplary in terms of sustainable development and eco-responsibility.

It is to be noted that at the time of the drafting of the report, the threat of the fall army worm was prevailing on the island affecting mainly Maize plantations. The phenomenon was noticed in the month of March and since then is being monitored by the Rodrigues Regional Assembly.

6.6.5.1.3.1 Main food crops in Rodrigues

Food production remains very varied, but the largest and most widespread products are:

Table 62: Main food production in Rodrigues in 2017 and shares of agricultural land

Food crops	Production (tons)	Share of total agricultural food producing area (%)
Corns	523	44
Onion	397	8
Red bean (dry)	85	36
Shooting*	318.5	5
Peanuts	14.5	2.5

* The shooting represents all the creeping plants such as Bitter gourd, calabash, Chayotte, Zucchini, cucumber, pastry, Pumpkin, melon, watermelon, etc.

6.6.5.1.3.2 The specific agricultural products of the island

Among all the agricultural products of Rodrigues, some have a reputation not only locally but also regionally (Mauritius and Reunion), namely:

- The lime or the silt of Rodrigues (Limon);
- The little chili pepper or Ti-Pima in Creole;
- The red bean; and,
- Honey.

These agricultural products are now being studied for the establishment of original certifications.

6.6.5.1.3.3 Agricultural production in the airport area

Agricultural production in the village of Sainte Marie

In the village of Sainte Marie, the economic and social stakes are rather high for farming activities, which are an indispensable element of agricultural production. The inhabitants of Sainte Marie have no land other than those available next to their dwelling.

Agricultural production is only a small part of their incomes, but this production allows villagers to achieve some form of autonomy. This practice is probably also related to the geographical isolation of the village of Sainte Marie.

The crops are varied (maize, bean, peanut, watermelon, tomato, cucumber, etc.) and the use of the cultivation space is very diversified with associations allowing sufficient production for households despite the agro-climatic conditions, which are rather unfavourable in this area (water stress, clean vegetation, saline air, shallow and rocky soils, etc.).

The integration of livestock in the agricultural system, therefore, makes sense: the contribution of organic matter (manure, slurry) is an essential element for the formation of the soil and the maintenance of its fertility. Livestock, thus, ensures the viability of agricultural production.

It should be noted that the inhabitants of Sainte Marie do not use and do not want to utilize synthetic chemicals such as pesticides or nitrogenous and phosphatic fertilizers. This is a very good example of the viability of an agro-pastoral system.

Agricultural production in the village of Plaine Corail

The plant production of Plaine Corail is also very diversified, although the plantations present a sequence of cultivars that is a little more pronounced within the parcel.

Another difference is that the agricultural production of Plaine Corail is more of an income crop because only a minimal part is kept for household consumption.

Also it was reported by an inhabitant that the younger generation is not interested in the work of the earth anymore.

6.6.5.1.3.4 Land rights on farmland

90% of Rodrigues's land belongs to the Rodrigues Regional Assembly. Land management and the granting of land on Rodrigues are governed by the State Lands Act, voted for in Mauritius in October 1982 and amended in 1991.

This law was passed in order to protect and to optimize the management of State lands. The State lands include "defensive grounds", geometric steps and all lands owned or possessed by the Mauritian State.

This law contains the legal provisions and in some cases the obligations of the various actors directly or indirectly involved in the project to enlarge the runway of the Plaine Corail airport. In Rodrigues, the grant of leasehold is defined in section 6 (1B): leases on State lands.

The lease on State land

In Rodrigues, all leases on State lands must be subject to the following minimum conditions:

- the leased land shall not be used for purposes for which it is not allocated without the approval of the authority concerned,
- the leasehold shall not be used in such a way as to constitute a nuisance, to harm natural resources or the environment, including sea, beach, freshwater, adjacent canals or rivers,
- the lease agreement may be terminated after the service of a notice indicating the reason for the cancellation, if subparagraphs (i) or (ii) are not duly observed.

A State land lease cannot be assigned for a period exceeding 60 years. The rent must be paid annually and in advance. An activity must be carried out in connection with the application for a lease. If the activity does not match the prerequisites or if it proves to be non-existent, the contract will be cancelled and may be forwarded to a third party.

Agricultural permit on State lands

The agricultural permit is specific to Rodrigues and the procedure for the application of agricultural land was established by the Committee on agriculture.

The lease on agricultural land is not directly granted to applicants. It is an agricultural permit that is granted so that the applicant can start or continue his farming and/or livestock activities. The agricultural permit corresponds to a contract which stipulates the area, the duration, the provisions and conditions of use of the land.

After a period of five to ten years of effective agricultural activity, the applicant may apply to the Agriculture Commission for an agricultural lease on the same land. After field investigations by agricultural technicians, recommendations are sent to the cadastre office for the precise delineation of the land with terminals. Finally, a Government evaluator visits the field to assess it to determine the annual lease amount. From there, the lease is granted for a professional agricultural activity where hard infrastructure can be built. Unlike the farm permit, the farm lease is paid and depends on the size of the land.

In the project area, all land situations are formally recognized.

6.6.5.2 Household economic activities

The economic activities of the villagers at the Sainte Marie and Plaine Corail sites are recorded through the analysis of the household surveys conducted. The main activities identified are livestock, agriculture and fisheries.

6.6.5.2.1 Breeding

91% of households surveyed practice livestock breeding.

Poultry farming comes first in terms of number of heads per capita. However, sheep farms (62%) and goats (62%), which are the most represented for the two localities, are significantly more important than pig or cow farms.

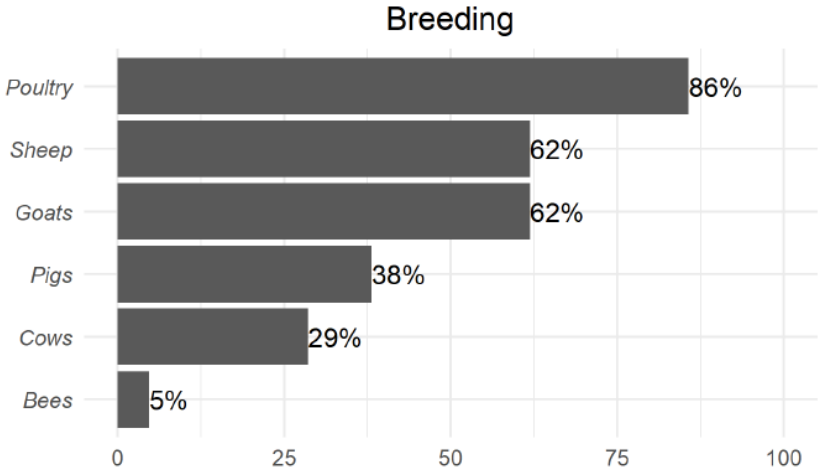


Figure 153: Proportion of animals raised among households in Sainte Marie and Plaine Corail villages

By comparing the villages of Sainte Marie and Plaine Corail, we can see that the types of livestock and associated quantities are substantially equivalent, with the exception of sheep farming, which seems more developed among the breeders of Sainte Marie.

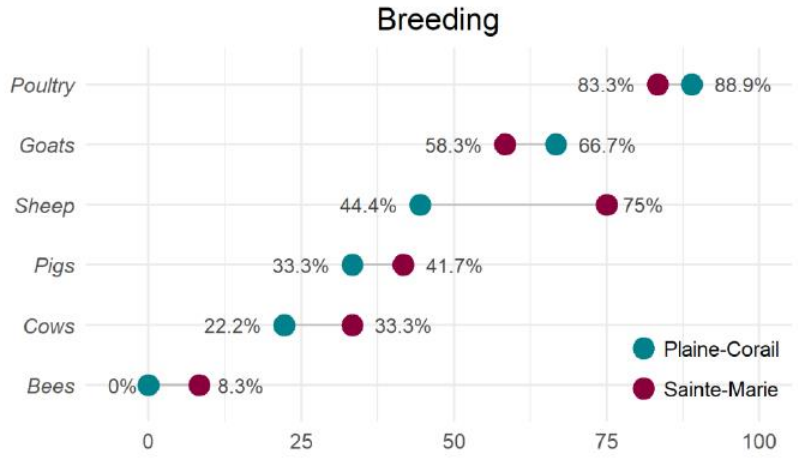


Figure 154: Share of livestock types by locality

6.6.5.2.2 Fishing

In the village of Sainte Marie, half of the households have a fishing activity recognized by the head of household. Women do not practice fishing, unlike in Plaine Corail where the female fishing activity is present.

We will then see the importance of this activity in terms of household incomes.

6.6.5.2.3 Agriculture

83% of households surveyed have an agricultural activity and 84% of them earn income.

The most cultivated plants are the shootings, such as the pumpkin, the calabash, the chayotte or even the watermelon. Then come corn, beans and solanaceous, such as eggplant and tomato.

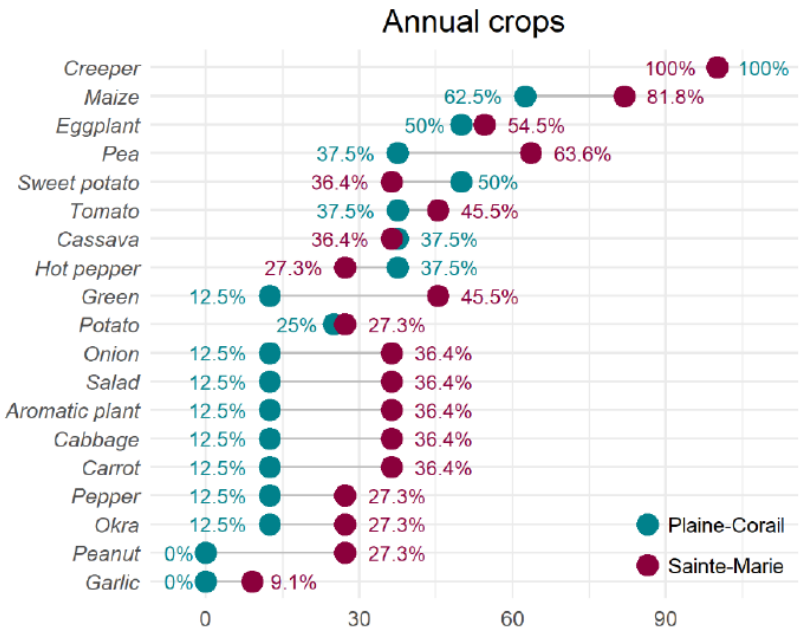


Figure 155: Distribution of annual crops by locality

Apart from a lesser proportion of beans cultivated on the Plaine Corail side, it is interesting to note that the same cultivars are present in both Sainte Marie and Plaine Corail.

More or less the same tendency is found with perennial (or fruit farm) crops. Only citrus fruits are noticeably more cultivated on the Plaine Corail side, whereas it is rather the Annona (Custard apple and Atemoya) that are more represented in the agricultural plots of Sainte Marie.

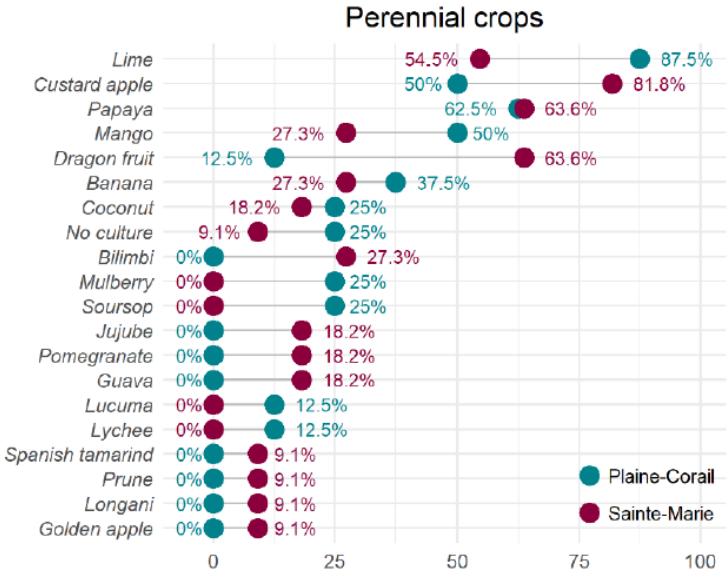


Figure 156: Distribution of fruit production by locality

6.6.5.3 Composition of household incomes

The analysis of the composition of the income derived from the activities carried out by the households of Sainte Marie and Plaine Corail shows that, despite the similarity in the types of

activities practiced in each locality, there seems to be a significant difference in income derived from those activities.

Revenu par habitant			*Revenu par ménage*		
Activite	**Plaine-Corail**	**Sainte-Marie**	**Activite**	**Plaine-Corail**	**Sainte-Marie**
Aide	13 051,61	13 109,77	**Aide**	44 955,56	40 265,71
Annual	5 935,48	8 325,58	**Annual**	20 444,44	25 571,43
Artisanat	161,29	2 930,23	**Artisanat**	555,56	9 000,00
Autre	10 838,71	5 930,23	**Autre**	37 333,33	18 214,29
Commerc	11 612,90	-	**Commerc**	40 000,00	-
Elevage	5 645,16	19 116,28	**Elevage**	19 444,44	58 714,29
Fonction	4 193,55	19 553,49	**Fonction**	14 444,44	60 057,14
Peche	7 032,26	14 232,56	**Peche**	24 222,22	43 714,29
Perenne	548,39	441,86	**Perenne**	1 888,89	1 357,14

Figure 157 Income per inhabitant / Income per household

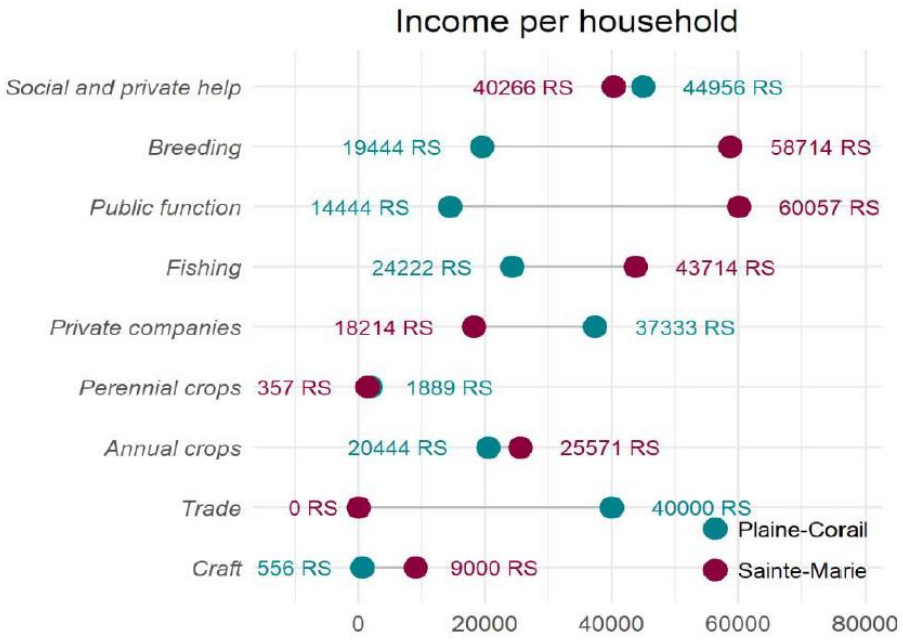


Figure 158: Distribution of household incomes in Plaine Corail and Sainte Marie villages by type of activity

The incomes from the main activities of livestock, fisheries and agriculture seem to appear much more substantial for the villagers of Sainte Marie than for those of Plaine Corail.

Conversely, some incomes, such as those derived from commercial or salaried activities of the private sector, represent a greater proportion of the incomes of the villagers of Plaine Corail compared to those of Sainte Marie.

6.6.5.4 Analysis points of the quantitative study

The demographic configurations described above indicate that the population of Plaine Corail is significantly more feminine than that of Sainte Marie. The male population of Plaine Corail

is younger on average than in Sainte Marie, with 86% of the men in the households surveyed under 40 years (compared with 61% among the inhabitants of Sainte Marie).

In terms of activities, the two communities have undeniable similarities. The most represented activities are livestock, fisheries and agriculture. But it seems that the income from these activities is much higher in Sainte Marie than in Plaine Corail. The inhabitants of Plaine Corail benefit from other sources of income, such as commercial activities.

It should also be noted that the fishing activity of women is only present in Plaine Corail.

Thus, while community configurations might be thought to be similar at first glance between the villages of Sainte Marie and Plaine Corail, there are certain specific traits that differentiate the current functioning of the two village entities. The village of Sainte Marie, with its isolation constraint, was able to find the means necessary to acquire a viable mode of economic functioning from the almost unique activities of livestock, fishing and agriculture.

On the other hand, for the inhabitants of Plaine Corail the activities of livestock, fishing and agriculture are less solicited, in favour of access (at least desired by the younger generations) to other income-generating activities.

6.6.6 Summary: Social environment sensitivity

Table 63: Social environment sensitivity

Sub-theme	Receptor	Sensitivity
Social environment	Demographic and social dynamics	High
	Power, governance and civil society	High
	Land	Major
	Agriculture	Major
	Sainte Marie and Plaine Corail inhabitants	Major
	Bangelique breeders	Major
	Fishermen of the impacted zone	Major

6.7 Air quality and noise environment

This chapter deals with noise and air quality. It aims to state the current air quality and noise level around the airport, and to identify how the airport activity contributes to the ambient pollution and noise.

It aims to base the assessment of the project impact on noise and air. During the construction, impacts might be due to work activities and road traffic for supplying the works. During the operational phase, air and noise pollution are due to the changes of air traffic.

To assess the consequences on human health, the population exposed is first analysed.

6.7.1 Area of influence

The area of influence is drawn from the large area that was modified to consider the planes' landing and taking off directions, and the exposed population distribution. It is mapped on next page's figure.

6.7.2 Demography and exposed population

The following map shows the location of the population living near Plaine Corail airport. It was based on field visits and analysis of aerial photographs. As residential buildings are sparse, the populations exposed to noise and pollution are limited. Yet, it should be noted that a school is located to the east of the airport and requires special attention. In general terms, the buildings and sites sensitive to noise and pollution are homes, schools, hospitals, and areas dedicated to sports.

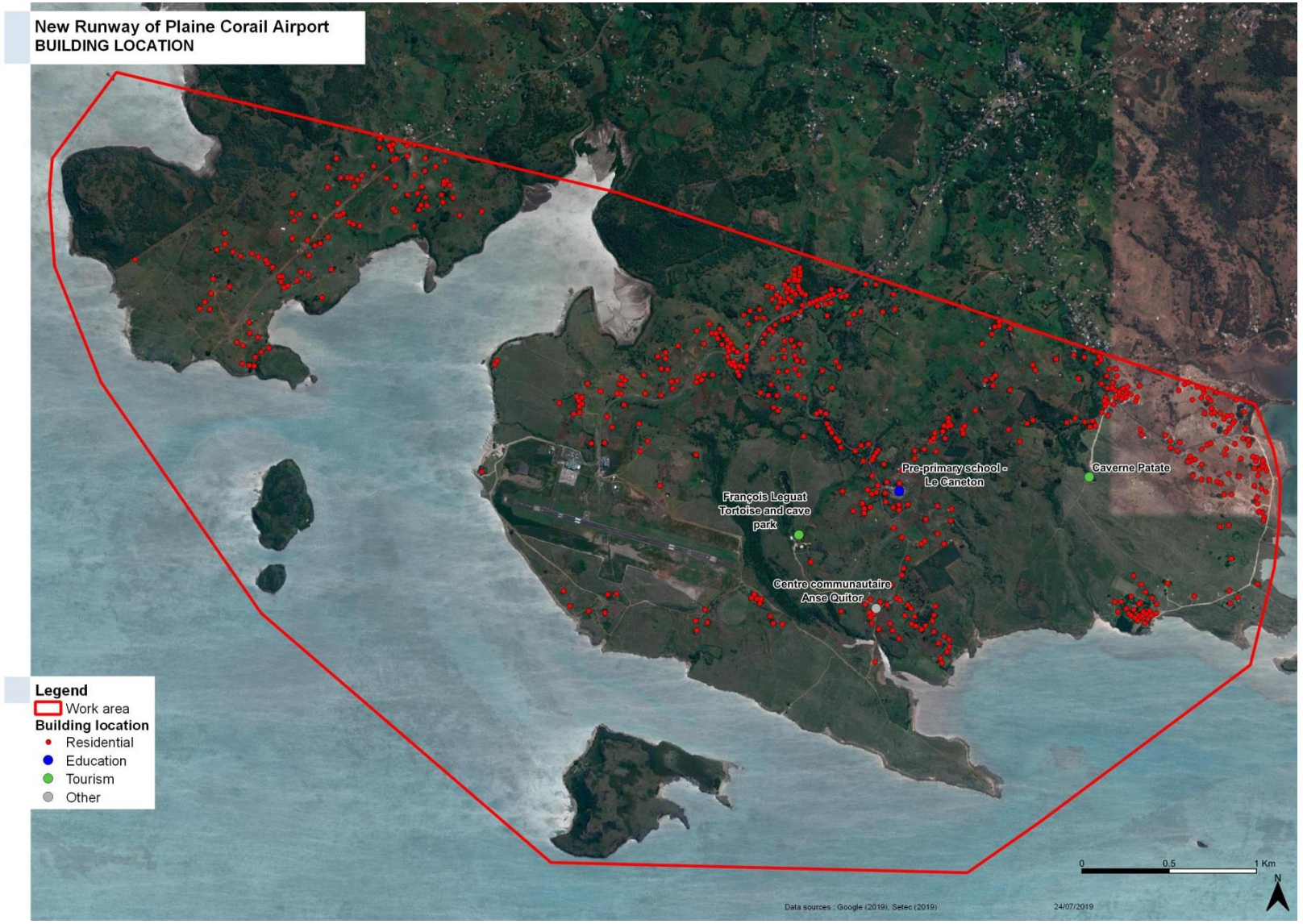


Figure 159: Building location map and area of influence

6.7.3 Air quality and carbon footprint

6.7.3.1 General information about air pollution

Air pollution can be defined as an alteration of air quality that can be harmful to human health, living things, the climate, or material goods. Below is a description of the main air pollutants.

Table 64: Description of main air pollutants

Carbon Monoxide (CO)

Origin	CO is produced by incomplete burning of carbon in fuels. Most of emissions are from transportation sources, especially road traffic. Industrial sources or incinerators might also produce CO.
Pollution mechanism	CO is involved in reactions creating ozone in the lower atmosphere. When transformed into carbon dioxide, it also contributes to greenhouse effect.
Effects on health and environment	CO is colourless and odourless. Carbon monoxide attaches itself instead of oxygen to the haemoglobin and causes a lack of oxygenation that can lead to death.

Hydrocarbons (HCs)

Origin	HCs are part of VOCs (volatile organic compounds), which is a large group of pollutants that come from industrial processes, incomplete combustion, solvents, agriculture or natural sources. Hydrocarbons are compounds of carbon among VOCs (except methane, ethane, and non-reactive compounds).
Pollution mechanism	HCs promote the formation of compounds contributing to the greenhouse effect and the formation of ozone in the lower atmosphere.
Effects on health and environment	The effects are very diverse depending on the pollutants, and range from respiratory effects to mutagenic and carcinogenic risks.

Nitrogen Oxides (NOx)

Origin	NO and NO_2 form during combustion process. Main sources are motor vehicles, stationary fuel combustion installations and aviation activities.
Pollution mechanism	NOx are involved in reactions creating ozone in the lower atmosphere and contribute to acid rain.
Effects on health and environment	NO_2 irritates the respiratory tract. Acid rain leads to soil degradation and forest dieback.

Carbon Dioxide (CO_2)

Origin	CO_2 comes from any combustion reaction of carbonaceous products.
Pollution mechanism	CO_2 is one of the main greenhouse gases.
Effects on health and environment	It is not harmful to humans but it contributes to the increase of greenhouse effect.

Sulphur Dioxide (SO_2)

Origin	Sulphur dioxide mainly comes from the combustion of fossil fuels containing sulphur (fuel oil, coal).
Pollution mechanism	In the presence of moisture, SO_2 forms sulfuric acid.
Effects on health and environment	SO_2 contributes to acid rain and also irritates the respiratory tract.

Suspended particulates

Origin	Particulates result from many different sources, such as industrial or household combustion, fuel consumption, vehicles, or are formed by an interaction of various gazes with other compounds in the air.
Pollution mechanism	Toxic compounds are transported by particulates into the respiratory tract. Particulate matter is classified according to the maximum diameter in micrometres: PM2,5 and PM10 are the inhalable and respirable classes.
Effects on health and environment	Depending on their size, particulates penetrate more or less deeply into the lungs. The finest can impair respiratory function; some are carcinogenic. Particulates also affect soil, buildings and monuments.

Local standards about air quality are set in the Environment Protection Act (1998) and are presented below.

Table 65: Air Quality regulations

First Schedule ***(regulation 3)***

Emission Standards

The following standards are maximum limits for the corresponding pollutant.

Pollutant	*Applicable to*	*Standard*	Applies to project (construction / operational phase)
(i) Smoke	All stationary fuel burning source	Ringelmann No. 2 or equivalent opacity (not to exceed more that 5 minutes in any period of one hour)	X
(ii) Solid particles	(a) Any trade, industry, process, industrial plant or fuel-burning equipment	200 mg/m^3	X
	(b) Any existing trade, industry process or industrial plant using bagasse as fuel	400 mg/m^3	
(iii) Sulphuric acid mist or sulphur trioxide	(a) Any trade, industry or process (other than combustion processes and plants for the manufacture of sulphuric acid)	120 mg/m^3 as sulphur trioxide	X
	(b) Any trade, industry or process in which sulphuric acid is manufactured	30 000 mg/m^3 as sulphur trioxide	
(iv) Fluorine compounds	Any trade, industry or process in the operation of which fluorine, hydrofluoric acid or any inorganic fluorine compounds are emitted	100 mg/m^3 as hydrofluoric acid	X
(v) Hydrogen Chloride	Any trade, industry or process	200 mg/m^3 as hydrogen chloride	X
(vi) Chlorine	Any trade, industry or process	100 mg/m^3 as chlorine	X
(vii) Hydrogen sulphide	Any trade, industry or process	5 ppm as hydrogen sulphide gas	X
(viii) Nitric acid or oxides of nitrogen	Any trade, industry or process in which the manufacture of nitric acid is carried out	2 000 mg/m^3 as nitrogen dioxide	
(ix) Nitric acid or oxides of nitrogen	Any trade, industry or process other than nitric acid plant	1 000 mg/m^3 as nitrogen dioxide	X
(x) Carbon monoxide	Any trade, industry or process	1 000 mg/m^3 as carbon monoxide	X

SECOND SCHEDULE **(***regulation 5)*

Ambient Air Quality Standards and Measurement Methods

Ambient Pollutant	*Standard (ug/m3) maximum*	*Averaging Time*	*Measurement Method**
Total suspended particles	150 50	24-hour Annual average	Hi-volume Sampler
PM10	100	24-hour	Hi-volume Sampler
Sulphur Dioxide	350 200 50	1-hour 24-hour Annual average	Fluorescence SO_2 Analyser, Colorimetry
Nitrogen Dioxide	200	24-hour	Sodium Arsenite, Chemiluminescence
Carbon Monoxide	25 10	1-hour 8-hour	Nondispersive Infrared Photometry
Lead	1.5	3-month average	Hi-volume Sampler with Atomic Absorption
Ozone	100	1-hour	Ozone Analyzer, Chemiluminescence

*the measurement methods are those indicated or other methods acceptable to the enforcing agency.

In addition to that, WHO provides guidelines for ambient air quality, expressed in concentration for the main atmospheric pollutants.

Table 66: WHO Ambiant air quality guidelines (2005)

	Averaging Period	Guideline value in µg/m³
Sulfur dioxide (SO_2)	24-hour 10 minute	125 (Interim target-1) 50 (Interim target-2) 20 (guideline) 500 (guideline)
Nitrogen dioxide (NO_2)	1-year 1-hour	40 (guideline) 200 (guideline)
Particulate Matter PM_{10}	1-year 24-hour	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline) 150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter $PM_{2.5}$	1-year 24-hour	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline) 75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)

Note 1: PM 24-hour value is the 99th percentile

Note 2: interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines.

6.7.3.2 Ambient air quality around Plaine Corail Airport

As there is no polluting industry and no significant agglomeration around Plaine Corail Airport, local sources of atmospheric pollutants are:

- Road traffic, and
- Air traffic and airport activities.

6.7.3.2.1 Polluting activities at an airport

6.7.3.2.1.1 Aircrafts: daily activities

Final approach, taxi in, taxi out, take-off and climb-out are the main polluting phases. The use of APU before the start-up and aircraft refuelling also contribute to air pollution.

6.7.3.2.1.2 Aircrafts: one-off activities

Aircraft, service vehicles and buildings are cleaned regularly and are subject to maintenance operations emitting air pollutants.

6.7.3.2.1.3 Stationary sources

Various sources related to the operation of the airport can produce pollution: fuel storage, petrol station, power plant, auxiliary generators.

6.7.3.2.1.4 Mobile sources

Road traffic in connection with passenger and cargo transportation emits air pollutants. Airport activities also require the use of special equipment, such as pushback tractors, and various service vehicles. The use of GPUs is to be noted.

As road traffic is considered low near Plaine Corail Airport, ambient air quality is assessed by considering only airport traffic, which is preponderant over the other sources of pollution.

Indeed, the results of studies, particularly at Toulouse Blagnac airport in France, show that aircraft emissions are significantly higher than other sources (ACNUSA, *Rapport de synthèse des travaux du groupe de travail sur les activités aéroportuaires et la gestion de la qualité de l'air,* July 2016).

6.7.3.3 Air quality measurement campaign

6.7.3.3.1 Measurement protocol

6.7.3.3.1.1 Location

Four sites representative of the site's environment were selected for measurements. They are located on the following map.

Figure 160 Air quality measurements location

6.7.3.3.1.2 Typology

Two different types of measurements were performed:

- Active measures
- These measurements were carried out using a continuous "Ecomsmart" device to analyze in real time the concentrations of PM10, PM2.5, CO, Ozone and NO2, each measure lasting 24 hours.
- The analyzer was placed near the homes affected by aircraft overflights on a larger perimeter around the airport. The device allows the concentration of the above-mentioned pollutants to be recorded every minute. The equipment is CE class B and FCC class A certified.
- The EcomSmart was moved every day to obtain a dynamic result in each of the 4 fixed points.
- Measure 1 Pointe Palmiste: from 28/09/19 to 29/09/19
- Measure 2 Plaine Corail: from 27/09/19 to 28/09/19
- Measure 3 Ecole des Canetons: from 25/09/19 to 26/09/19
- Measure 4 Plaine Caverne: from 26/09/19 to 27/09/19
- A first measurement was carried out from 24/09 to 25/09 at point 1 but a power failure did not allow Ecomsmart to operate, so the measurement was repeated from 28/09 to 29/09.
- Concerning measuring point 2 at Le Caneton school, the measurement stopped at around 4pm, probably due to a power failure.
- Passive measures
- The dynamic measurement was completed by passive tube measurements at each of the 4 measurement points over a 5-day period, from 24/09/19 to 29/09/19. Benzene and nitrogen dioxide were measured by Radiello tube and analyzed by the TERA Environnement laboratory.

6.7.3.3.1.3 Wheather conditions

Weather conditions were recorded at the airport station.

Table 67: Meteorological Data , Plaine Corail

Weather conditions	Day				
	24/09/2019	25/09/2019	26/09/2019	27/09/2019	28/09/2019
Wind speed m/s (2m high)	5,1	4,7	4,6	5,0	4,4
Temperature °C	23,4	23,9	24,8	23,7	24,3
Rainfall mm	0,8	3,3	0,0	0,1	0,0
Nebulosity octas	5,2 / 8	3,8 / 8	3,6 / 8	5,8 / 8	3,2 / 8
Humidity %	85,8%	84,9%	83,8%	85,3%	76,6%

6.7.3.3.1.4 Aircraft overflights

The table below shows the aircraft movements recorded during the air quality measurement campaign. All aircraft are Air Mauritius ATR-72.

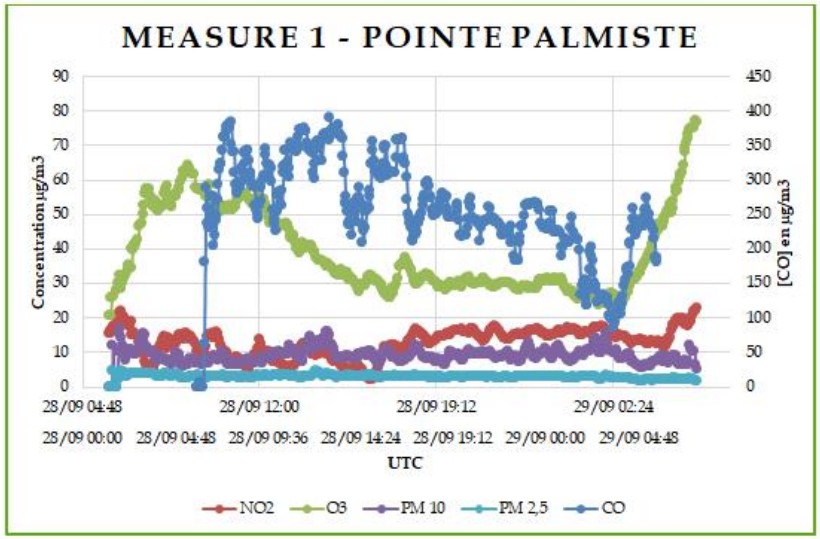
Table 68: aircraft movements recorded during the air quality measurement

Aircraft movement at Plaine Corail Airport for the period 24- 28 September 2019

SN	DATE	23-Sep-19	24-Sep-19	25-Sep-19	26-Sep-19	27-Sep-19	28-Sep-19
1	**MK 120**						
	Arrival	10:06 hrs	10.15 hrs	10.19 hrs	10.14 hrs	10:12	10:16
	Departure	10:50 hrs	10.55 hrs	10.53 hrs	10.54 hrs	10:38	10:45
2	**MK 126/7**						
	Arrival	13.06 hrs	no flight	no flight	no flight	13:30	no flight
	Departure	13.51 hrs				14:02	
3	**MK 130/1**						
	Arrival	14:31 hrs	14.49 hrs	14.40 hrs	14:59	14:36	14:26
	Departure	15.12 hrs	15.28 hrs	15.10 hrs	15:39	15:07	15:15
4	**MK 140/1**						
	Arrival	19.00 hrs	19.11 hrs	19.07 hrs	18:56	18:55	19:13
	Departure	19.32 hrs	19.38 hrs	19.32 hrs	19:25	19:29	19:50

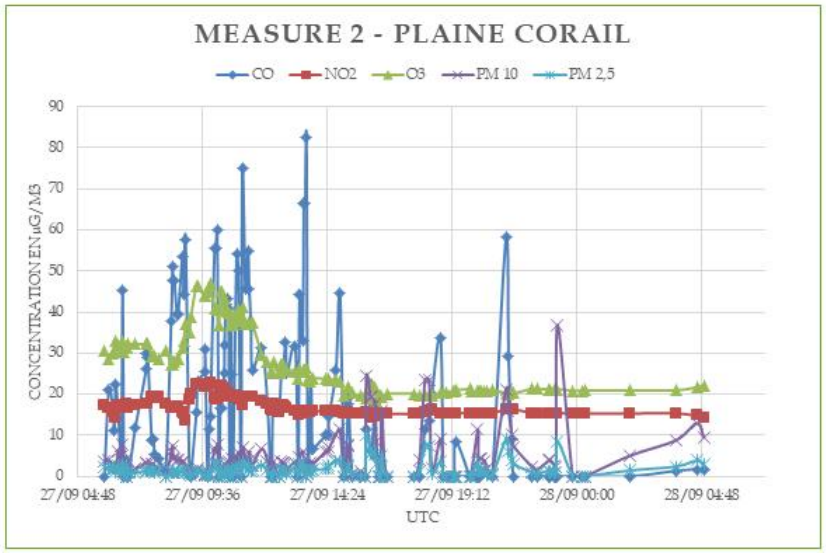
6.7.3.3.2 Results

MEASURE 1 – POINTE PALMISTE
28/09/2019 to 29/09/2019



Measure 1 – Pointe palmiste – 28/09/19 to 29/09/19				
1-hour average	**CO** µg/m³	**NO_2** µg/m³	**O_3** µg/m³	**PM 10** µg/m³
10h-11h	150,17	17,61	31,29	8,08
11h-12h	343,79	8,43	51,73	10,83
12h-13h	309,38	13,34	56,10	7,59
13h-14h	284,12	12,88	59,50	6,99
14h-15h	305,25	11,32	51,68	8,09
15h-16h	356,12	7,37	54,50	7,08
16h-17h	352,21	8,86	49,68	8,68
17-18h	320,23	8,25	42,75	9,71
18h-19h	256,09	9,69	37,06	12,99
19h-20h	320,77	5,92	32,11	8,66
20h-21h	323,50	4,02	30,31	8,82
21h-22h	249,00	10,80	29,95	8,70
22h-23h	264,53	14,15	32,40	9,41
23h-00h	236,36	14,48	29,49	8,10
00h-01h	243,15	15,96	30,19	9,07
01h-02h	237,22	15,28	29,89	9,08
02h-03h	213,64	14,74	29,02	8,94
03h-04h	256,49	15,65	29,91	9,47
04h-05h	227,97	16,03	29,20	9,26
05h-06h	206,89	16,10	25,78	10,69
06h-07h	150,19	15,21	25,54	10,38
07h-08h	112,38	13,02	33,26	6,84
08h-09h	201,78	13,55	48,05	8,00
09h-10h	231,34	19,53	68,27	7,52
8-hour average	**CO** µg/m³	**NO_2** µg/m³	**O_3** µg/m³	**PM 10** µg/m³
8h	302,66	11,01	49,65	8,38
8h	266,33	11,29	31,43	9,35
8h	200,08	15,48	36,13	8,89
24-hour average	**CO** µg/m³	**NO_2** µg/m³	**O_3** µg/m³	**PM 10** µg/m³
	256,6	12,5	38,9	8,7

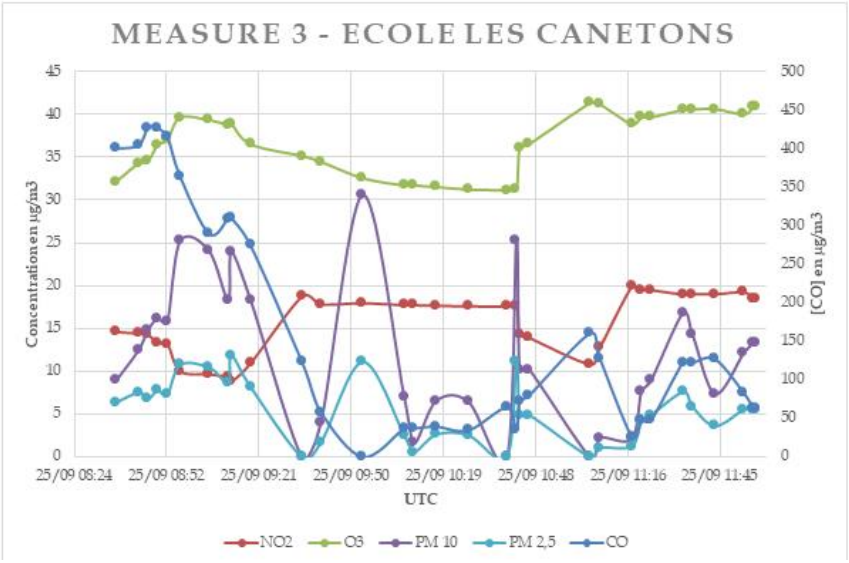
MEASURE 2 – PLAINE CORAIL
27/09/2019 to 28/09/2019



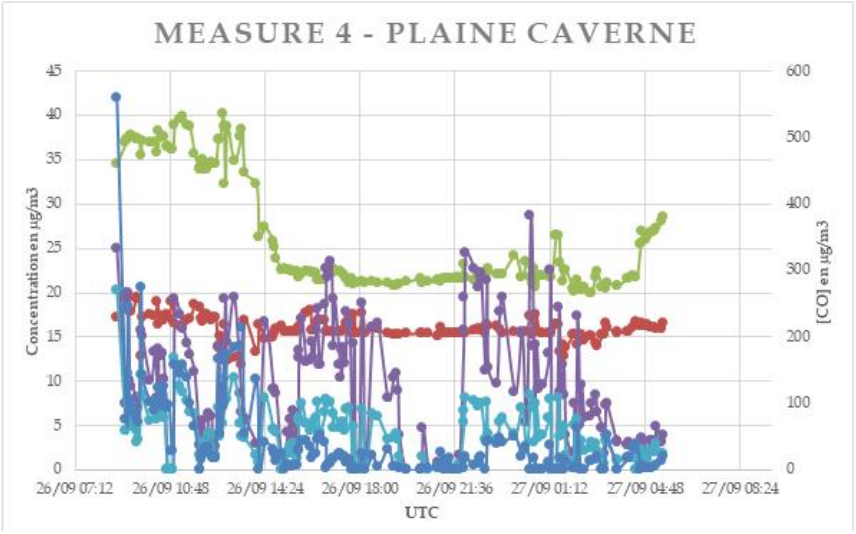
Measure 2 – Plaine Corail – 27/09/19 to 28/09/19				
1-hour average	**CO** µg/m³	**NO_2** µg/m³	**O_3** µg/m³	**PM 10** µg/m³
10h-11h	13,0	16,6	31,2	3,1
11h-12h	15,5	18,4	30,7	2,6
12h-13h	42,1	16,2	29,9	3,9
13h-14h	13,5	21,6	43,7	0,9
14h-15h	33,0	19,9	40,2	3,1
15h-16h	39,3	19,0	36,9	4,1
16h-17h	18,6	16,9	26,5	2,2
17h-18h	33,2	15,7	24,9	2,7
18h-19h	21,1	15,8	23,5	8,1
19h-20h	6,9	15,3	20,3	5,9
20h-21h	5,0	15,0	20,4	8,4
21h-22h	0,0	15,1	19,8	1,9
22h-23h	7,9	15,5	20,4	5,2
23h-00h				
00h-01h	0,4	15,3	20,8	4,3
01h-02h	24,1	16,4	20,2	13,5
02h-03h	0,0	15,4	21,2	2,9
03h-04h	0,0	15,3	21,1	10,5
04h-05h	0,0	15,3	20,9	0,0
05h-06h	0,0	15,3	20,9	5,0
06h-07h				
07h-08h	1,3	15,3	21,0	8,8
08h-09h	1,7	14,6	22,0	11,3
8-hour average	**CO** µg/m³	**NO_2** µg/m³	**O_3** µg/m³	**PM 10** µg/m³
8h	26,0	18,1	33,0	2,8
8h	9,4	15,5	20,8	6,8
8h	0,4	13,0	18,2	5,5
24-hour average	**CO** µg/m³	**NO_2** µg/m³	**O_3** µg/m³	**PM 10** µg/m³
	18,5	17,0	28,3	4,5

MEASURE 3 – ECOLE DES CANETONS
25/09/2019 to 26/09/2019

Measure 3 – Ecole des Canetons – 25/09/19 to 26/09/19				
1-hour average	**CO** µg/m³	**NO_2** µg/m³	**O_3** µg/m³	**PM 10** µg/m³
12h-13h	405,9	13,3	35,7	15,6
13h14h	194,8	13,3	36,5	17,0
14h-15h	50,0	16,7	32,6	8,4
15h-16h	90,0	17,8	40,3	8,9
24-hour average	**CO** µg/m³	**NO_2** µg/m³	**O_3** µg/m³	**PM 10** µg/m³
	162,2	15,7	36,7	11,8



MEASURE 4 – PLAINE CAVERNE
26/09/2019 to 27/09/2019



Measure 4 – Plaine Caverne – 26/09/19 to 27/09/19				
1-hour average	**CO µg/m³**	**NO_2 µg/m³**	**O_3 µg/m³**	**PM 10 µg/m³**
11h-12h	4233,6	15,1	37,4	362,4
12h-13h	4537,7	11,5	41,4	389,3
13h14h	140,5	18,2	37,1	11,8
14h-15h	96,8	17,6	37,0	8,4
15h-16h	86,5	17,3	37,2	11,0
16h-17h	65,1	15,8	35,6	7,8
17h-18h	159,2	13,6	36,1	10,1
18h-19h	40,4	15,1	26,8	8,0
19h-20h	20,3	16,2	22,3	7,7
20h-21h	27,0	16,2	22,0	16,5
21h-22h	12,5	15,9	21,7	10,8
22h-23h	12,2	16,2	21,1	12,8
23h-00h	7,8	15,3	20,9	7,0
00h-01h	2,0	15,3	21,3	1,3
01h-02h	6,1	15,5	21,7	3,1
02h-03h	19,8	15,8	22,0	19,5
03h-04h	44,2	15,8	22,5	14,0
04h-05h	8,2	15,9	21,9	12,6
05h-06h	7,9	14,9	23,4	8,7
06h-07h	11,5	14,9	20,5	7,1
07h-08h	18,4	15,4	20,9	4,9
08h-09h	13,3	16,2	24,1	2,3
10h-11h	8,3	16,1	27,4	3,6
8-hour average	**CO µg/m³**	**NO_2 µg/m³**	**O_3 µg/m³**	**PM 10 µg/m³**
8h	1170,0	15,5	36,1	101,1
8h	13,4	15,8	21,6	9,8
8h	16,0	15,6	23,0	7,6
24-hour average	**CO µg/m³**	**NO_2 µg/m³**	**O_3 µg/m³**	**PM 10 µg/m³**
	268,37	15,81	26,90	28,44

6.7.3.3.2.1 Analysis

- **Active measurements**

- CO
  - The regulatory values for CO concentrations are 25 mg/m^3 over 1 hour and 10 mg/m^3 over 8 hours.
  - CO concentrations are respected at all measurement points and are well below the threshold concentrations. There is a high concentration of CO in point 4 over a few hours, which may be due to a fire near the measurement point.

- PM10
  - The threshold value for PM10 is 100 µg/m^3 over 24 hours.
  - The daily concentrations at each point are well below this threshold concentration.

- Ozone
  - The regulatory value for ozone is 100 µg/m^3 over 1 hour.
  - None of the hourly values exceed 100µg/m^3 over 1h. Ozone concentrations therefore comply with regulatory thresholds. It should also be noted that graphically we can see the evolution of concentrations during the day with a peak concentration in the middle of the day. It should be remembered that ozone is a secondary pollutant formed by photochemical reaction, in particular from NO2.

- NO2
  - The regulatory value for NO2 is 200 µg/m^3 over 24 hours.
  - No measurement points exceed local requirements. Nitrogen dioxide concentrations measured on site are low.

No influence of the aircraft overflight could be observed on the dynamic measurement results. Indeed, no significant variation is observed on the results as they approach or leave. Thus, the low influx of aircraft is not currently noticeable on Rodrigues Island air quality.

- **Passive measurements**

PF 1

PF 2

PF 3

PF 4

Measure	Date	Location	NO_2	Benzène
PF1	24/09/2019 to 29/09/2019	Pointe Palmiste	0,73 µg/m³	0,84 µg/m³
PF2		Plaine Corail	1,40 µg/m³	1,16 µg/m3
PF3		Ecole les Canetons	0,77 µg/m³	1,17 µg/m³
PF4		Plaine Caverne	0,91 µg/m³	1,72 µg/m³

The NO2 concentrations measured by passive tubes are extremely low and are almost 10 times lower than the dynamic measurements. In both passive and active cases, nitrogen dioxide concentrations are extremely low, reflecting very good air quality.

Concerning the benzene concentration, the measures using radiello tubes are also very low. No exceedance of the regulatory thresholds was found on these measures.

It should be noted, however, that the passive tubes were exposed to fairly heavy weather conditions (short rains over time but abundant with a strong wind throughout the week). The tubes may have been "washed" by showers, resulting in extremely low concentrations.

6.7.3.3.2.2 Conclusion

Despite unfavourable conditions (wind, rain) and electrical incidents, the measures still allow positive conclusions to be drawn about air quality on Rodrigues Island. No measurements exceed regulatory thresholds wich apply to O3, CO, PM10, NO2 and Benzene.

The concentrations measured are very low, reflecting very good air quality on Rodrigues Island.

Concerning aircraft overflight, no influence is observed on concentrations for the current 4 daily overflights.

6.7.3.3.3 Emissions inventory

6.7.3.3.3.1 Definition

An emissions inventory is based on the theoretical calculation of the pollutants emitted into the atmosphere. A simplified method that helps to establish orders of magnitude of polluting emissions consists of calculating the product of the activity and the emission factors:

$$E(X) = \sum_{\text{type d' aéronef Y}} N(\text{cycle LTO})_{\text{aéronef Y}} * FE_X$$

- E (X), emissions of pollutant X (kg)
- N (cycle LTO) $_{\text{aeronef Y}}$, the number of LTO cycles for the aircraft type Y
- FE_X the emission factor, for the pollutant X, by LTO cycle.

This method is compliant with the French guide “Guide de calcul des émissions dues aux aéronefs” (DGAC - STAC, 2015).

It does not directly estimate the concentration of pollutants in the air, which requires a complex dispersion model, yet an emissions inventory is a useful tool for managing air quality and its impact, and for informing the public. Based on the results of an emissions inventory, the gain from an emissions reduction policy can be assessed, and air quality modelling tools (concentrations) can be fed.

6.7.3.3.3.2 Inputs

The calculations take into account the overall annual commercial aircraft traffic (year 2017) and the type of aircraft.

6.7.3.3.3.3 Study area and pollutants investigated

Calculations are based on a standard "Landing-Take-Off" (LTO) cycle per aircraft, as defined by OACI vol II, appendix 16. This cycle includes all aircraft operations from the ground to a height of 3000 feet, as only emissions below this height have a direct impact on local air quality.

Aircraft engine emissions are calculated from the emission factors established for the "ICAO" LTO cycle. An ICAO database lists fuel consumption and emission factors for the four phases of movement in the atmospheric layer between 0 and 3000 ft: taxi, take-off, cruise and approach. Each phase is associated with an engine speed and its duration (see table and image below).

Table 69: Duration and engine speed associated with the different phases of LTO cycle

Phases of the LTO cycle	Duration (minutes)	Engine speed (%)
Approach	4	30
Taxi	26	7
Takeoff	0,7	100
Climb-out	2,2	85

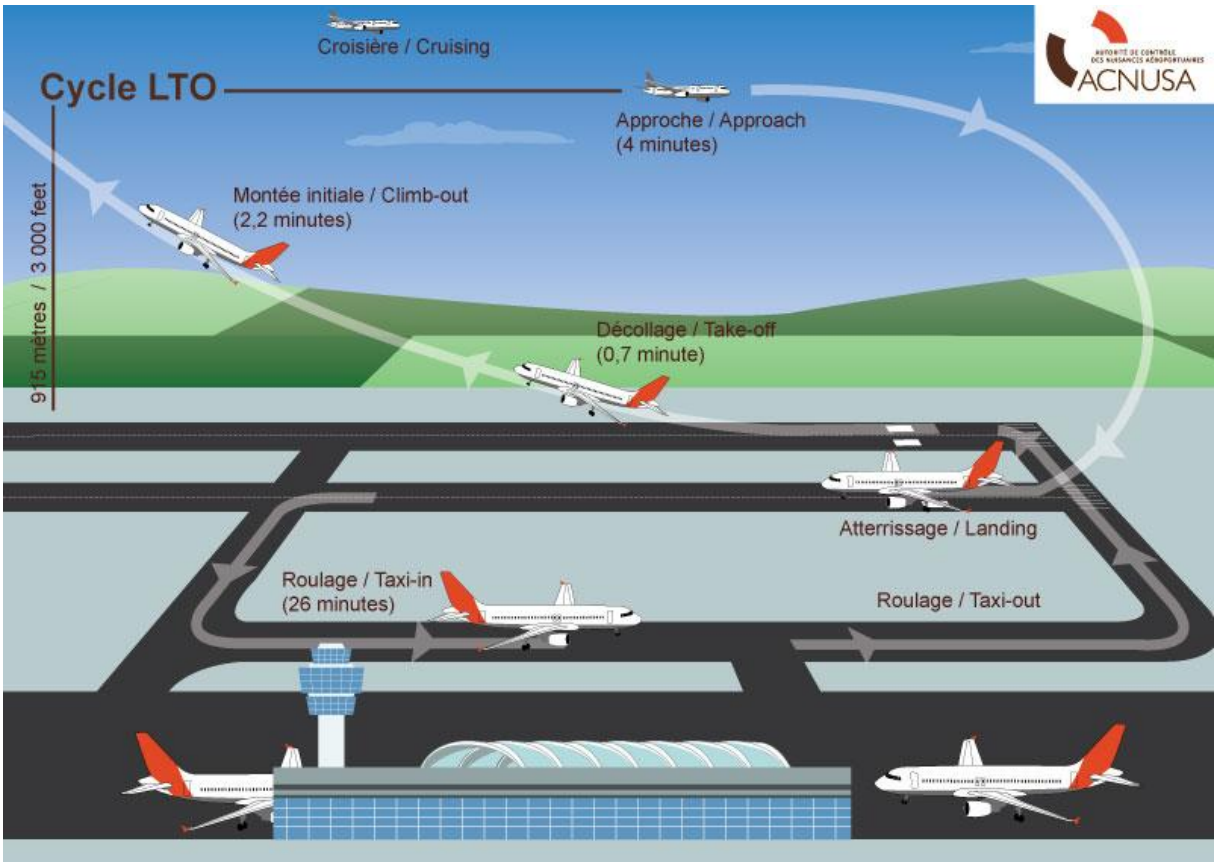


Figure 161: LTO cycle (Source: Acnusa)

The European Environment Agency (EEA) offers a tool called "Aviation LTO emissions calculator", which makes it possible to quantify pollutant emissions from aircraft, based on the standard LTO cycle.

Using this tool, calculations were made for Plaine Corail Airport, for emissions of nitrogen oxides, carbon monoxide, unburned hydrocarbons and also fuel consumption. Carbon dioxide emissions are calculated in order to assess the carbon footprint.

NMVOC will not be processed because their emissions are currently poorly known. Kerosene contains very few heavy metals, so they are not included in the calculations.

In regard to PM emissions, as the quantification of PM emitted by aviation has not been completed, it is not included in the study either. Indeed, in the absence of certified ICAO data, the available emission factors are based on obsolete studies (1997 and 2001) and insufficient in number to validate their results. Several working groups are underway, including the Particulate Matter Tasking Group, under the aegis of ICAO. Pending a better knowledge of PM emissions, it was decided not to carry out a calculation with too much inaccuracy.

The results of the current situation, based on the default LTO cycle (see Table 69Table 69: Duration and engine speed associated with the different phases of LTO cycle) expressed in kg per year, are presented in the following table.

Table 70: Gas emissions and fuel consumption per year

	CO emitted	**HC emitted**	**NOx emitted**	**SO_2 emitted**	**CO_2 emitted**	**Fuel consumption (kg/year)**
Emissions (kg/year)	3 777	470	2 950	324	1 005 020	324 200

Calculations take into account 1612 movements per year (traffic in 2017); these results will have to be compared with the forecast emission balances, taking into account the traffic linked to the new runway.

This baseline emissions inventory were supplemented by an air quality measurement campaign carried out by ARL in 2019 (see above).

The measurement campaign will be representative of the week in which it took place (including weather conditions and nomber of aircraft movements). By comparing the weather readings with the annual data, and the number of movements with the annual traffic, we will try to extrapolate the results to the average conditions of the whole year. However, this operation might not be reliable.

In the absence of a permanent air quality monitoring system, the assessment of the initial annual air quality requires to carry out measurement campaigns lasting several months, spread over the island's two seasons. ESIA's planning was not compatible with such a campaign, yet ARL could implement a monitoring program to this end.

6.7.3.3.4 Air quality issues

The air quality issue is due to the presence of sensitive populations living nearby and of the pre-primary school Le Caneton. The presence of agricultural parcels is also to be taken into account.

The aircraft traffic growth will lead to a significant increase in pollutant emissions; thus, the receptor sensitivity to the project is considered high.

6.7.4 Noise

6.7.4.1 General information about noise

Sound is a wave that travels through the air and makes it vibrate, from the sound source to the receiver: the ears. The vibration of air molecules causes a vibration of the eardrums, which results in an auditory sensation. Noise is used to describe the generally unpleasant perception associated with an unbalanced set of sounds.

A noise can be characterized by several objective criteria, such as level (or volume: low, high), frequency (or pitch: low, high) and duration of occurrence.

The usual scale for measuring noise is a logarithmic scale, which reflects the sensitivity of the human ear to pressure variations associated with the vibration of air molecules. Noise levels are thus expressed in decibels (dB). As low and high frequencies are not perceived in the same way by the human ear, a filter is applied to the decibel value to take this feature into account. This is referred to as "A" decibels, noted dB(A).

The diagram below shows some examples of sound levels associated with everyday noise and the associated auditory sensation.

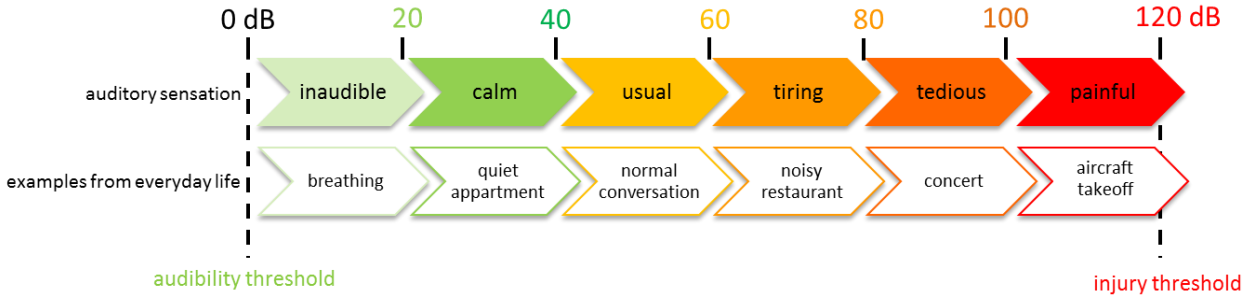


Figure 162: Diagram of sound levels

The propagation of noise in a given site depends on the conditions of the surrounding environment and in particular on the distance travelled, the ground effect (reflection or absorption of sound), the presence of obstacles and meteorology (temperature, wind, and/or humidity).

6.7.4.1.1 Noise indicators

*6.7.4.1.1.1 **LAeq:** equivalent sound pressure level (A-weighted)*

Noise is an essentially fluctuating phenomenon. It is the accumulation of sound energy received by an individual that is the most representative indicator of the effects of noise on humans.

This accumulation is reflected by the equivalent energy level noted LAeq. The LAeq is expressed in dB(A) and is defined as follows: "the equivalent LAeq level of a variable noise is equal to the level of a constant noise that would have been produced with the same energy as

the noise perceived during the same period. It represents the average acoustic energy perceived during the observation period".

The following diagram illustrates this definition.

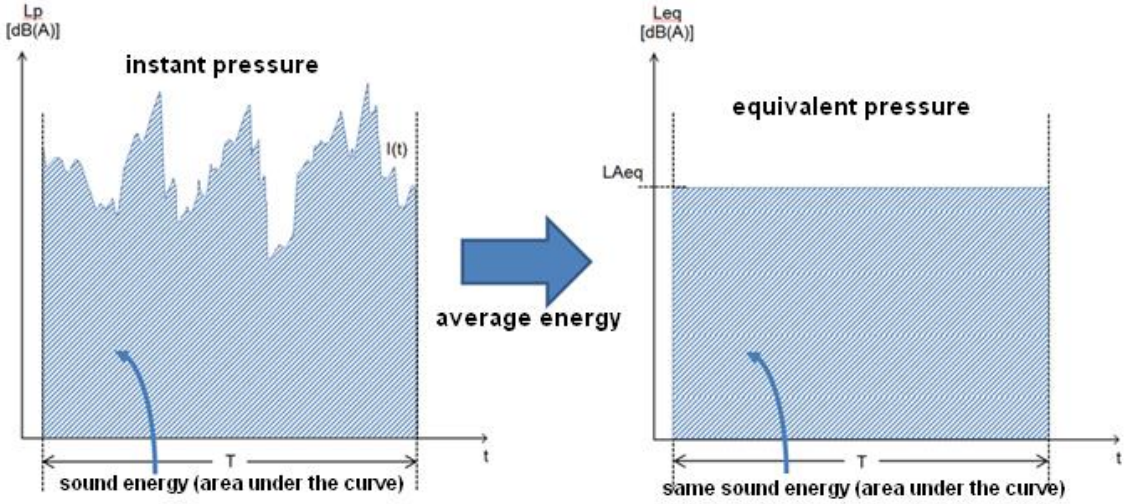


Figure 163: Illustration of the definition of the LAeq

*6.7.4.1.1.2 **DNL** "Day Night Level"*

This noise indicator is a LAeq noise level with a 10 dB weighting for the night-time period (22:00 to 7:00). This means a penalty of 10 dB is taken into account for noise caused by any aircraft movement at night (considered more annoying than during day-time).

*6.7.4.1.1.3 **Lden** "Level Day Evening Night"*

This noise indicator is a LAeq noise level with a 5 dB weighting for the evening period (18:00 to 22:00) and a 10 dB weighting for the night-time period (22:00 to 7:00). This means a penalty of 5 dB is taken into account for noise caused by any aircraft movement in the evening and 10 dB at night (movements during these periods are considered more annoying than during day-time).

6.7.4.1.2 Noise contours

A noise contour is a line on a map that represents equal levels of noise exposure. The contours for airport noise are usually shown in 5-decibel increments, for noise values from 50 to 75 and more.

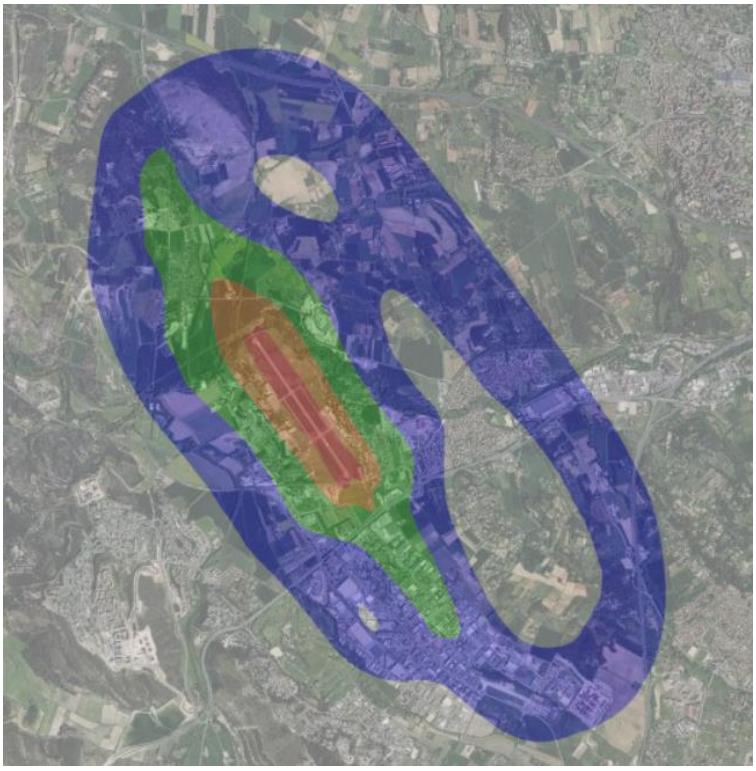


Figure 164: Example of noise contours – French aerodrome Aix Les Milles

6.7.4.2 Noise guidelines

The environmental noise standards in Rodrigues are described in the Environment Protection Act. The regulations are:

- Noise exposure limits to industrial noise

07.00 – 21.00 hrs 60 dB(A) LAeq

21.00 – 07.00 hrs 55 dB(A) LAeq

- Noise exposure limits to neighbourhood noise

07.00 – 18.00 hrs 60 dB(A) LAeq

18.00 – 21.00 hrs 55 dB(A) LAeq

21.00 – 07.00 hrs 50 dB(A) LAeq

No specific regulation applies to airport noise.

In the “Environmental noise guidelines for the European Region”, published in 2018, the Wold Health Organisation (WHO) recommends limiting the exposure value to airborne noise to Lden 45 dB (40 dB for night-time noise), in order to avoid health impacts.

6.7.4.3 Ambient noise around Plaine Corail Airport

Noise sources around Plaine Corail Airport are mainly:

- Road traffic,
- Air traffic, and
- Airport activities.

As the local road network is sparsely used, except to serve the airport and the houses nearby, the ambient noise is mostly due to the activity of Plaine Corail Airport: aircraft movements, ground support vehicles and heavy vehicles used to transport goods and supplies.

6.7.4.4 Noise measurements campaign

6.7.4.4.1 Measurement protocol

The acoustic measurement campaign was carried out from 24/09/2019 to 29/09/2019.

6.7.4.4.1.1 Location

In total, 4 long-term measurements over 5 days points were distributed over the study area. They are located on the map shown below (see § results).

6.7.4.4.1.2 Typology

The measurements include a weekend during which air traffic could have been be higher (in practice there were systematically 4 aircraft per day).

The positions of the measurement points were defined from the 4 existing residential areas to the east, north and west of the airport. These are the most immediate sectors on which the project can potentially have an impact.

Noise measurements were performed with Class 1 equipment in accordance with French standard NFS 31-009 for precision sound level meters. Each measuring instrument was equipped with a rainproof kit and large windproof equipment to limit its effects.

These measurements are used to define the regulatory indices LAeq (07.00 – 18.00 hrs), LAeq (18.00 – 21.00 hrs) and LAeq (21.00 – 07.00 hrs).

6.7.4.4.1.3 Weather conditions

Weather conditions were recorded at the airport station.

Table 71: Meteorological Data at Plaine Corail

Weather conditions	Day				
	24/09/2019	25/09/2019	26/09/2019	27/09/2019	28/09/2019
Wind speed m/s (2m high)	5,1	4,7	4,6	5,0	4,4
Temperature °C	23,4	23,9	24,8	23,7	24,3
Rainfall mm	0,8	3,3	0,0	0,1	0,0
Nebulosity octas	5,2 / 8	3,8 / 8	3,6 / 8	5,8 / 8	3,2 / 8
Humidity %	85,8%	84,9%	83,8%	85,3%	76,6%

These results can be interpreted as follows.

Weather conditions	Day				
	24/09/2019	25/09/2019	26/09/2019	27/09/2019	28/09/2019
Wind speed m/s (2m high)	Vent fort	Vent fort	Vent fort	Vent fort	Vent fort
Wind direction	East	East	East	East	East
Temperature °C	from 21,9 to 24,5°	From 22,6 to 25,7°	from 23,2 to 27,0°	from 22,2 to 26,1°	from 22,4 to 26,5°
Rainfall mm	Very low	Low	None	None	None
Nebulosity octas	Cloudy	Covered weather	Covered weather	Cloudy	Covered weather
Humidity %	High	High	High	High	High

Day 1: The weather conditions were very windy and humid throughout the day, the measurement was disrupted.

Day 2: The weather conditions were very windy throughout the day and at times accompanied by showers, the measurement was very disturbed.

Day 3: Weather conditions were more stable, there was much less wind and the sky was clear, the weather impact was moderate.

Day 4: The weather conditions were very windy and the sky was clear, the measurement was very disturbed by the wind.

Day 5: The weather conditions were very windy and the sky was clear, the measurement was very disturbed by the wind.

In this area, conditions contributed to a slight decrease in measured noise levels.

It is always difficult when taking noise measurements in a windy place to ensure the validity of the measured data. Therefore, the microphones have been positioned close to the facades or roof in order to avoid the effects of gusts which could disrupt measurements.

A marked rainfall during the first 2 days is to be noted.

6.7.4.4.1.4 Aircraft overflights

The table below shows the aircraft movements recorded during the air quality measurement campaign. All aircraft are Air Mauritius ATR-72.

Table 72: aircraft movements recorded during the air quality measurement

Aircraft movement at Plaine Corail Airport for the period 24- 28 September 2019

SN	DATE	23-Sep-19	24-Sep-19	25-Sep-19	26-Sep-19	27-Sep-19	28-Sep-19
1	MK 120						
	Arrival	10:06 hrs	10.15 hrs	10.19 hrs	10.14 hrs	10:12	10:16
	Departure	10:50 hrs	10.55 hrs	10.53 hrs	10.54 hrs	10:38	10:45
2	MK 126/7						
	Arrival	13.06 hrs	no flight	no flight	no flight	13:30	no flight
	Departure	13.51 hrs				14:02	
3	MK 130/1						
	Arrival	14:31 hrs	14.49 hrs	14.40 hrs	14:59	14:36	14:26
	Departure	15.12 hrs	15.28 hrs	15.10 hrs	15:39	15:07	15:15
4	MK 140/1						
	Arrival	19.00 hrs	19.11 hrs	19.07 hrs	18:56	18:55	19:13
	Departure	19.32 hrs	19.38 hrs	19.32 hrs	19:25	19:29	19:50

6.7.4.4.2 Results

The table and map below show the overall noise levels measured by regulatory period.

Note: the 4 aircraft per day are divided into 3 of them over the period 07h00-18h00, only one over the period 18h00-21h00 and none during the night. The planes systematically land and take off in front of the wind, either on Rodrigues Island, from west to east.

Each measurement was treated separately in order to highlight the contribution of each aircraft to the overall level measured. This contribution is not always detectable depending on the specific environment at each point: ambient noise, wind gust, rain....

Table 73: overall noise levels measured

Measure	Date	Location	LAeq 7h-18h dB(A)	LAeq 18h-21h dB(A)	LAeq 21h-07h en dB(A)
PF1	from 24/09/2019 to 28/09/2019	Pointe Palmiste, Île Rodrigues	59.5	55.0	50.5
PF2	from 24/09/2019 to 28/09/2019	Plaine Corail, Île Rodrigues	55.5	53.0	50.0
PF3	from 24/09/2019 to 28/09/2019	Ecole les Canetons, Île Rodrigues	66.0	47.0	45.5
PF4	from 24/09/2019 to 28/09/2019	Plaine Caverne, Île Rodrigues	56.0	55.5	50.5

Figure 165 Noise measurements - location and results

6.7.4.4.2.1 Analysis

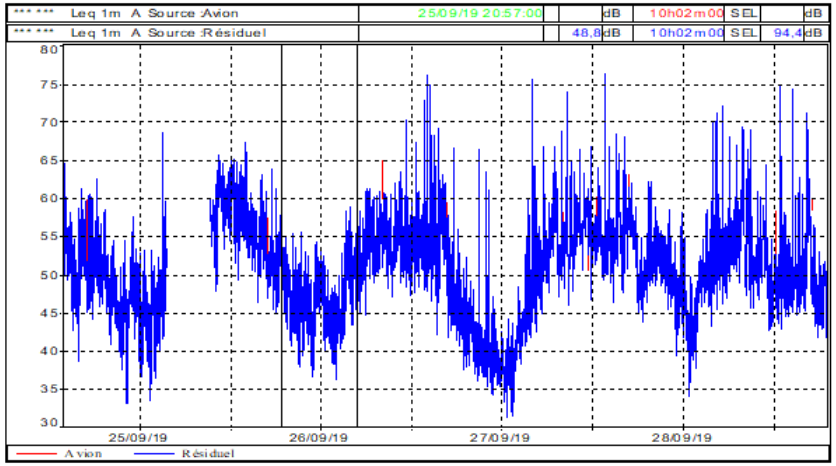
The detailed results of the noise measurements are shown below :

- The measured noise levels (LAeq and L50);
- The location (Name, Address, Location...) ;
- The noise level;
- A photo showing the position of the microphone on the front panel;
- A photo showing the vision from the microphone;
- The equipment used;
- The temporal evolution of the recorded signal;
- The main and secondary noise sources recorded;
- The impact of meteorology.

PF1

Pictures & location

Temporal evolution



Details

Measure	PF1
Date et duration	From 24/09/2019 to 29/09/2019 (5 days)
Name & adress	M. Allas - Pointe Palmiste - Île Rodrigues
Device	Svan 971 – Svantek
Height	ground floor
Main noise source	Wind
Secondary noise source	Environnment & household
Distance to airport	#1800m
Disturbance	Punctually wind & rain

Comments

The measurement was disrupted by weather conditions during part of the recording. Despite these disruptions, we tried to detect the landing peaks (western area of the airport) on the time evolution below. The presence of aircraft is not really noticeable at this measurement point. The red coding on the signal corresponds to the theoretical coding of aerial overflights. This makes it possible to establish the contribution of aerial overflights to the measured noise levels. Note: on the first day the measurement was interrupted due to a power failure

Conclusion

PF1	LAeq 7h-18h dB(A)*	LAeq 18h-21h dB(A)*	LAeq 21h-07h dB(A)*
Regulatory threshold	60.0	55.0	50.0
Aerial overflight contribution	33.5	37.0	0.0

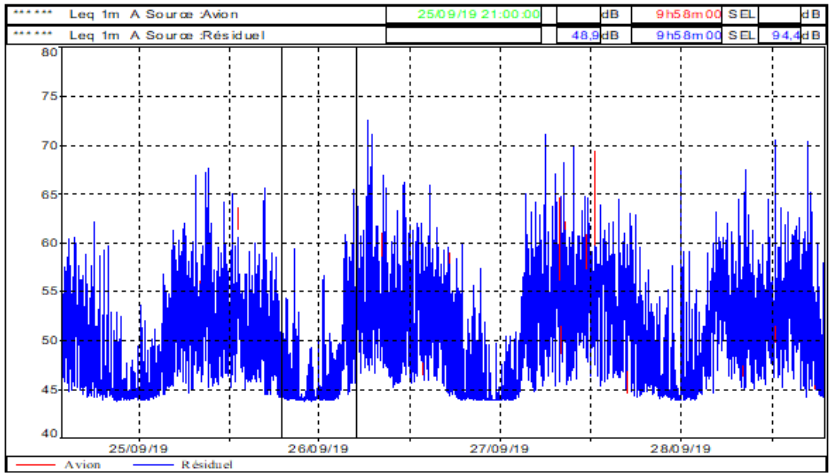
(*) rounded to the nearest 0.5 dB(A)

In conclusion, despite the disturbances due to climatic contingencies, the measured levels are below the regulatory acceptable thresholds (more than 25 dB(A) below the thresholds during the day and in the evening).

PF2

Pictures & location

Temporal evolution



Details

Measure	PF2
Date et duration	From 24/09/2019 to 29/09/2019 (5 days)
Name & adress	Mr. Prudence - Plaine Corail - Île Rodrigues
Device	Svan 971 – Svantek
Height	Ground floor
Main noise source	Noise
Secondary noise source	Plaine Corail road
Distance to airport	#1200m
Disturbance	Punctually wind & rain

Comments

The measurement was disrupted by weather conditions during part of the recording. Despite these disruptions, we tried to detect landing or take-off peaks (area north of the airport) on the time evolution shown opposite. The presence of aircraft is not really noticeable at this measurement point. The red coding on the signal corresponds to the theoretical coding of aerial overflights. The latter makes it possible to establish the contribution of aerial overflights to the measured noise levels.

Note: The presence of the airport road in front of this measurement point is noted.

Conclusion

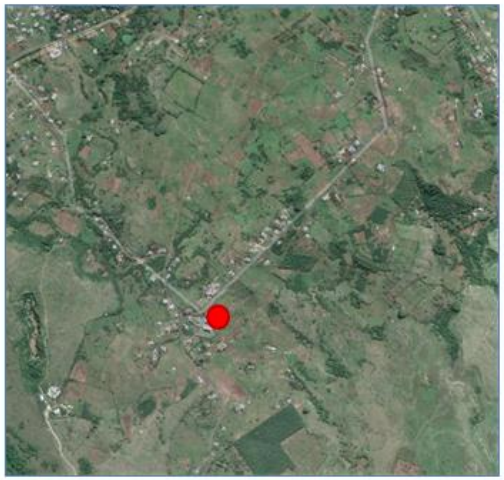
PF2	LAeq 7h-18h dB(A)*	LAeq 18h-21h dB(A)*	LAeq 21h-07h dB(A)*
Regulatory threshold	60.0	55.0	50.0
Aerial overflight contribution	39.5	34.5	0.0

(*) rounded to the nearest 0.5 dB(A)

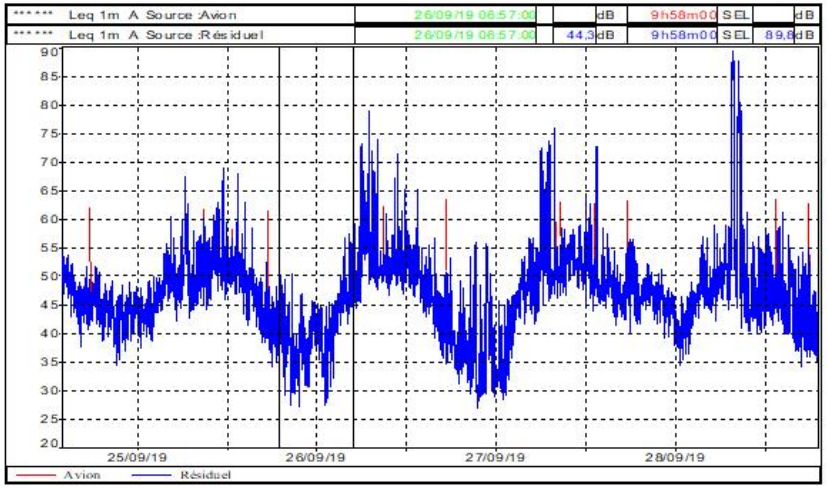
In conclusion, despite the disturbances due to climatic contingencies, the measured levels are below the regulatory acceptable thresholds (more than 20 dB(A) below the thresholds during the day and in the evening).

PF3

Pictures & location



Temporal evolution



Details

Measure	PF3
Date et duration	From 24/09/2019 to 29/09/2019 (5 days)
Name & adress	Pre prmary school les Canetons
Device	Svan 971 – Svantek
Height	Ground floor
Main noise source	School and weather conditions
Secondary noise source	Cutting of a tree with a chainsaw
Distance to airport	#1000m
Disturbance	Punctually wind, rain, children…

Comments

The measurement was disrupted by school recess periods, weather conditions during part of the recording and by brushing (very noisy - see peaks opposite) of the school garden. Despite these disruptions, we detect many takeoff peaks (area east of the airport) on the time evolution opposite. The presence of aircraft is perceptible at this measurement point. The red code on the signal corresponds to the code for aerial overflights. The latter makes it possible to establish the contribution of aerial overflights to the measured noise levels.

Conclusion

PF3	LAeq 7h-18h dB(A)*	LAeq 18h-21h dB(A)*	LAeq 21h-07h dB(A)*
Regulatory threshold	60.0	55.0	50.0
Aerial overflight contribution	36.0	39.0	0.0

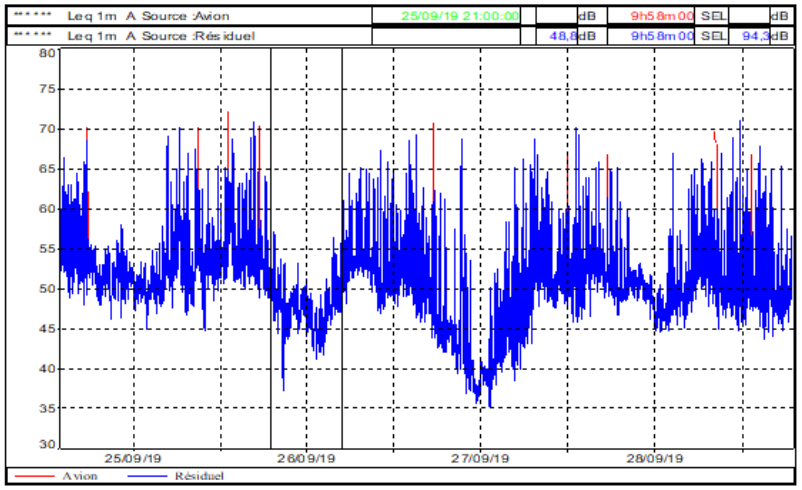
(*) rounded to the nearest 0.5 dB(A)

In conclusion, despite the disturbances due to climatic contingencies, the measured levels are below the regulatory acceptable thresholds (nearly 25 dB(A) below the thresholds during the day and only 15 in the evening because of parasitic noise).

PF4

Pictures & location

Temporal evolution



Details

Measure	PF4
Date et duration	From 24/09/2019 to 28/09/2019 (5 days)
Name & adress	Mrs Larcher - Plaine Caverne - Île Rodrigues
Device	Svan 971 – Svantek
Height	Ground floor
Main noise source	Road
Secondary noise source	Environnment (noise from humain activities)
Distance to airport	#900m
Disturbance	Punctually rain, noise, children...

Results

The measurement was disrupted by weather conditions during part of the recording. Despite these disruptions, we detected the takeoff peaks (area east of the airport) on the time evolution shown opposite. The presence of aircraft is perceptible at this measurement point. The red code on the signal corresponds to the code for aerial overflights. The latter makes it possible to establish the contribution of aerial overflights to the measured noise levels.

Conclusion

PF4	LAeq 7h-18h dB(A)*	LAeq 18h-21h dB(A)*	LAeq 21h-07h dB(A)*
Regulatory threshold	60.0	55.0	50.0
Aerial overflight contribution	42.0	46.0	0.0

(*) rounded to the nearest 0.5 dB(A)

In conclusion, despite the disturbances due to climatic contingencies, the measured levels are below the regulatory thresholds (just under 20 dB(A) below the thresholds).

6.7.4.4.2.2 Conclusion

The noise measurements present the pre-existing sound environment. In each of the sectors studied, there is a strong impact of the elements (rain & wind) on the "sound" feeling of the site as well as significant human activity.

The measurements highlight more clearly a greater impact due to aircraft take-offs (on the west side of the airport) while landings are less noticeable to the east of the site (the proximity of the building to the airport in the west also explains this perception).

However, the measurements show that the permissible thresholds for neighbourhood noise are not exceeded by considering the contribution of airport flights alone: overall, air traffic generates noise levels that are nearly 20 dB(A) lower than the permissible thresholds during the day and evening (not at night when there is no overflight).

6.7.4.5 Aircraft noise emissions

The baseline noise levels in the area are assessed with a calculation tool compliant with ICAO recommendations (the Integrated Noise Model software, 7.0d). The calculations take into account:

- Aircraft movements,
- Aircraft types,
- Flight paths,
- Runway alignment, and
- Annual average weather conditions.

Other noise sources from airport activities are assumed to be limited compared to aircraft noise.

The resulting noise contours around the airport are represented on the map below indicating the presence of population; thus, this map illustrates the exposure of populations to current aircraft noise. The scale representing sound levels range from Lden 45 dB(A) (very low noise exposure) to 85 dB(A) (very high noise exposure). The noise indicator Lden, used in European noise directives and French noise expoisure plans, has been chosen because it takes into account the nuisances felt during evening and night periods.

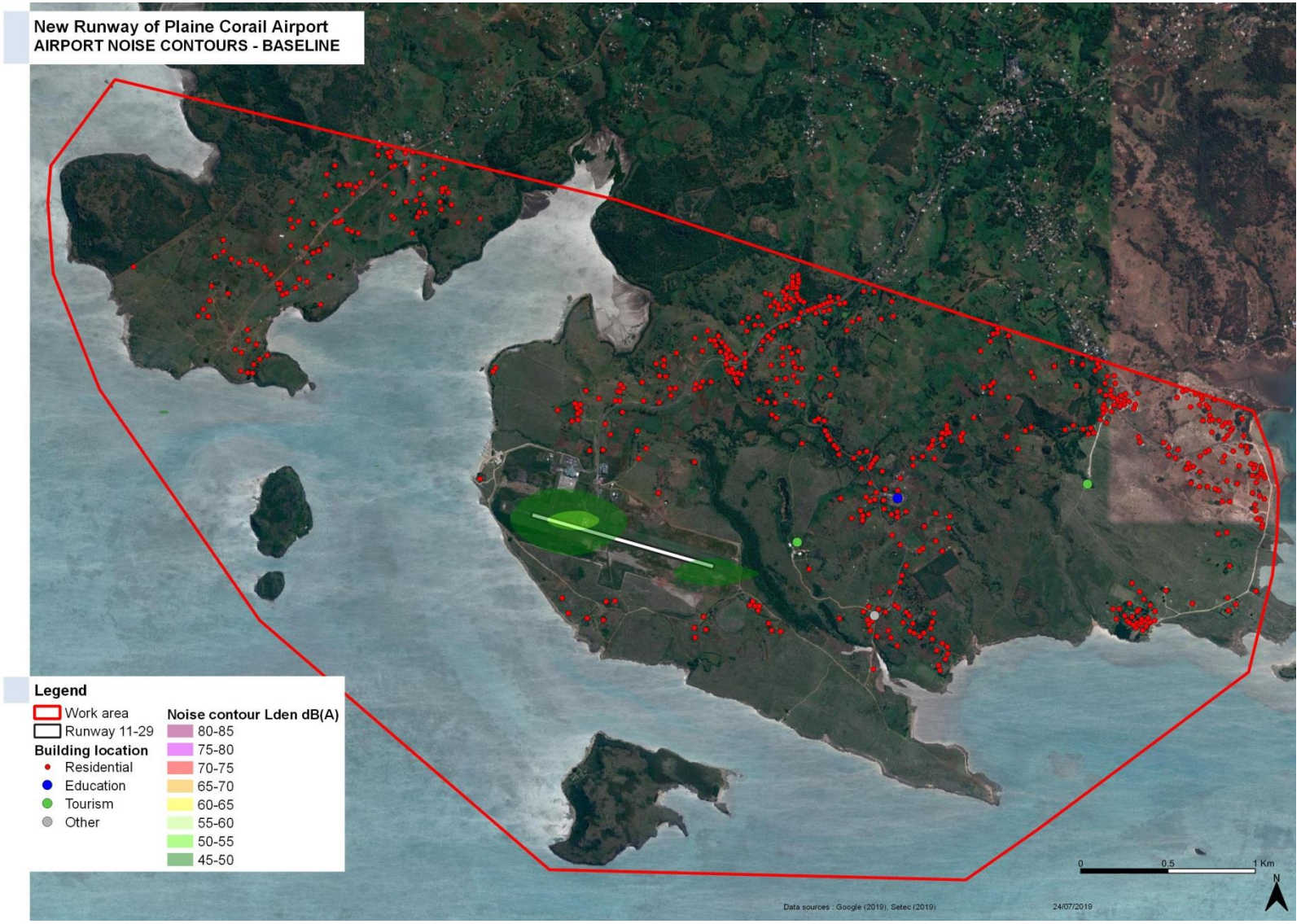


Figure 166: Airport noise contours

As few airplanes land on Plaine Corail Airport, and they are quite quiet, the noise curves are small. No dwelling or noise-sensitive building has been identified in the footprint of the lowest noise curves that define noise exposure down to 45 dB. This confirms that populations are currently almost not exposed to airport noise.

6.7.4.6 Issues

The noise issue is due to the presence of sensitive populations living nearby and of the pre-primary school Le Caneton.

The aircraft traffic growth will lead to a significant increase in noise; **thus, the receptor sensitivity to the project is considered high**.

6.7.5 Summary: air and noise sensitivity

The area around the airport is sparsely populated, yet it should be noted that a school is located to the east of the airport and requires special attention. In the south of the island, ambient air quality and sound environment are directly linked to the airport's activities.

The commissioning of an additional runway will increase noise and pollutant emissions from the airport platform; the impact of the project will be assessed by comparing the noise curves and pollutant quantities calculated for the baseline.

Table 74: air and noise sensitivity

Theme	Sub-theme	Receptor	Sensitivity
Air quality and noise	Air quality	Population exposed	High
	Noise	Population exposed	High

6.8 Heritage resources and visual environment

The purpose of this chapter is to identify elements of historical heritage, cultural heritage, but also places of worship or of a religious nature.

The presence or potential presence of archaeological remains and the palaeontological richness of the site are assessed.

Finally, the landscape characteristics of the site are described.

This baseline will provide a basis for assessing the impacts of the project, including building demolitions, land use changes, earthwork and general changes in topography.

6.8.1 Area of influence

The relevant area of influence is the restricted area, except for the visual environment, which is addressed on the large area level.

6.8.2 Cultural heritage resources

The island's interest lies mainly in the environmental heritage it possesses, constituted by its landscapes, beaches, caves, or by the different species of fauna and flora.

The **National Heritage Fund (NHF)** is mandated to identify, protect, manage and promote the Mauritius National heritage and so to develop a sense of belongingness in all Mauritians by caring for the past and bequeathing it to the future.

The Republic of Mauritius ratified the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Convention on the Safeguarding of Intangible Cultural Heritage on June 4th 2004. The Convention's General Provisions acknowledges "the importance of intangible cultural heritage as a mainspring of cultural diversity and a guarantee of sustainable development" and yet observes that globalisation and other detrimental forces are a grave threat to the future of this unique kind of heritage.

To honour this commitment and endeavour the safeguarding of intangible cultural heritage, Mauritius has undertaken several measures to research, inventory and document its intangible heritage. In June 2010, the Government of Mauritius designated the National Heritage Fund as a National Repository of Intangible Cultural Heritage. The National Heritage Fund has undertaken an inventory of intangible cultural heritage. In 2013, the Traditional Mauritian Sega and Bhojpuri Geet-Gawai files were sent to UNESCO for possible inscription on the UNESCO Representative List of Intangible Cultural Heritage of Humanity. In 2014, the Traditional Mauritian Sega was inscribed on the UNESCO Representative List of Intangible Cultural Heritage of Humanity.

There are also six National Heritage Sites in Rodrigues, none of which are located within the project area of influence

- Cannon (Pointe Canon),
- Ex-Administration Block (Port Mathurin),
- Garde Post (Mont Venus),
- Ben Gontron House (Barclay Street, Port Mathurin),
- Lieu de Mémoire, L'Union, Rodrigues, and
- Residency Buildings (Port Mathurin)

6.8.2.1 Information collected during the field interviews

Interviews carried out throughout the project's area of social influence have systematically integrated questions on the presence and possible nature of cultural heritage sites in the direct impact area (Bangélique, Sainte Marie Hill, Corail Point). Not having obtained information in relation to this type of heritage, no documentation and geo-referencing of the sites could be applied.

In no case, neither during the interviews nor during the visits carried out in the company of the inhabitants, was the presence or the possible nature of cultural heritage sites mentioned in the direct impact zone (Bangélique, Sainte Marie Hill, Pointe coral). In the discussions, interesting suggestions were made by some inhabitants of Sainte Marie, in relation to the attendance of caves and other natural places particularly conducive to meditation and spiritual activities. None of these places are located in the project area, and the project will not prevent access in any way.

It is thus possible to conclude that the area does not present any type of site or material object associated with any identity, religious, historical value collectively recognized as structuring the local society.

6.8.3 Archaeology and palaeontology

In the restricted area, several sites have been identified as having a paleontological interest.

Indeed, the underground hydrographic network has formed karst structures like cracks and caves throughout Plaine Corail.

These Karst formations in Plaine Corail are ancient (up to 500,000 years) and are particularly interesting under the point of view of sedimentology and fossil conservation.

The Grotte Fougère cave contains more than 3000 years of sediment filled with a lot of fossils in an excellent state of conservation. This cave is in a direct alignment with the new runway route. These sediments probably contain an important heritage: the DNA from extirpated species. So, the Grotte Fougère must be considered as an important site which has to be protected. A little further to the north, there are other interesting cavities, which are important for the paleoclimate study, especially climatic variations in the Indian Ocean between 6000 and 3000 years BC. This includes Grotte Gastonia, the hydrological system of which is potentially vulnerable, or Grotte Cabris, which is threatened by its proximity to the new runway.

These formations also contain fossils and concretions (stalactites/stalagmites).

6.8.4 Landscape and visual environment

The role of landscape is to understand the dialogue which exists between man and nature. A reading of the landscape of this territory was made and has been translated into a social interpretation of nature.

The main question is to know what makes up the landscape near the airport of Rodrigues. Beyond the simple appearance, the issue is to identify the wealth of components and the landscape characteristics of this territory.

In other words, this section seeks to understand how the new runway project involves the landscape components.

Field observation is a first step in responding to the problem. A step back on the territory then makes it possible to place the airport of Rodrigues in a historical and geographical context, rather than confining it within its boundaries.

By reviewing all the existing documents relating to the area of influence and the project, but also all topographical data, it is possible to place the airport in its context.

6.8.4.1 Area of influence

From a visual and landscape perspective, the area of influence exceeds the large area of influence defined in the introduction.

For the purposes of assessment, visual and landscape impact assessment, the study area is defined as the area in which the project can be seen by the human eye. This is called the Zone of Theoretical Visibility or Zone of Visual Influence.

ZTV or ZVI analysis is the process of determining the visibility of an object in the surrounding landscape. The process is objective in which areas of visibility or non-visibility are determined by computer software using a digital elevation dataset. The output from the analysis is used to create a map of visibility.

The ZTV/ZVI map below illustrates the potential (or theoretical) visibility in the landscape of the Mount Saint-Mary. The phrase "potential visibility" is used to describe the result because the analysis does not take into account any landscape artefacts such as trees, woodland or buildings etc. The analysis is made on the basis of topography alone.

The results are not intended to show the actual visibility of the Mount Saint-Mary, they are intended to indicate where it may be visible from. Therefore, it gives an indication about the project area of influence in the existing landscape.

Actual visibility can only accurately be determined by site survey since there are a multitude of local variables that may affect lines of sight. On the other hand, the ZTV/ZVI map does show where an object definitely cannot be seen.

6.8.4.2 Main landscape features

The airport area, like the entire territory of Rodrigues, presents a rugged relief, which is found everywhere except near the coastal fringe.

This relief presents a challenge with regard to the integration of the project into the landscape and the stability of the land crossed. Natural hazards are a major constraint: sinkholes, cyclones, storm surges, etc. The climate is therefore also a major challenge.

Rodrigues' silhouette is one of a picturesque "green island".

A forest mantle covers the tops of the main mountains and parts of the hill sides (but there is no mangrove swamp to underline the coast). This relatively homogeneous and systematic coverage on the landform is explained by the climate. It testifies to an ancient tropical woodland that once covered the entire island.

The contrasts are not very well marked from one sector of the island to another; due to patches of shrubby vegetation and thickets on hill sides that make large and seamless transitions. It is possible to consider three large landscape units:

- The mountains covered with forest mantle,
- The vast expanses of grassland on hill sides and plains, and
- The lagoon islands.

The island has very few urban areas and artificial spaces.

6.8.4.3 Landscape components

To the southwest of Rodrigues Island, the airport stands amid a large plain (Pointe l'Herbe, Plaine Corail, Plaine Coco) backed with forested mountains with secondary landform (hills) in the mid distance, and faces a steep shore with lagoon islands.

Figure 167: Locally, the only built visual reference points are the airport buildings

Figure 168: The large plain backed with forested mountains and hills in the mid distance

6.8.4.3.1 Large plain

The area surrounding the airport is mainly a pastoral land characterized by alternating grassland and thickets, far from urban or inhabited areas destined to be urbanized in the near future. Locally, the only visible reference points are the airport buildings. Structuring elements, such as hedgerows or infrastructures, are rare.

The plain area is marked by open landscapes of large and flat grassland and retains a countryside atmosphere. The development of urbanisation, and thus the change of (rural) character do not appear to threaten this area.

Figure 169: The plain area is marked by open landscapes of large grassland

6.8.4.3.2 Field crop areas

These spaces are open spaces, of geometric shapes, often characterized by monoculture and representing small plots. A few hedges surround these areas.

6.8.4.3.3 Urbanized spaces

Urbanised areas are made up of buildings that are not quite typical of the local culture, surrounded by hedges or green areas. These buildings have roofs made of corrugated sheet metal or flat concrete roof. The urbanized areas of the area of influence are removed from the airport and almost not visible from the project area.

6.8.4.3.4 Artificial or semi-artificialized spaces

The existing airport is already quite well integrated into the landscape: large areas are grassland within the airport's footprint, thus retaining the landscape character of large plain.

6.8.4.3.5 Rivers

The Quitor stream flows into the Anse Quitor just outside the airport. Cut valleys and high gradient slopes are the main characteristics of Rodrigues' rivers.

6.8.4.4 Landscape issues and landscape impacts

Overall, the project is part of a context of anthropogenic pressure on already fragile natural environments and landscapes.

Regardless of the alternative chosen, the expected impacts on the landscape will be significant. The total volume of excavation is estimated at 3 million m^3 and will entail the cutting of Sainte Marie Hill as per the Preliminary design Report. The construction of the new infrastructure will require a particular intention in order to limit the inevitable consequences on the environment and the landscape.

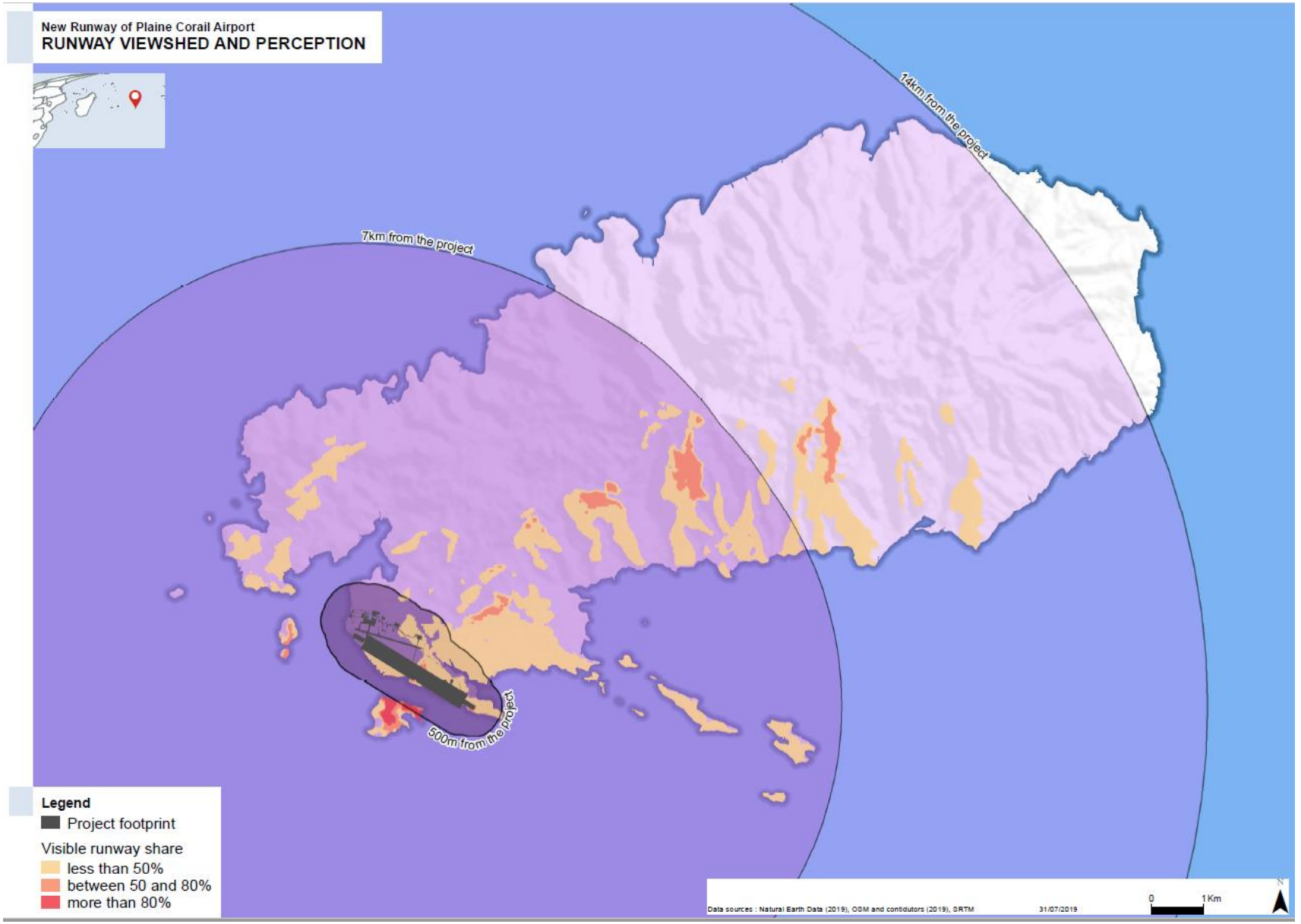
The landscape impacts and challenges are very diverse. They are of two kinds: immediate and medium-term.

Figure 170: Grazing is the most common form of anthropogenic pressure on landscape and environment

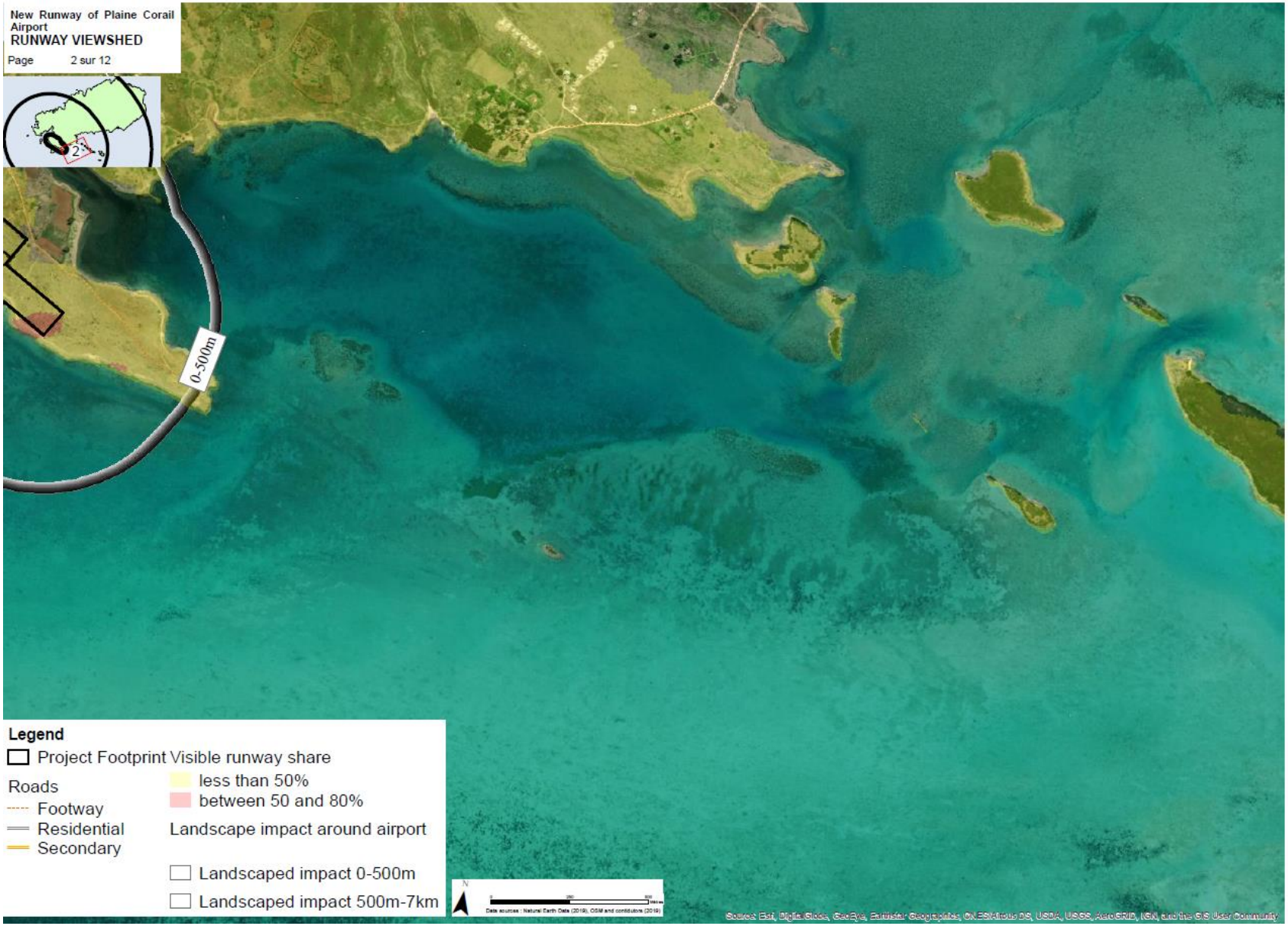
6.8.5 Summary: cultural and visual environment sensitivity

Table 75: cultural and visual environment sensitivity

Theme	Sub-theme	Receptor	Sensitivity
Heritage resources and visual environment	Cultural heritage resources	Presence of cultural site	Low
	Archeology and paleonthology	Presence of cultural site of archaelogical or palaeonthological interest	High
	Landscape end visual environment	Living environment and site visibility	High

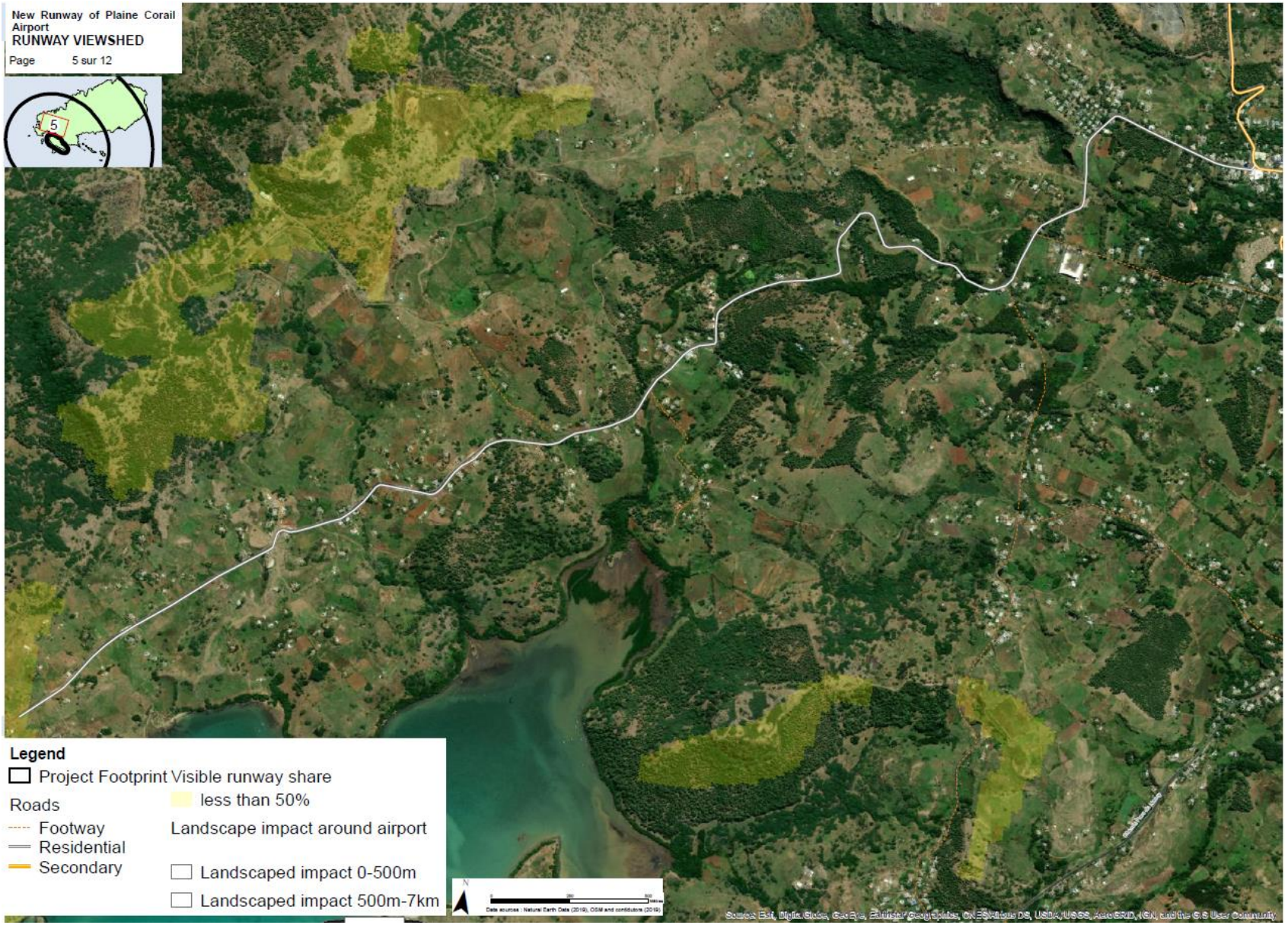

New Runway of Plaine Corail Airport
RUNWAY VIEWSHED AND PERCEPTION
14km from the project
7km from the project
500m from the project
Legend
Project footprint
Visible runway share
less than 50%
between 50 and 80%
more than 80%
Data sources : Natural Earth Data (2019), OSM and contidutors (2019), SRTM
31/07/2019
0
1 Km
N

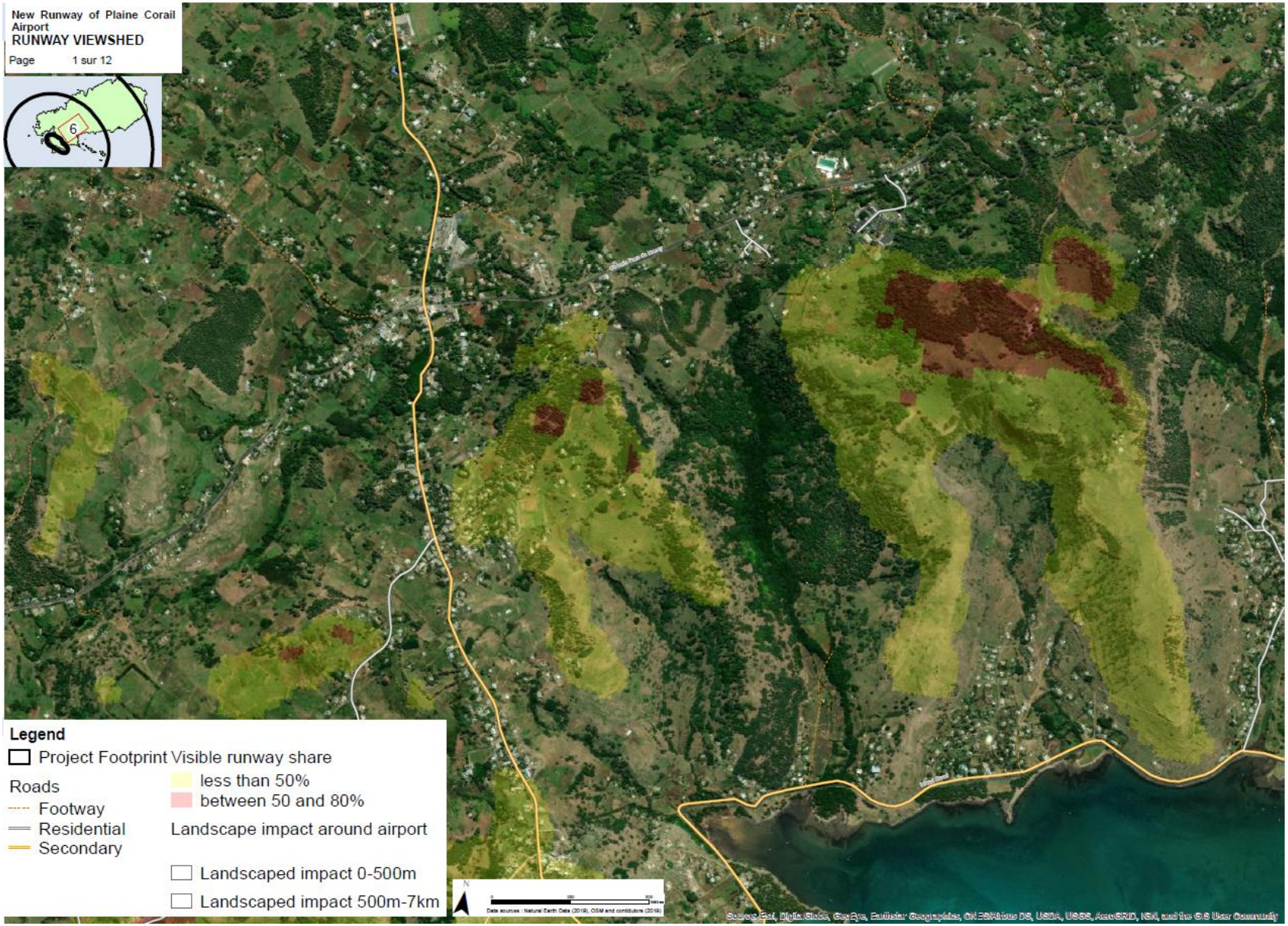

New Runway of Plaine Corail Airport
RUNWAY VIEWSHED
Page 1 sur 12
Legend
Project Footprint
Visible runway share
less than 50%
Roads
Footway
Residential
Secondary
Landscape impact around airport
Landscaped impact 0-500m
Landscaped impact 500m-7km
500m-7km


New Runway of Plaine Corail Airport
RUNWAY VIEWSHED
Page 2 sur 12
0-500m
Legend
Project Footprint
Visible runway share
less than 50%
between 50 and 80%
Roads
Footway
Residential
Secondary
Landscape impact around airport
Landscaped impact 0-500m
Landscaped impact 500m-7km
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community


New Runway of Plaine Corail Airport
RUNWAY VIEWSHED
Page 3 sur 12
0-500m
Legend
Project Footprint
Visible runway share
less than 50%
between 50 and 80%
more than 80%
Roads
Footway
Residential
Secondary
Landscape impact around airport
Landscaped impact 0-500m
Landscaped impact 500m-7km
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community


New Runway of Plaine Corail Airport
RUNWAY VIEWSHED
Page 4 sur 12
0-500m
Legend
Project Footprint
Visible runway share
less than 50%
between 50 and 80%
Roads
Footway
Residential
Secondary
Landscape impact around airport
Landscaped impact 0-500m
Landscaped impact 500m-7km


New Runway of Plaine Corail Airport
RUNWAY VIEWSHED
Page 5 sur 12
5
Legend
Project Footprint
Visible runway share
less than 50%
Roads
Footway
Residential
Secondary
Landscape impact around airport
Landscaped impact 0-500m
Landscaped impact 500m-7km


New Runway of Plaine Corail Airport
RUNWAY VIEWSHED
Page 1 sur 12
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Legend
Project Footprint
Visible runway share
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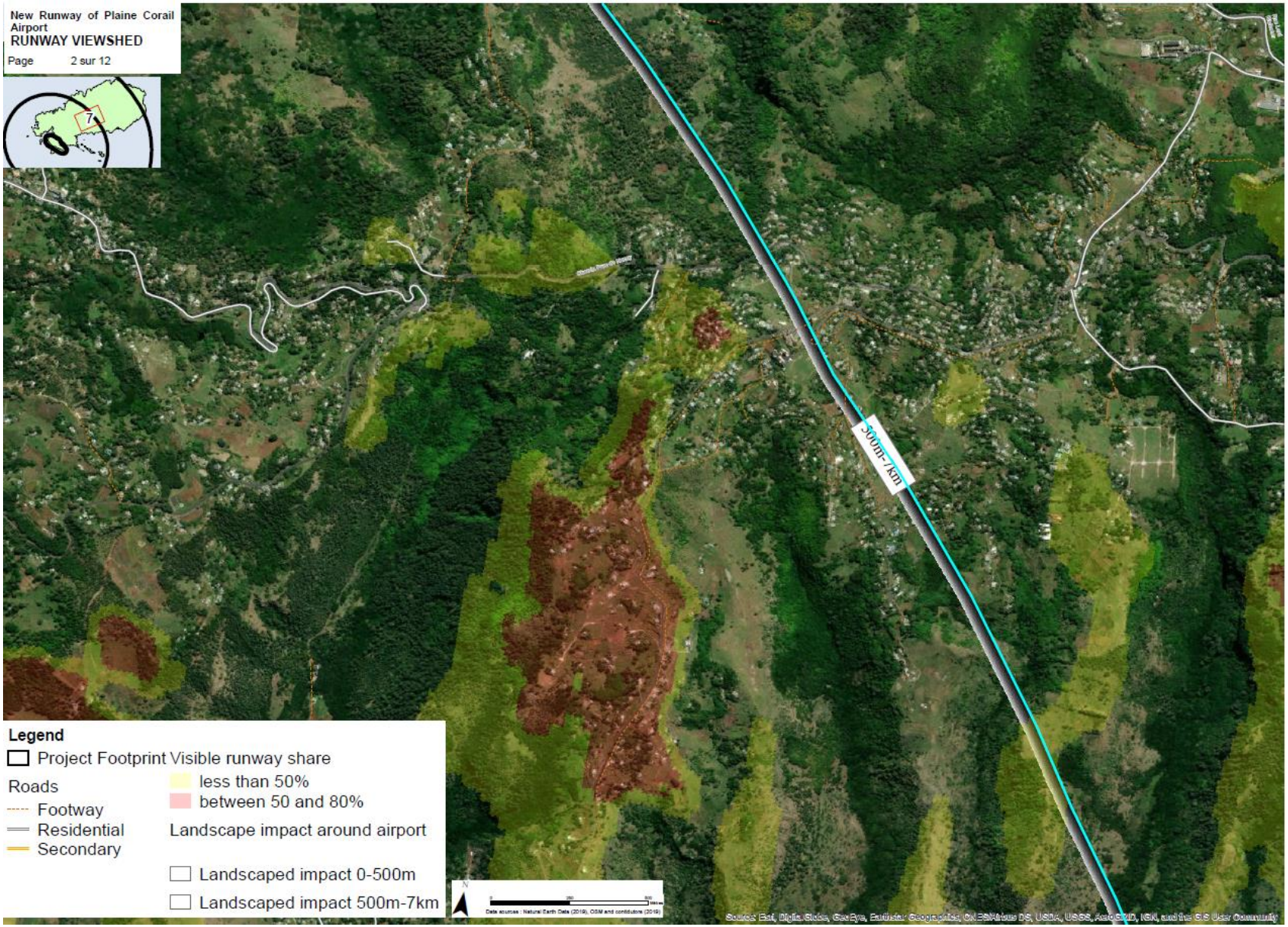
between 50 and 80%
Roads
Footway
Residential
Secondary
Landscape impact around airport
Landscaped impact 0-500m
Landscaped impact 500m-7km


New Runway of Plaine Corail Airport
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Page 2 sur 12
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500m-7km
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Project Footprint
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Secondary
Landscape impact around airport
Landscaped impact 0-500m
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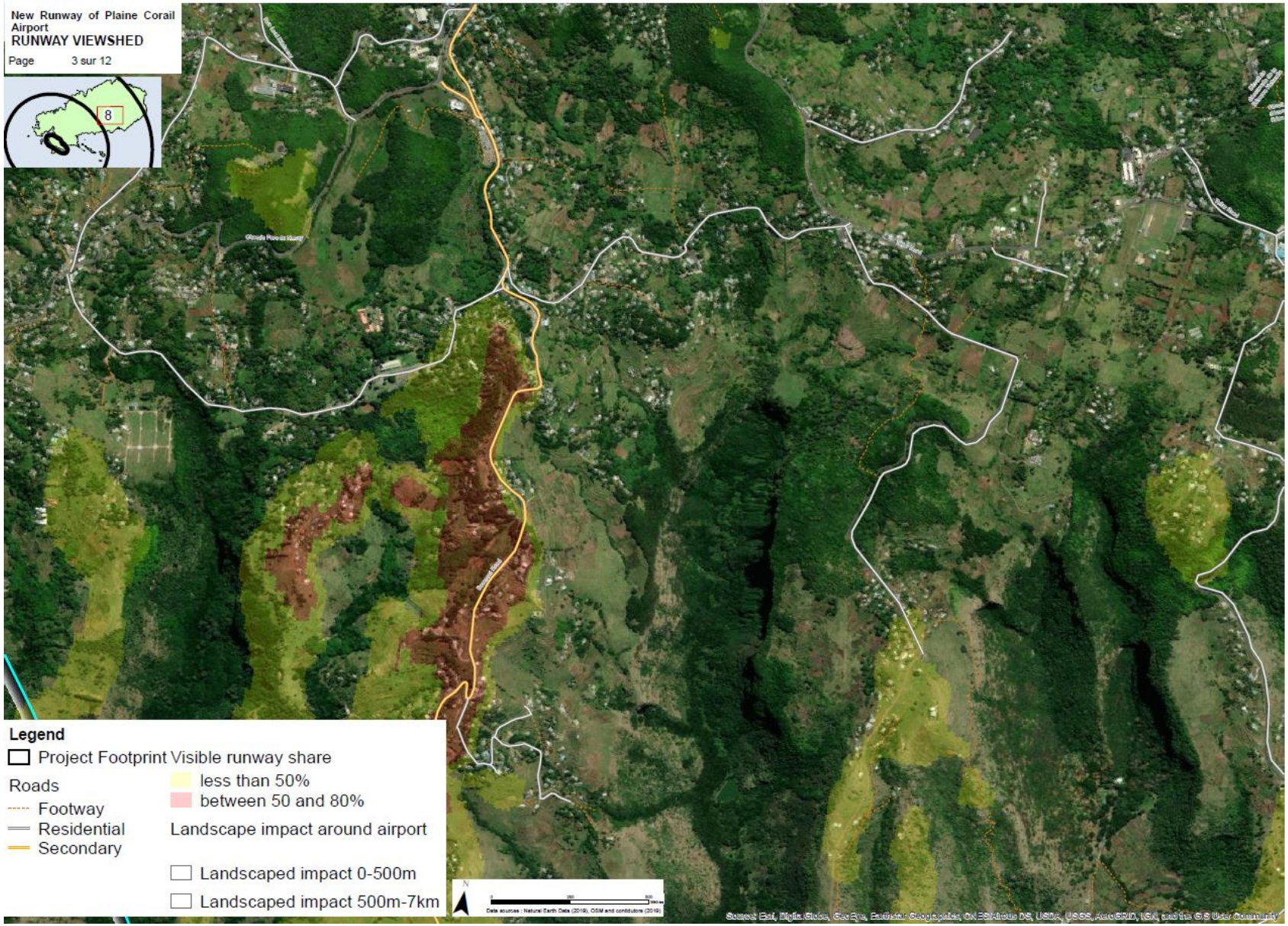
New Runway of Plaine Corail Airport
RUNWAY VIEWSHED
Page 3 sur 12
8
Legend
Project Footprint
Visible runway share
less than 50%
between 50 and 80%
Roads
Footway
Residential
Secondary
Landscape impact around airport
Landscaped impact 0-500m
Landscaped impact 500m-7km


New Runway of Plaine Corail Airport
RUNWAY VIEWSHED
Page 4 sur 12
9
Legend
Project Footprint
Visible runway share
less than 50%
between 50 and 80%
Roads
Footway
Residential
Secondary
Landscape impact around airport
Landscaped impact 0-500m
Landscaped impact 500m-7km


New Runway of Plaine Corail Airport
RUNWAY VIEWSHED
Page 5 sur 12
10
Legend
Project Footprint
Visible runway share
less than 50%
between 50 and 80%
Roads
Footway
Residential
Secondary
Landscape impact around airport
Landscaped impact 0-500m
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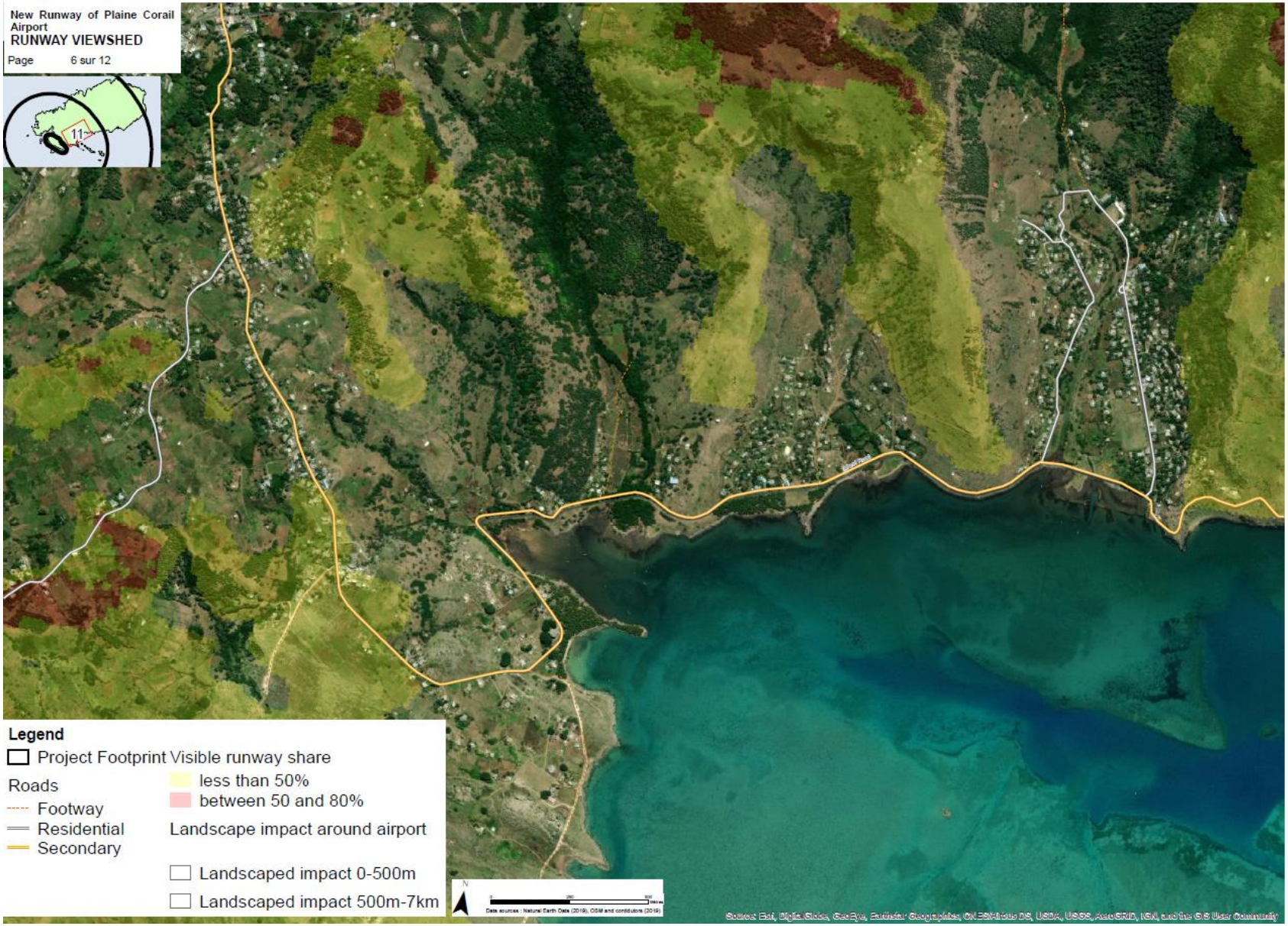
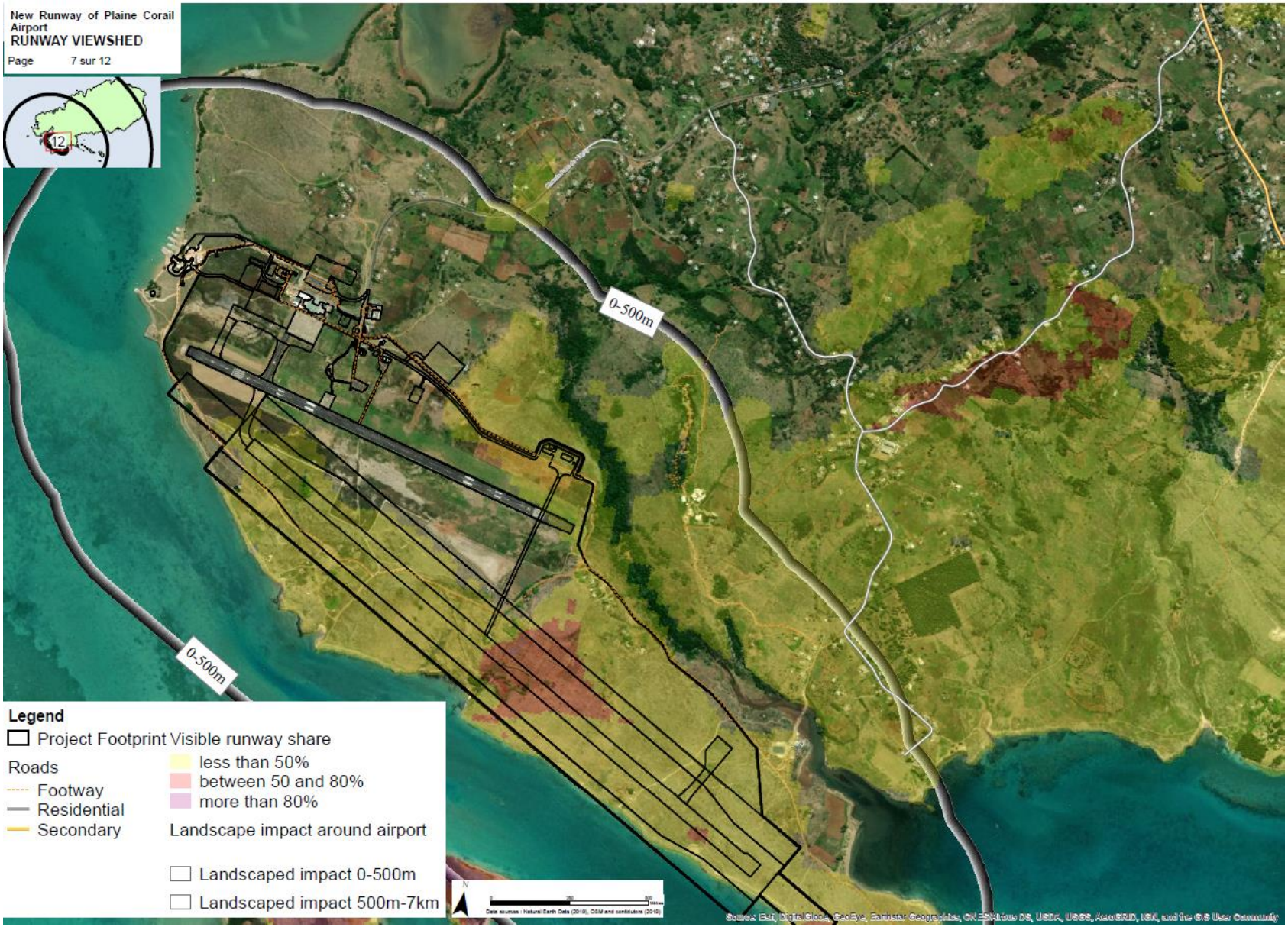

New Runway of Plaine Corail Airport
RUNWAY VIEWSHED
Page 6 sur 12
11
Legend
Project Footprint
Visible runway share
less than 50%
between 50 and 80%
Roads
Footway
Residential
Secondary
Landscape impact around airport
Landscaped impact 0-500m
Landscaped impact 500m-7km


New Runway of Plaine Corail Airport
RUNWAY VIEWSHED
Page 7 sur 12
12
0-500m
0-500m
Legend
Project Footprint
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less than 50%
between 50 and 80%
more than 80%
Roads
Footway
Residential
Secondary
Landscape impact around airport
Landscaped impact 0-500m
Landscaped impact 500m-7km

6.9 Conclusion: main issues of the baseline

The main issues identified in the baseline assessment are:

- The karstic system, involving a risky geology and a high sensitivity of groundwater, to be put into perspective of the scarcity of fresh water,
- The paleontological value of Grotte Fougère located next to the proposed runway alignment
- Many protected species, especially floristic ones such as *Foetidia Rodriguesiana*, and the vicinity of the Anse Quitor reserve and the François Leguat reserve, and of dry forest habitat,
- Marine reserves and habitats, and marine species such as *Acropora Formosa* and marine turtles,
- The expected change in the landscape resulting from the development due to the massive volumes of earthwork involving the cutting of the St Marie Hill, and
- Inhabited villages in the project area, and agricultural and fishing activities.

Two particularly important risks must be considered in this inventory:

- Presence of a critical habitat inside of which is located the control tower in the preliminary design. However, the control tower can be moved as part of the detailed design, thus avoiding any impact on the habitat.
- The need to move villages in which approximately 30 families live. The resettlement of these families is the subject of a concerted approach that is already well advanced locally. This impact should also be reduced.

As is the case for any project, other predictable impacts can already be numbered; (noise, air pollution, impact on fauna and flora, impact on the socio-economic development, etc.). These shall be mitigated by avoiding or compensating measures.