

SUMMARY OF RESEARCH UNDERTAKEN



To form the 7 key
recommendations for the
conservation of the terrestrial
biodiversity of the island of
Anjouan

2009 - 2020



A. DETERMINING THE STATE OF ANJOUAN'S HABITATS AND BIODIVERSITY

Extensive surveys were set up to assess the state of Anjouan's biodiversity, focusing on birds, reptiles, butterflies, and mammals, as well as habitat quality. Comprehensive transect and plot surveys of animals and plants were conducted using a standardized methodology at **240 locations** across Anjouan to make the data comparable (Fig. 1).

The number of locations and the timing of the surveys varied between years (see Table 1). An ongoing survey of the island's Livingstone's fruit bat populations has been conducted bi-annually at all known roost sites since 2012 to assess the population numbers of this Critically Endangered keystone species.

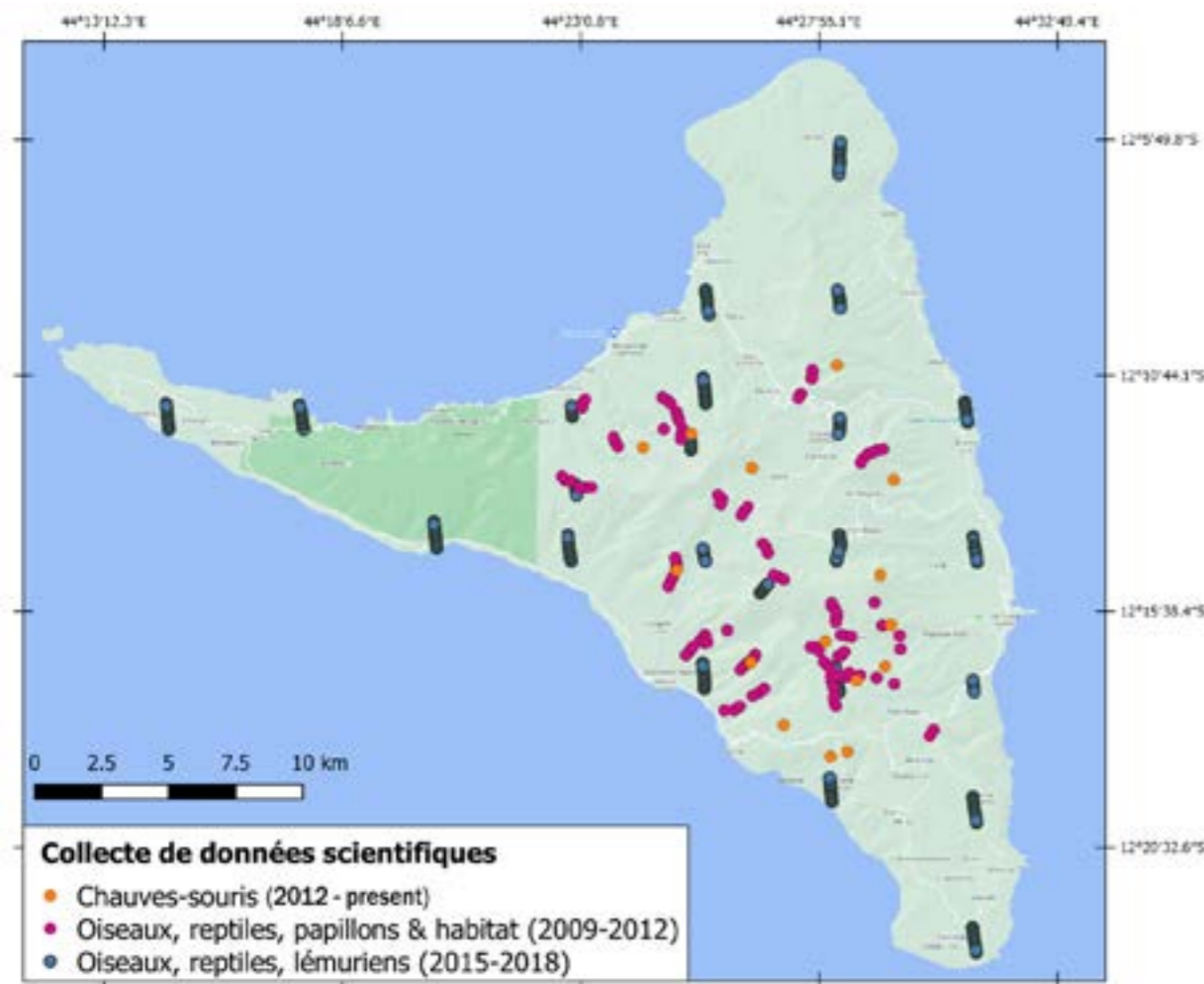


Fig. 1. Map of Anjouan with all 240 locations (birds = 128, butterflies = 51, flying foxes = 15, lemurs = 23, reptiles = 23) where surveys on local biodiversity were conducted since 2009.

Tab. 1. Number of data collection points/transects and time when data were collected for all sampled taxa between 2010 and 2018.

TAXA	DATA COLLECTION POINTS OR TRANSECTS	YEARS
Birds	77/51	2010-2011/2017-2018
Butterflies	51	2009-2011
Flying foxes	15	2012-2018
Lemurs	23	2015-2016
Reptiles	23	2017-2018

All data were used to produce species distribution models which are based on species presence, habitat, and climate characteristics. These models show where individual species are most likely to occur and give us detailed information of the types of habitats, elevations, and areas on which biodiversity relies. The information is crucial for developing targeted, effective conservation measures. The resulting estimated population sizes and habitat requirements mean that eight additional bird species qualify for the IUCN Red List label as "Endangered". Dahari's previous work resulted in the upgrading of *Pteropus livingstoni* to "Critically Endangered".

To understand the habitat availability across Anjouan, landcover maps were produced using a remote-sensing approach based on Sentinel2 satellite images. The results show that only **46 km²** of forest (comprising areas of natural forest and disturbed forest with signs of human disturbances such as logging, under-planting, or fires) are left on Anjouan, **170 km²** is comprised of agroforestry (a patchwork of non-indigenous fruit trees and agricultural crops with occasional native trees), and **178 km²** do not have any native trees remaining due to intense agricultural practices (Fig. 2).

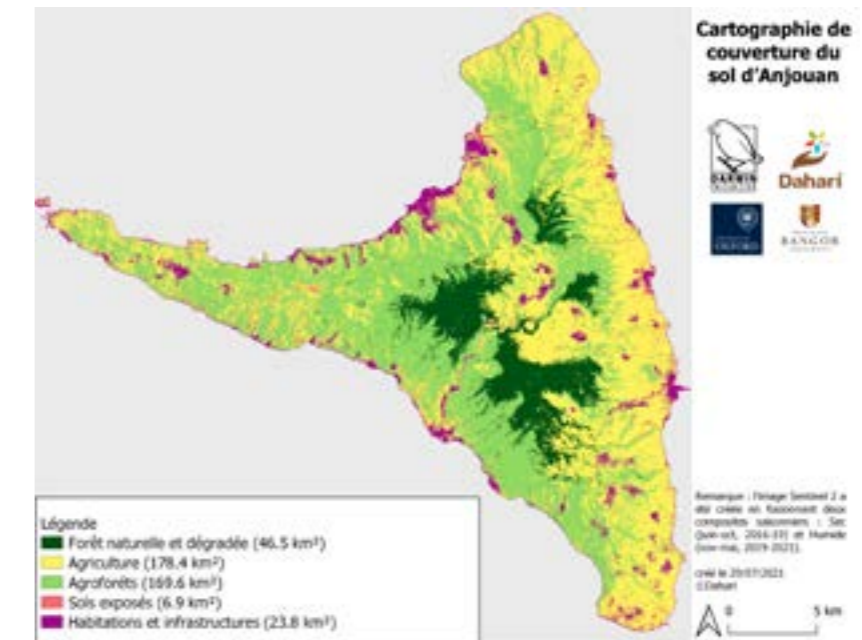


Fig. 2. Landcover map of Anjouan (version: July 2021) based on Sentinel2 satellite imagery and semi-automatic classification procedures.



B. PRIORITY ZONES FOR CONSERVATION ACTIONS

Based on the results of the distribution maps and the suitable habitat available for each species, we delimited areas of importance for conservation for endemic birds, and butterflies, the reptile *Phelsuma v-nigra anjouanensis* and the flying fox *Pteropus livingstonii* (Fig. 3 & Fig. 4). These zones show where the species are most likely to occur and which habitat they rely on for survival. The delimitation was an important step to understand habitat dependencies and guide conservation actions for the protection of threatened biodiversity on Anjouan. Altogether the area important for biodiversity conservation is **100km²** in size, about **23%** of the island's surface. The area of overlap between all species falls within mid-altitudes. Landcover classification revealed that most areas of conservation interest are located within forest zones on Anjouan (Fig. 5). This implies that areas that should be prioritised for protecting and restoring are those that still harbour forest, regardless of level of degradation. Those areas are particularly important for birds. Flying foxes seem to adapt to agroforest habitat, but more long-term research is necessary to understand their ecological requirements.

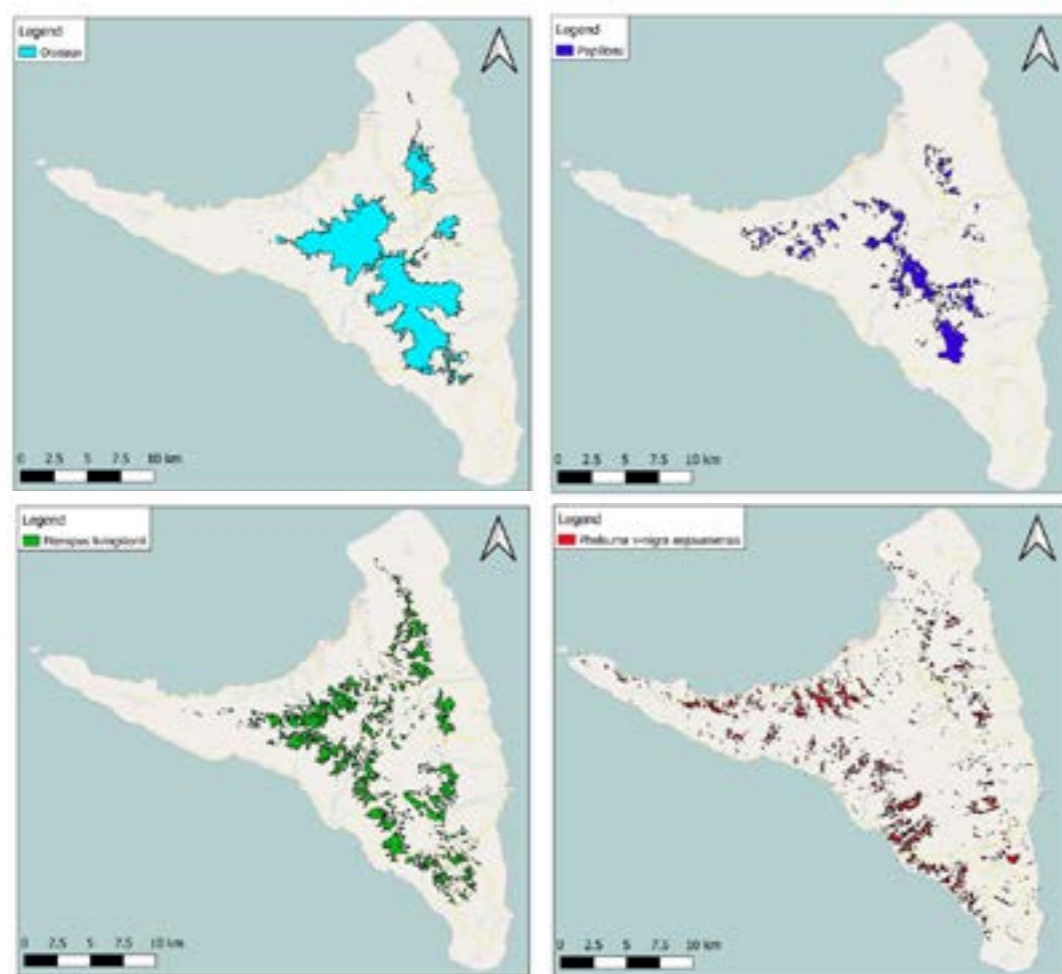


Fig. 3. Individual areas of conservation importance based on species distribution and habitat suitability modelling. The sizes of the areas and elevation levels differed between **A)** endemic birds (58km², 551-1598m abs), **B)** endemic butterflies (17km², 324-1598 m abs), **C)** *Pteropus livingstonii* (35km², 750-1385 m abs) and **D)** *Phelsuma v-nigra anjouanensis* (18km², 0 - 1057m abs).

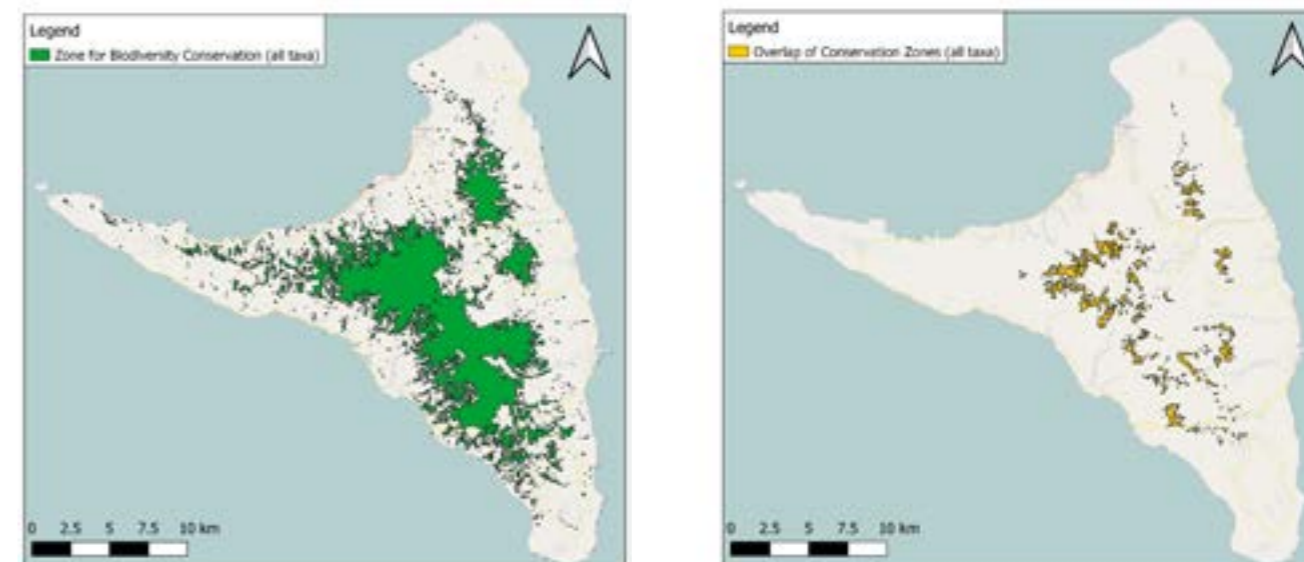


Fig. 4. The total and overlap areas important for biodiversity conservation based on species distribution and habitat suitability modelling for endemic birds, butterflies, *Pteropus livingstonii* and *Phelsuma v-nigra anjouanensis*. The **A)** green area shows the total area for all species of interest, which is 100km² in size. The **B)** yellow area is the area where all species of interest overlap: prioritising these areas could ensure the conservation of multiple species across the island. The overlap area is approx. 13 km² in size and lies predominantly in mid-range altitudes.

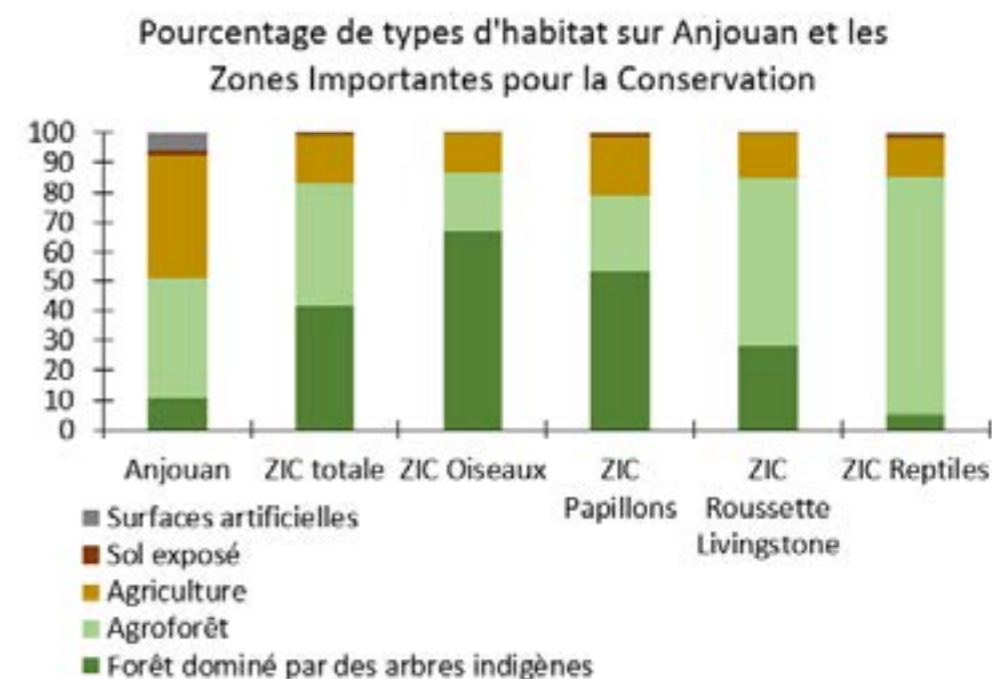


Fig. 5. While Anjouan's landscape is comprised mainly of agroforest and agricultural fields, a large part of the area of conservation importance falls within the remaining forested zones on the island. The individual percentages for each landcover type are shown in the bar graph above: **42%** of the entire zone of conservation importance (green, in Fig. 4) is comprised of degraded or natural forest. Forested areas make up **67%** and **53%** respectively of the zones important for the conservation of endemic birds and butterflies. Only zones of conservation importance for *Pteropus livingstonii* and *Phelsuma v-nigra anjouanensis* contain large percentages of agroforest habitat.



C. WOOD-USE ON ANJOUAN

Two studies were undertaken between 2015 and 2019 to understand how trees are used by the local population. The first investigated the levels of timber extraction for different uses (ylang ylang distillation, furniture, construction, charcoal, cooking), and the species of tree favoured for each usage. This resulted in a rough estimate of 16 tonnes of wood removed yearly from the Moya Forest alone, including 1200 mature native trees. The study clearly demonstrated that the main uses for native mature trees are construction and the furniture trade (Tab. 2).

Tab. 2. Ideal species for doors and furniture according to local landholders in order of desirability. Higher scores indicate a higher desirability. All these species are either endemic or native to the Comoros.

COMORIAN NAMES	SCIENTIFIC NAMES	TOTAL SCORE
Mrobwe	<i>Ocotea comorensis</i>	21
Mtrondro, Mpori, Mlandrema, Mnyombembe, Mtakamaka.	<i>Khaya comorensis</i>	19
Mbanjeou, Mfuantsi	<i>Chrysophyllum gorungosanum</i>	12
Mkindrikindri, Murimundra	<i>Weinmania comorensis</i>	8
Mvuvu	<i>Ficus lutea</i>	6
Mhonko	<i>Rhizophora mucronata</i>	4
Chivundze, hadza	<i>Phyllarthron comorense</i>	3
mnyamba	<i>Terminalia catappa</i>	3

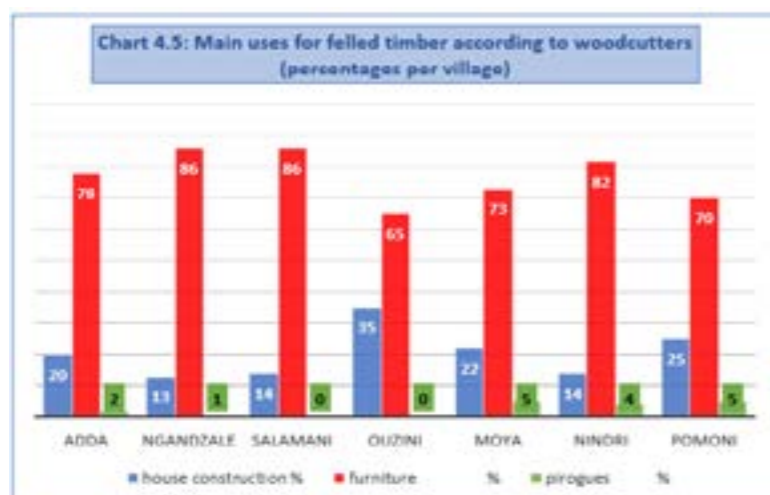


Fig. 5. The main uses for felled timber according to woodcutters (% per village)

The second study led by World Agroforestry involved local-knowledge gathering to understand the different tree species planted and used by farmers in their fields, and their perceptions of their benefits and disadvantages. Combined with scientific knowledge, this resulted in a technical manual of 77 tree species used on Anjouan, as well as tools for supporting farmers with agroforestry development. This contains information on how trees may be propagated, maintained, and deployed with the aim of benefiting local biodiversity and local communities.

PUBLICATIONS :

Samuel P. Lloyd (2010). Habitat suitability modelling for the Anjouan Scops owl, A cryptic unstudied species (MSc thesis, Imperial College London)

M'madi Soufiani (2011). Étude de la distribution géographique pour l'identification des stratégies de recherche appropriées à la conservation de l'Otus capnodes. (Thesis, Université des Comores)

Ali M. Elyamine (2001). Etude de la distribution et de l'habitat des reptiles nocturnes d'Anjouan-Comores (Thesis, Université des Comores)

Amélaïd, H. (2012). Etude de la dynamique spatio-temporelle et inventaire des populations des oiseaux endémiques d'anjouan en union des Comores (report)

Green, K. E. et al. (2015). Out of the darkness: the first comprehensive survey of the Critically Endangered Anjouan Scops Owl *Otus capnodes*. *Bird Conservation International*, 25(3), 322-334

Doulton, H. et al. (2016) Combattre la dégradation des forêts dans un petit État insulaire en développement: une approche paysagère aux Comores. *Unasylva* 247/248, Vol. 67, pp. 30-38

Daniel, B. et al. (2017). A bat on the brink? A range-wide survey of the Critically Endangered Livingstone's fruit bat *Pteropus livingstonii*. *Oryx*, 51(4), 742-751

Salim, D. (2018) Impacts anthropogéniques sur les papillons endémiques des Comores : implications sur leurs conservations. (MSc thesis, Université Polytechnique de Bobo-Dioulasso)

Ormsby, L. (2019). Distribution, Abundance and Habitat Use of the Mongoose Lemur, *Eulemur mongoz*, on Anjouan, Comoros (MSc thesis, University of Bristol)

Amélaïd, H. (2020). Ecologie et priorité de conservation des vertébrés terrestres d'Anjouan (Union des Comores) (PhD thesis, Université d'Antananarivo)

Amélaïd, H. et al. (2020). Classification hiérarchique des zones boisées d'altitudes de l'île d'Anjouan, Comores. *Vertigo-la revue électronique en sciences de l'environnement*, 20(2)

Mandl, I. et al. (2021) GPS tracking provides critical insights into ecology of Livingstone's flying foxes to inform conservation strategies, *Oryx*, 1-4. doi:10.1017/S0030605320000563

CITATION :

Boussougou, G.B. et al. (2015) Novembre. Changements de la couverture forestière dans l'île d'Anjouan entre 1995 et 2014. In *Spatial Analysis and GEomatics conference*, SAGEO 2015.

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