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## Terrestrial Biodiversity Mapping of the Comoro Islands: Methods and Results

*February 2014*

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Bristol Conservation  
& Science Foundation



### About the ECDD project

The ECDD project was run by Bristol Conservation & Science Foundation (an operating unit of Bristol, Clifton & West of England Zoological Society Ltd.) in partnership with Durrell Wildlife Conservation Trust, the Government of the Union of the Comoros and the Administration of the Island of Anjouan, and with the support of Agronomes et Vétérinaires Sans Frontières.

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The project worked with consultants from the International Union for the Conservation of Nature and Cranfield University.

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## 1. Aim and objectives

Aim: To inform conservation planning in the Comoro Islands through identification of priority conservation areas for endemic fauna.

Objective 1: To produce niche suitability models for key endemic species of birds, reptiles, butterflies, and mammals.

Objective 2: To perform detailed population estimates of two species of particular conservation importance, the Anjouan scops owl (*Otus capnodes*) and the Livingstone's fruit bat (*Pteropus livingstonii*).

## 2. Data collection

Niche suitability models predict potential suitable locations for a species by combining field data collected on the presence of individuals of a species with digital layers of environmental variables. Presence data collected by ECDD consist of the locations where individuals of a species were recorded during ecological field surveys between 2009 and 2012.

### 2.1. Field methods

Field data on the presence of species was collected on the three islands of the Comoros over a period of three years between 2009 and 2012. A range of methods were used dependent on the species and area to be surveyed. Transects of 500m were established on the three islands to survey butterflies, reptiles, and lemurs. Along each of these transects, 3 x 15minute point counts were conducted at 200m apart to survey birds (see diagram 1). Additional areas were surveyed using standardised opportunistic searching. This involved searching for butterflies, reptiles, and lemurs over a set period of time within the survey area. Within these survey areas 15 minute bird point counts were also conducted, with each point at least 200m apart. Bird surveys were conducted at dawn, butterfly surveys between 10:00-15:00, and reptile surveys both between 10:00-15:00 and early evening 18:00-20:00. These are the times in which activity is normally highest for these taxa. During all transects observers noted any groups of lemurs observed. No surveying was conducted in windy or rainy conditions.

Diagram 1. Schematic diagram of the methods used to survey faunal species

| Species   | Method                                      | Description |      |      |      |      |
|-----------|---|-------------|------|------|------|------|
|           |   | 100m        | 200m | 300m | 400m | 500m |
| Bird      | Point counts and casual observations        | ○           | ○    |      | ○    |      |
| Butterfly | Strip transects and opportunistic searching |             |      |      |      |      |
| Reptile   | Strip transects and opportunistic searching |             |      |      |      |      |
| Lemur     | Line transects and opportunistic searching  |             |      |      |      |      |

The Anjouan scops owl was surveyed using point counts with playback. Each point count consisted of five minutes passive listening then three minutes of playback. Points were located along transects, each at least 200m apart.

## 2.2. Field results

All the field data collected was inputted into excel spreadsheets. Presence data of each species recorded was identified and exported into ArcGIS using the GPS coordinates collected in the field. Results of the surveys are shown in Table 1 and more details shown in Appendix 1.

Table 1. Total number of species observed and endemism

| Island        | Birds                   |            | Butterflies             |            | Reptiles                |            |
|---------------|-------------------------|------------|-------------------------|------------|-------------------------|------------|
|               | Total Number of Species | % Endemics | Total Number of Species | % Endemics | Total Number of Species | % Endemics |
| Anjouan       | 32                      | 50%        | 34                      | 41%        | 13                      | 31%        |
| Grande Comore | 29                      | 79%        | 23                      | 48%        | 6                       | 50%        |
| Mohéli        | 31                      | 61%        | 16                      | 38%        | 4                       | 25%        |

## 2.3. Environmental Data

Environmental layers from different variables were created using ArcGIS, Aster Digital Elevation Models (DEM), and land cover maps produced from remotely sensed imagery. Experimentation of the different layers in the model and the influence they have upon the model was conducted to determine the most important variables. The seven most influential layers were selected (Table 2). The layers which did not influence the model and were not included were temperature, rainfall, patchiness (patch area), edge density (of each patch), and distance from valleys.

Table 2. Environmental layers used in the niche suitability models

| Layer                                     | Source  |
|---|---|
| Elevation                                 | Aster DEM   |
| Aspect                                    | Using ArcGIS Spatial Analyst and the Aster DEM  |
| Slope                                     | Using ArcGIS Spatial Analyst and the Aster DEM  |
| Distance from rivers (Anjouan only)       | Using flow accumulation in ArcGIS Spatial Analyst and the Aster DEM                                 |
| Distance from roads and urban areas       | Using ArcGIS Spatial Analyst and manual digitised roads and urban outlines                          |
| Habitat                                   | Land cover map with four classes: natural forest, degraded forest, agroforestry and non-forest      |
| Distance from natural and degraded forest | Using ArcGIS Spatial Analyst and the outline of natural and degraded forest from the land cover map |

## 3. Modelling

The software selected for producing the niche suitability model was MaxEnt as it performs well with small amounts of presence data. The features were left as default (auto features). Response curves were created and jackknife tests performed to measure the importance of different variables. Random seed function was used to select randomly the test data for each model. For each species the percentage of test data (10-30%) and regularisation multiplier (1-5) were trialled. All other settings remained default. Modelling was run individually for all endemic species. Binomial maps of high and

low niche suitability were produced from the probability output by using 'Equal Training Sensitivity and Specificity' value as the threshold of high and low niche suitability.

## 4. Results

For each species, the output of the modelling process was a probability map which shows for each pixel the probability of the presence of a suitable niche. This probability infers species distribution as the greater the probability of a suitable niche the more likely it is that the species will occur. Using this probability data and the 'Equal Training Sensitivity and Specificity' value as the threshold of high and low niche suitability, the binomial maps were produced.

The binomial maps for each species from each taxa were then combined to create maps of irreplaceability and vulnerability across the different taxa surveyed. Maps of irreplaceability include all endemic species across the different taxa and vulnerability includes all species which are classed as Near Threatened, Vulnerable, Endangered, or Critically Endangered on the IUCN's Red List. If insufficient presence data was available for a species (<10 records), then modelling was not possible and presence points are shown.

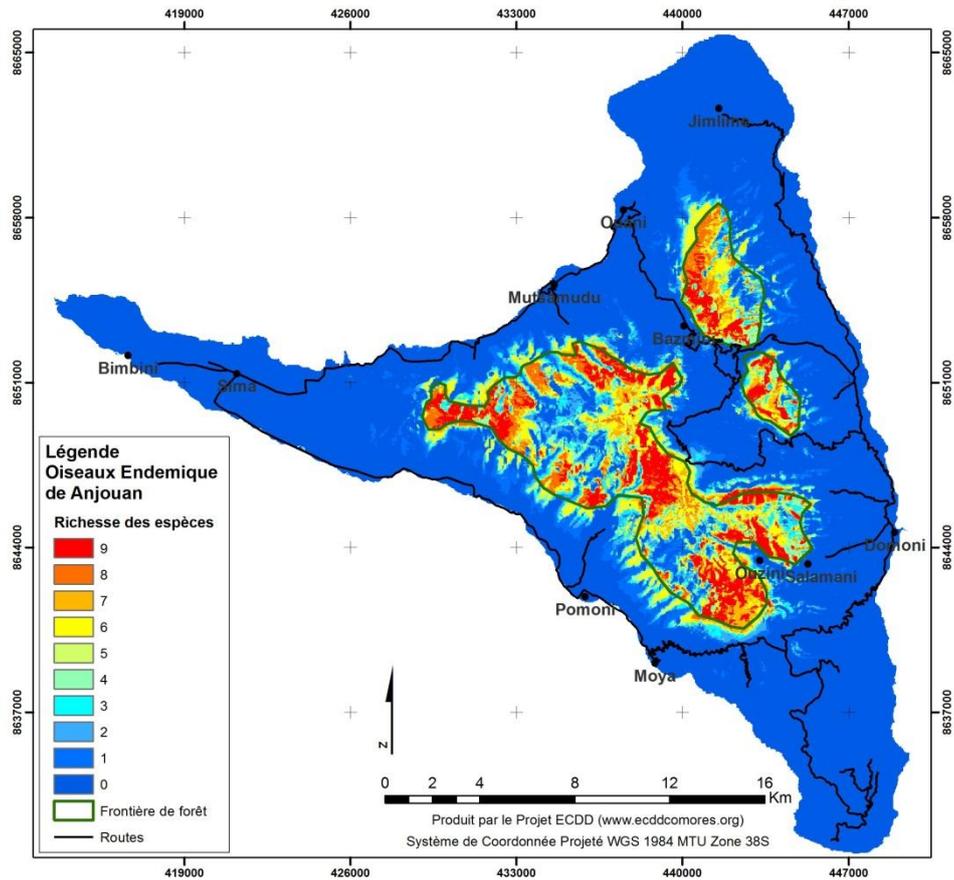
It should be noted that these outputs are models and only as accurate as the data inputted. For example, most of the models show no species present at low altitude although some species do occur here. This is a result of the ecological surveying being conducted only in mid-high altitude zones, thus no presence data was available for the low altitude zones, or the highest parts of Mount Karthala in Grande Comore. The mid-high altitude zones were selected due to the aims of the work: to inform conservation planning, in particular the zonation of potential protected areas. All of the remaining natural forest fragments on the three islands are found only at mid to high altitude zones, thus, this is where conservation planning is required. In Anjouan the natural forest is found only at high altitudes, however we decided to survey mid-altitude zones as well to enable us to investigate the potential of degraded areas for biodiversity. In Grande Comore we did not survey the very high altitude of Mount Karthala as this is covered with low lying heathland of *Erica comorensis*. Although some species do occur within this heathland, these are not under threat, and the majority of our target species are only found in the forests at slightly lower altitudes.

## 4.1. Birds

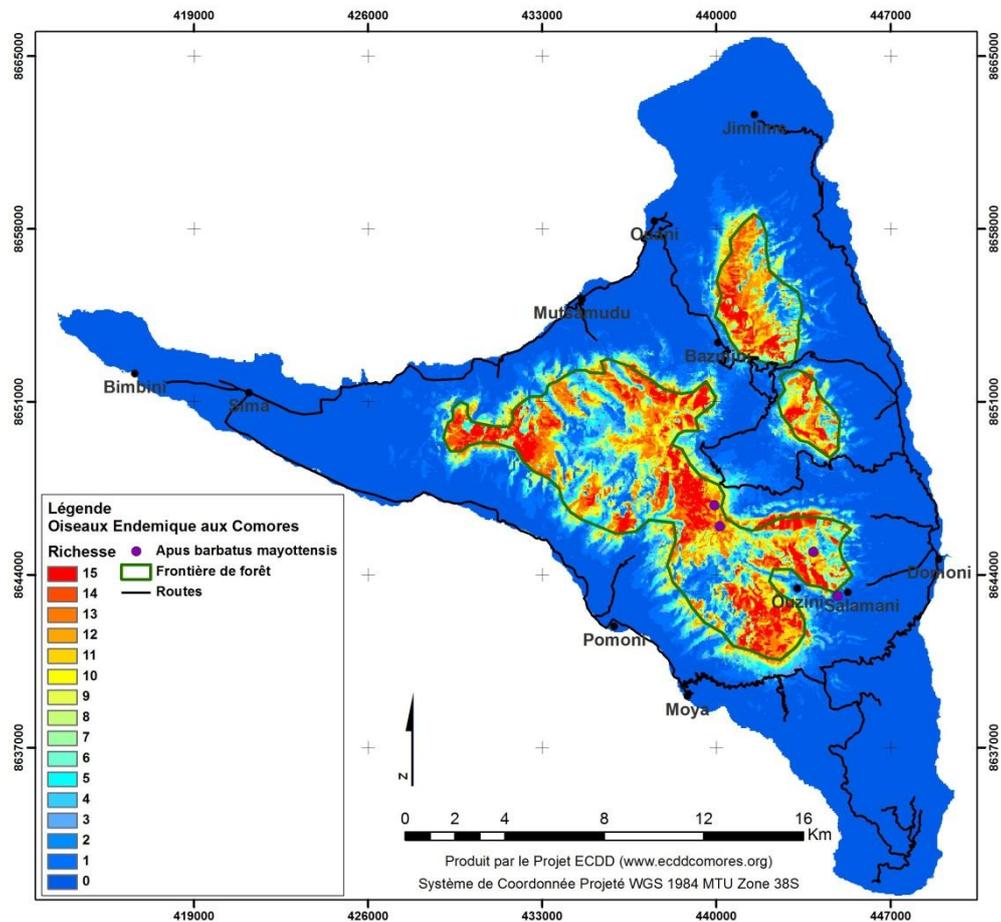
Table 3. Endemic bird species included in the niche suitability models

|   | Anjouan                                     | Grande Comore                               | Mohéli   |
|---|---|---|--|
| <b>Within the niche suitability model</b>     |   |   |  |
| 1   | <i>Accipiter francesiae griveaudi</i>       | <i>Alectroenas sganzini sganzini</i>        | <i>Alectroenas sganzini sganzini</i>           |
| 2   | <i>Alectroenas sganzini sganzini</i>        | <i>Coracina cinerea cucullata</i>           | <i>Coracopsis vasa comorensis</i>              |
| 3   | <i>Columba pollenii</i>                     | <i>Coracopsis nigra sibilans</i>            | <i>Cyanolanius madagascariensis comorensis</i> |
| 4   | <i>Coracopsis nigra sibilans</i>            | <i>Coracopsis vasa comorensis</i>           | <i>Foudia eminentissima eminentissima</i>      |
| 5   | <i>Coracopsis vasa comorensis</i>           | <i>Foudia eminentissima consobrina</i>      | <i>Hypsipetes parvirostris moheliensis</i>     |
| 6   | <i>Cypsiurus parvus griveaudi</i>           | <i>Hypsipetes parvirostris parvirostris</i> | <i>Nectarinia humbloti moheliicus</i>          |
| 7   | <i>Dicrurus forficatus potior</i>           | <i>Leptosomus discolor intermedius</i>      | <i>Nectarinia notatus voeltzkowi</i>           |
| 8   | <i>Foudia eminentissima anjouanensis</i>    | <i>Nectarinia humbloti humbloti</i>         | <i>Nesillas mariae</i>                         |
| 9   | <i>Leptosomus discolor intermedius</i>      | <i>Nectarinia notatus moebii</i>            | <i>Streptopelia picturata comorensis</i>       |
| 10  | <i>Nectarinia comorensis</i>                | <i>Nesillas typica longicaudata</i>         | <i>Terpsiphone mutata voeltzkowiana</i>        |
| 11  | <i>Nesillas typica longicaudata</i>         | <i>Terpsiphone mutata comoroensis</i>       | <i>Turdus bewsheri moheliensis</i>             |
| 12  | <i>Streptopelia picturata comorensis</i>    | <i>Turdus bewsheri comorensis</i>           | <i>Zosterops maderaspatana comorensis</i>      |
| 13  | <i>Terpsiphone mutata vulpina</i>           | <i>Zosterops maderaspatana kirki</i>        |  |
| 14  | <i>Turdus bewsheri bewsheri</i>             | <i>Zosterops mouroniensis</i>               |  |
| 15  | <i>Zosterops maderaspatana anjouanensis</i> |   |  |
|   |   |   |  |
| <b>Point distribution due to lack of data</b> |   |   |  |
| 1   | <i>Apus barbatus mayottensis</i>            | <i>Accipiter francesiae griveaudi</i>       | <i>Columba pollenii</i>                        |
| 2   |   | <i>Apus barbatus mayottensis</i>            | <i>Coracina cinerea moheliensis</i>            |
| 3   |   | <i>Columba pollenii</i>                     | <i>Nesillas typica moheliensis</i>             |
| 4   |   | <i>Cyanolanius madagascariensis bensoni</i> |  |
| 5   |   | <i>Cypsiurus parvus griveaudi</i>           |  |
| 6   |   | <i>Humblotia flavirostris</i>               |  |
| 7   |   | <i>Streptopelia picturata comorensis</i>    |  |
| 8   |   | <i>Zoonavena grandidieri mariae</i>         |  |

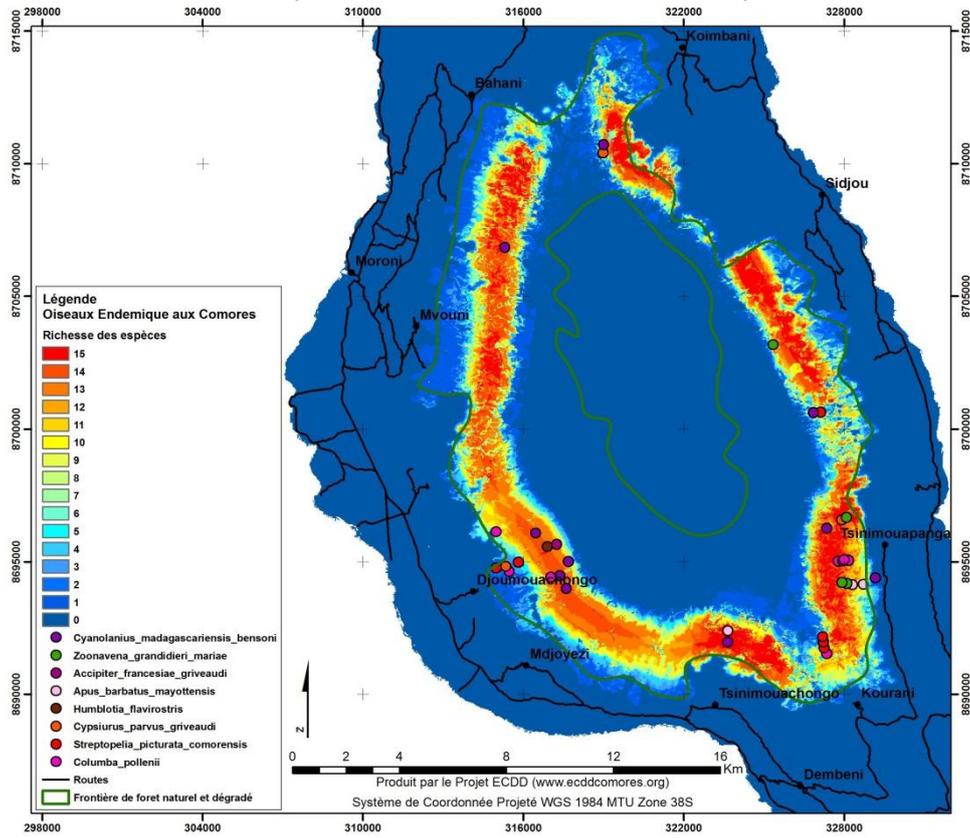
Map 1. Anjouan – bird species endemic to Anjouan only



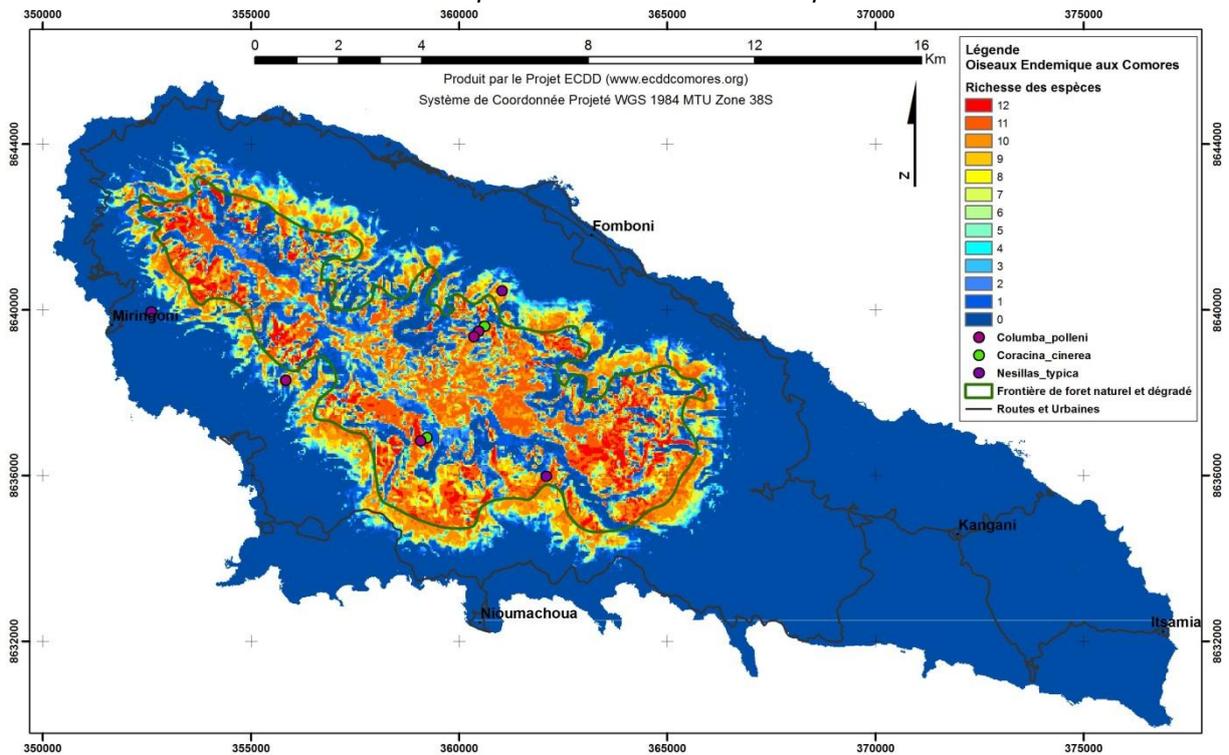
Map 2. Anjouan – endemic bird species



Map 3. Grande Comore – endemic bird species



Map 4. Mohéli – endemic bird species

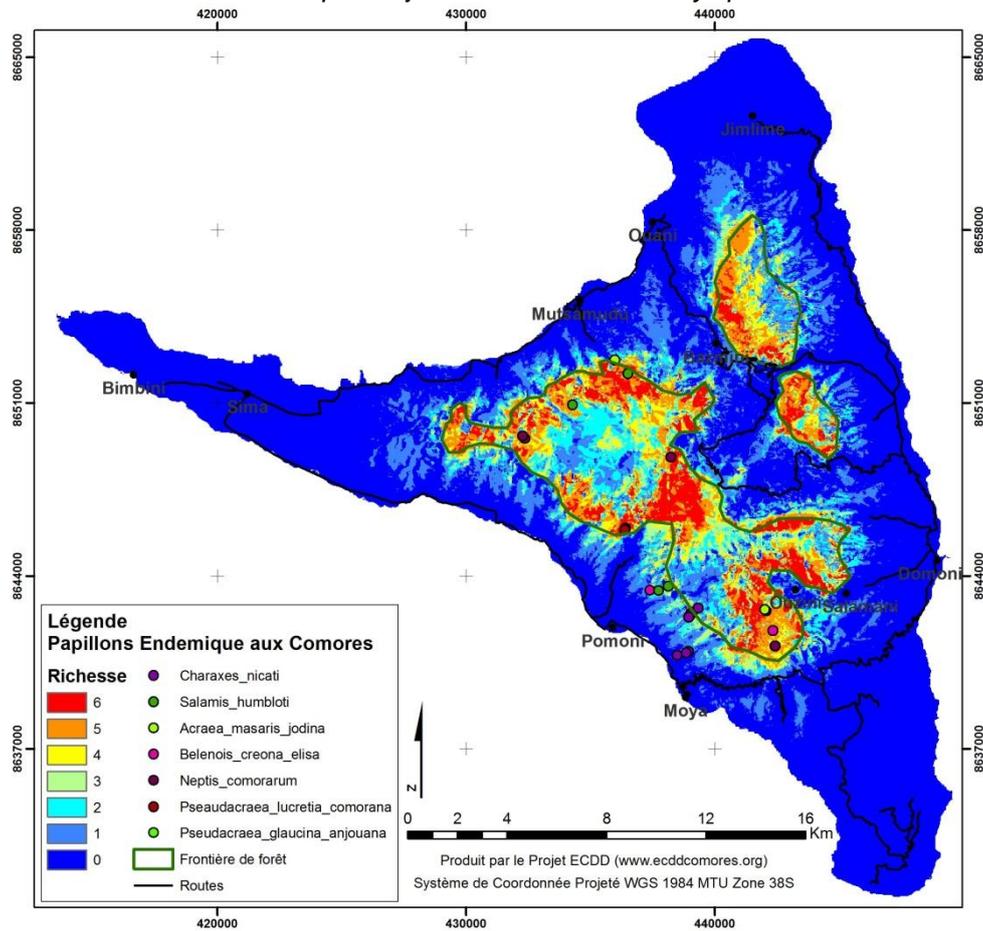


## 4.2. Butterflies

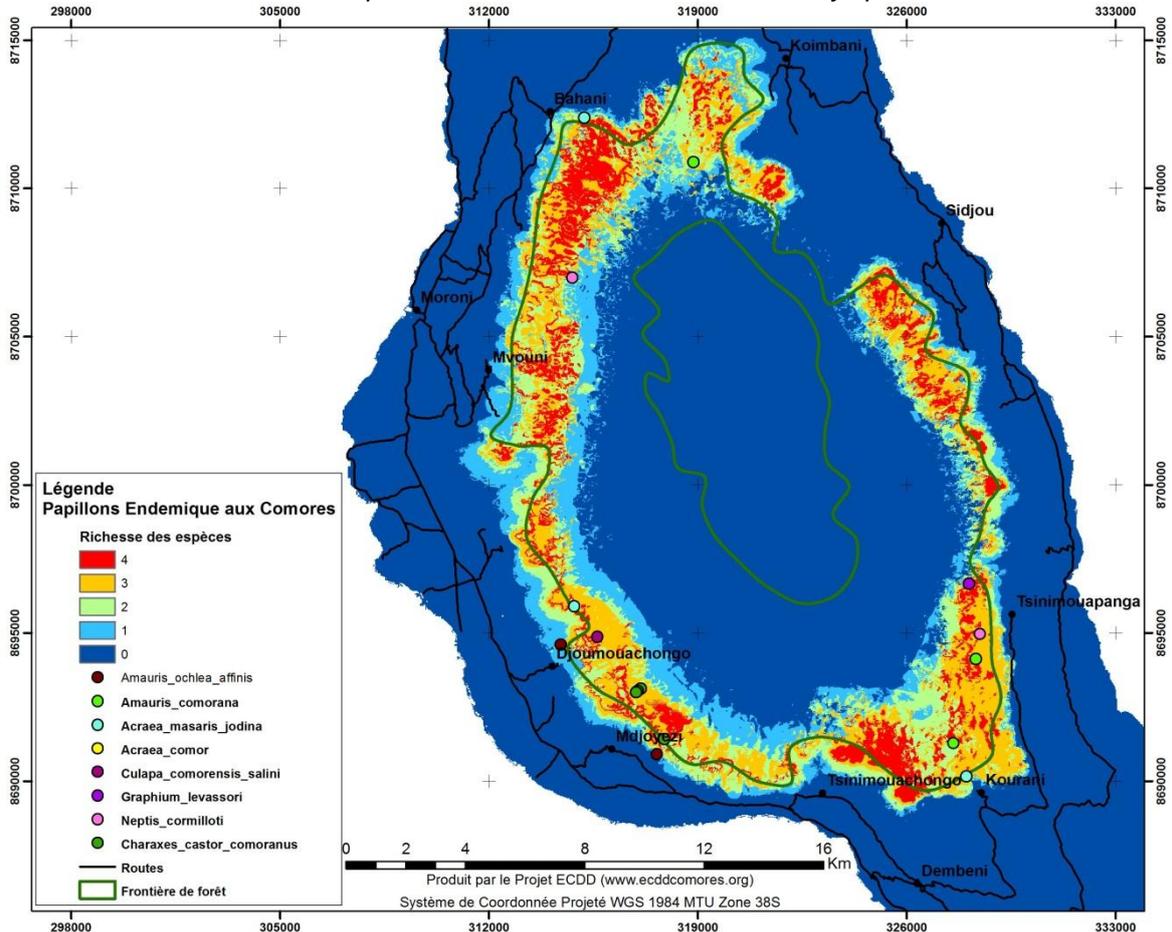
Table 4. Endemic butterfly species included in the niche suitability models

|   | Anjouan                              | Grande Comore                    | Mohéli                              |
|---|--------------------------------------|----------------------------------|-------------------------------------|
| <b>Within the niche suitability model</b>     |                                      |                                  |                                     |
| 1   | <i>Acraea masaris masaris</i>        | <i>Culapa comorensis salami</i>  | <i>Acraea masaris masaris</i>       |
| 2   | <i>Amauris ochlea moya</i>           | <i>Mylothris ngaziya</i>         | <i>Culapa comorensis comorensis</i> |
| 3   | <i>Culapa comorensis comorensis</i>  | <i>Papilio aristophontes</i>     |                                     |
| 4   | <i>Culapa subrufa</i>                | <i>Papilio dardanus humbloti</i> |                                     |
| 5   | <i>Mylothris humbloti</i>            |                                  |                                     |
| 6   | <i>Papilio epiphorbas guyonnaudi</i> |                                  |                                     |
|   |                                      |                                  |                                     |
| <b>Point distribution due to lack of data</b> |                                      |                                  |                                     |
| 1   | <i>Acraea masaris jodina</i>         | <i>Acraea masaris jodina</i>     | <i>Acraea masaris jodina</i>        |
| 2   | <i>Belenois creona elisa</i>         | <i>Amauris comorana</i>          | <i>Belenois creona elisa</i>        |
| 3   | <i>Charaxes nicati</i>               | <i>Amauris ochlea affinis</i>    | <i>Charaxes nicati</i>              |
| 4   | <i>Neptis comorarum comorarum</i>    | <i>Charaxes castor comoranus</i> | <i>Papilio epiphorbas</i>           |
| 5   | <i>Pseudacraea glaucina anjouana</i> | <i>Culapa comorensis salami</i>  |                                     |
| 6   | <i>Pseudacraea lucretia comorana</i> | <i>Graphium levassori</i>        |                                     |
| 7   | <i>Salamis humbloti</i>              | <i>Neptis cormilloti</i>         |                                     |

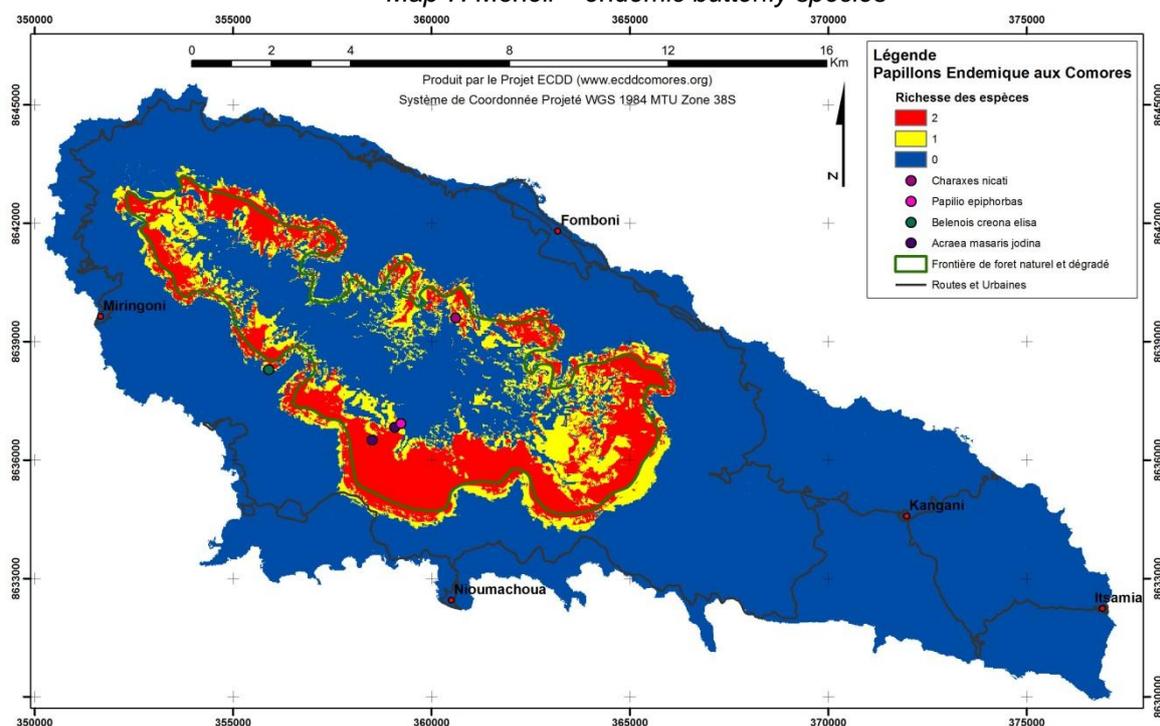
Map 5. Anjouan – endemic butterfly species



Map 6. Grande Comore – endemic butterfly species



Map 7. Mohéli – endemic butterfly species

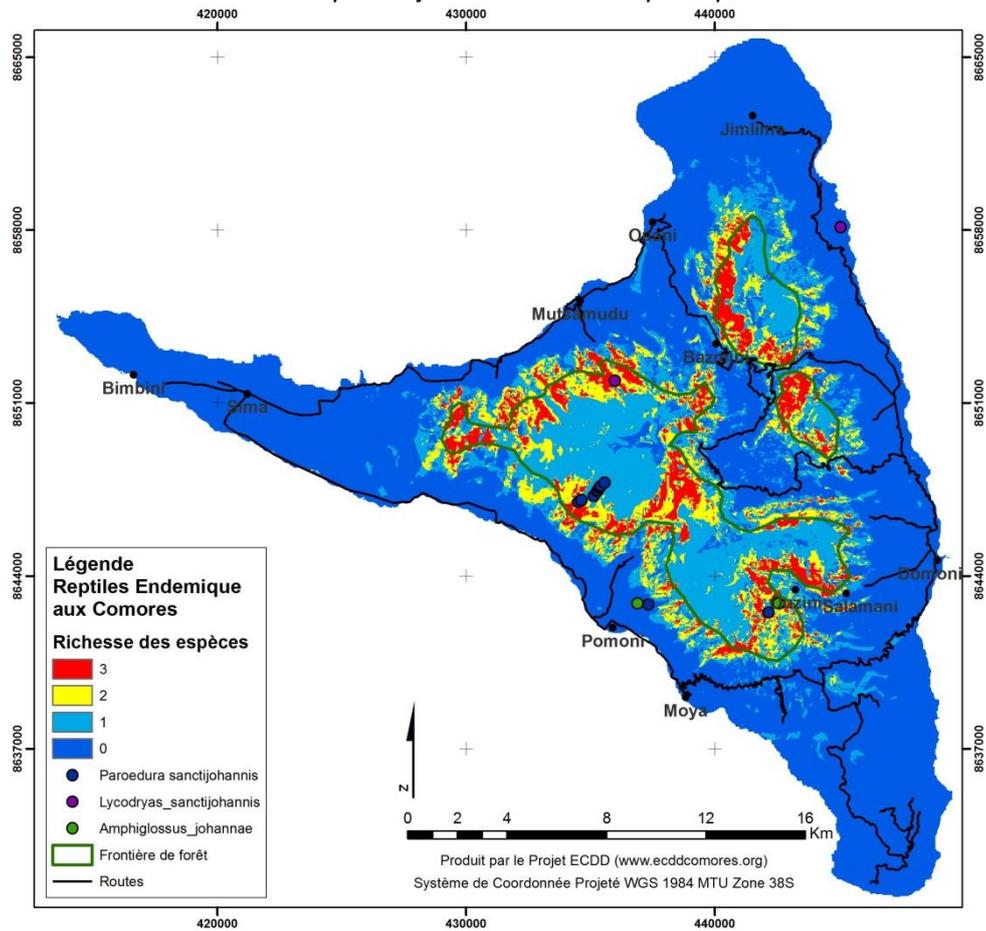


### 4.3. Reptiles

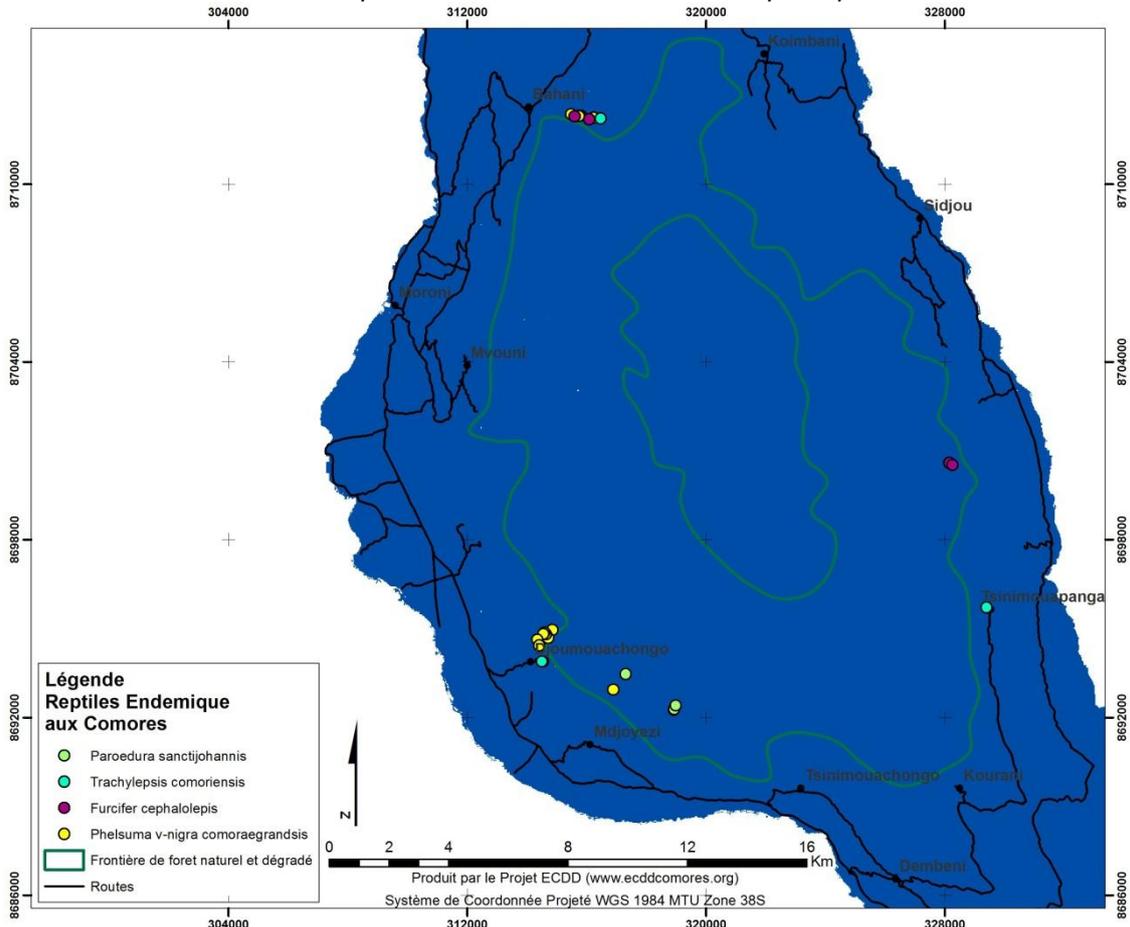
Table 5. Endemic reptile species included in the niche suitability models

|   | Anjouan                             | Grande Comore                             | Mohéli                          |
|---|-------------------------------------|---|---------------------------------|
| <b>Within the niche suitability model</b>     |                                     |   |                                 |
| 1   | <i>Trachylepis comoriensis</i>      |   | <i>Trachylepis comoriensis</i>  |
| 2   | <i>Phelsuma vnigra anjouanensis</i> |   | <i>Phelsuma v-nigra v-nigra</i> |
| <b>Point distribution due to lack of data</b> |                                     |   |                                 |
| 1   | <i>Amphiglossus johanna</i>         | <i>Furcifer cephalolepis</i>              |                                 |
| 2   | <i>Lycodryas sanctijohannis</i>     | <i>Paroedura sanctijohannis</i>           |                                 |
| 3   | <i>Paroedura sanctijohannis</i>     | <i>Phelsuma v-nigra comoraegrandensis</i> |                                 |
| 4   |                                     | <i>Trachylepis comoriensis</i>            |                                 |

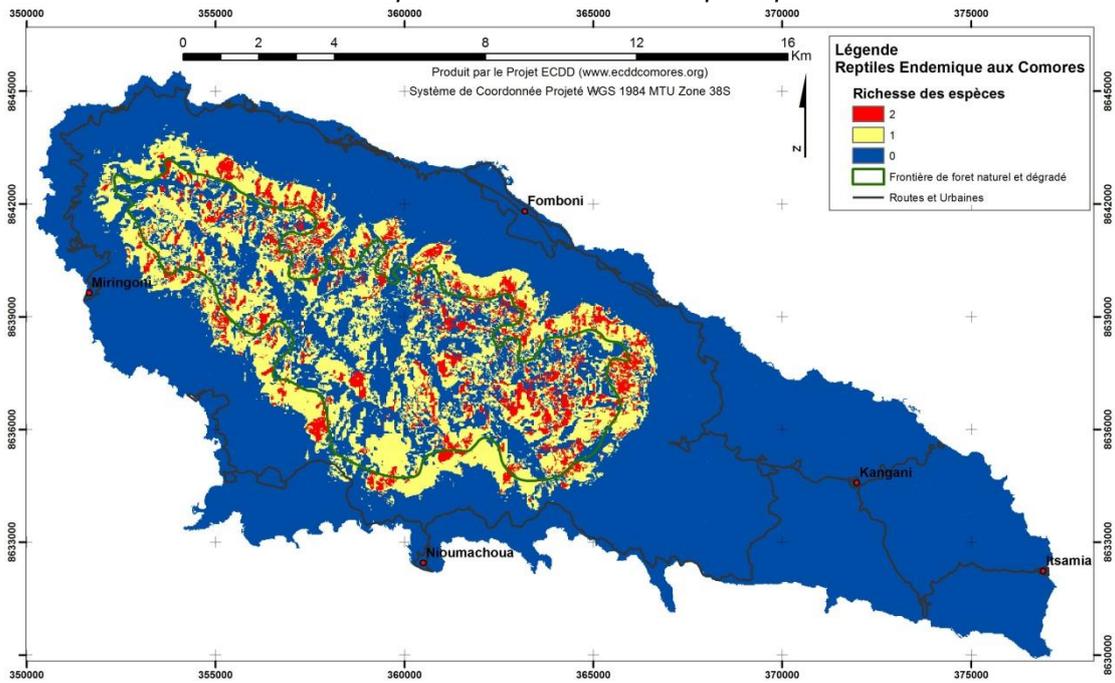
Map 8. Anjouan – endemic reptile species



Map 9. Grande Comore – endemic reptile species



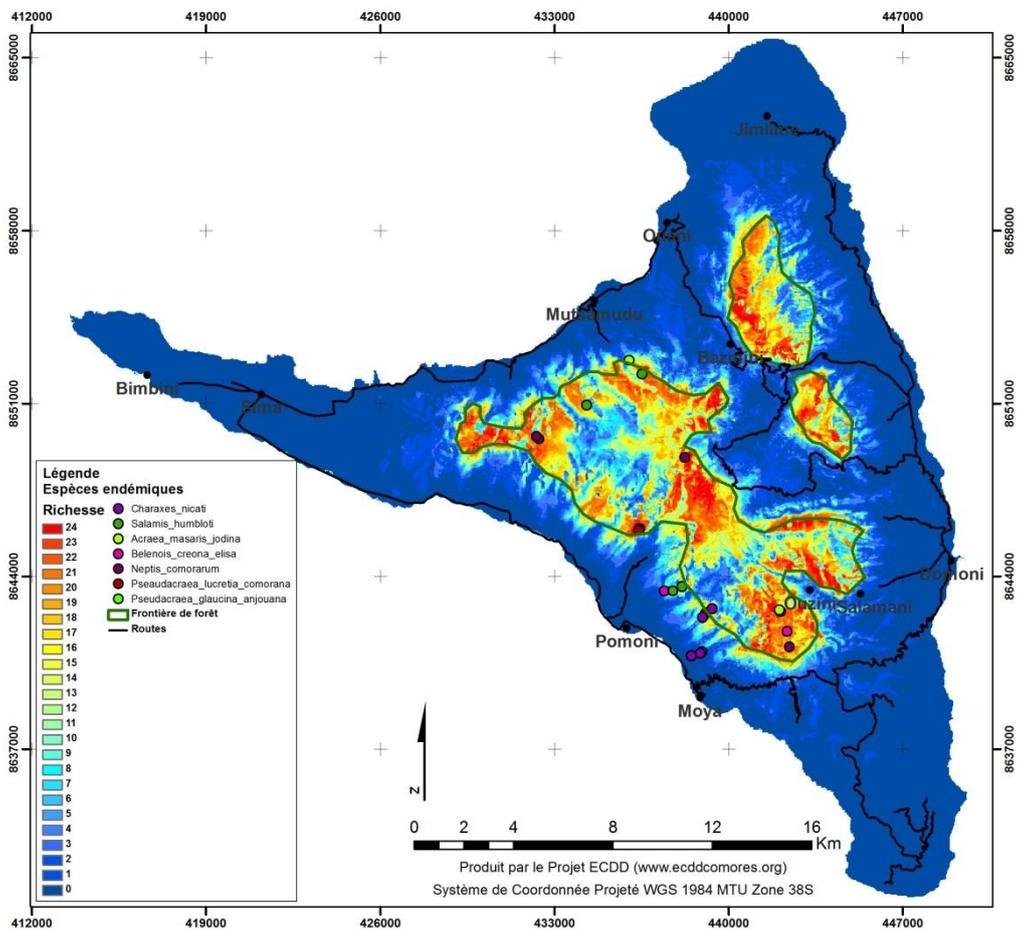
Map 10. Mohéli – endemic reptile species



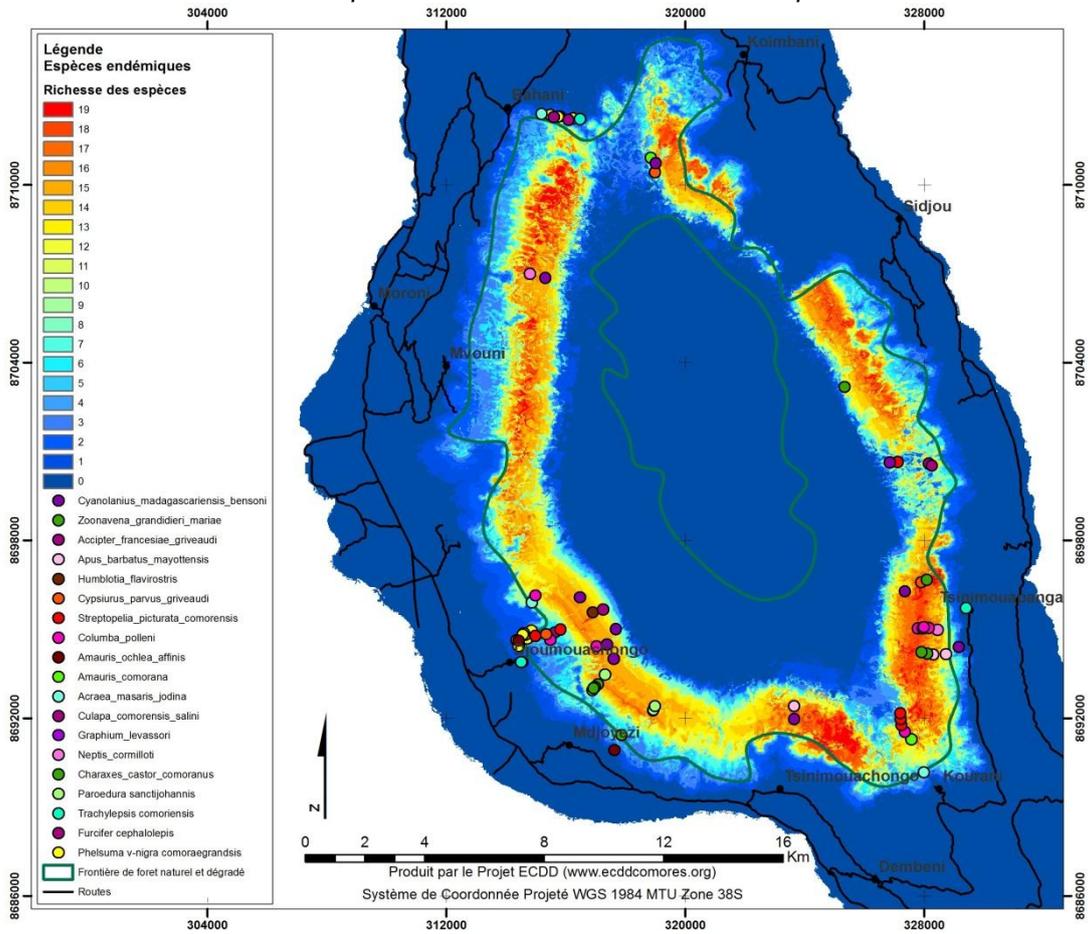
#### 4.4. Irreplaceability

All endemic species of birds, butterflies and reptiles listed above included.

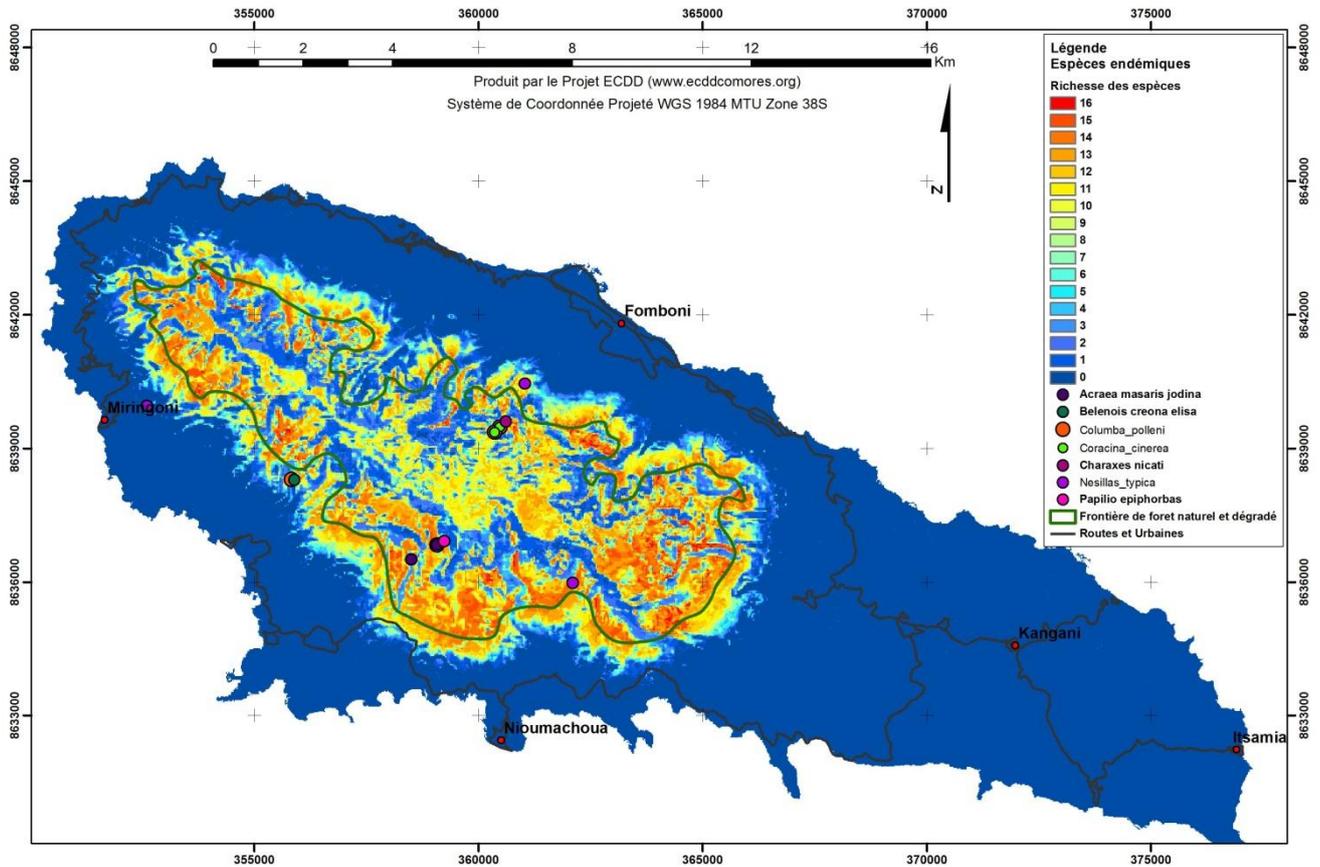
Map 11. Anjouan – all endemic species



Map 12. Grande Comore – all endemic species

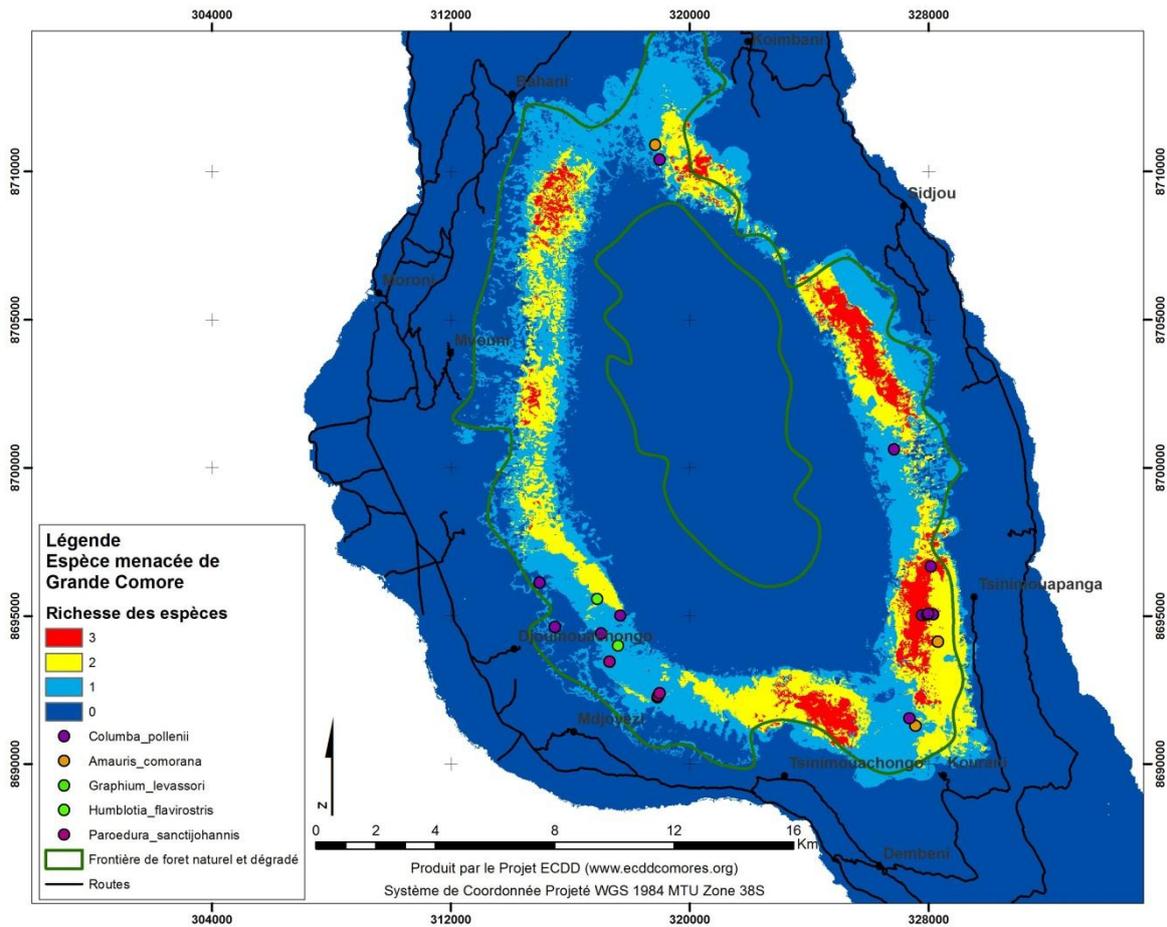


Map 13. Mohéli – all endemic species

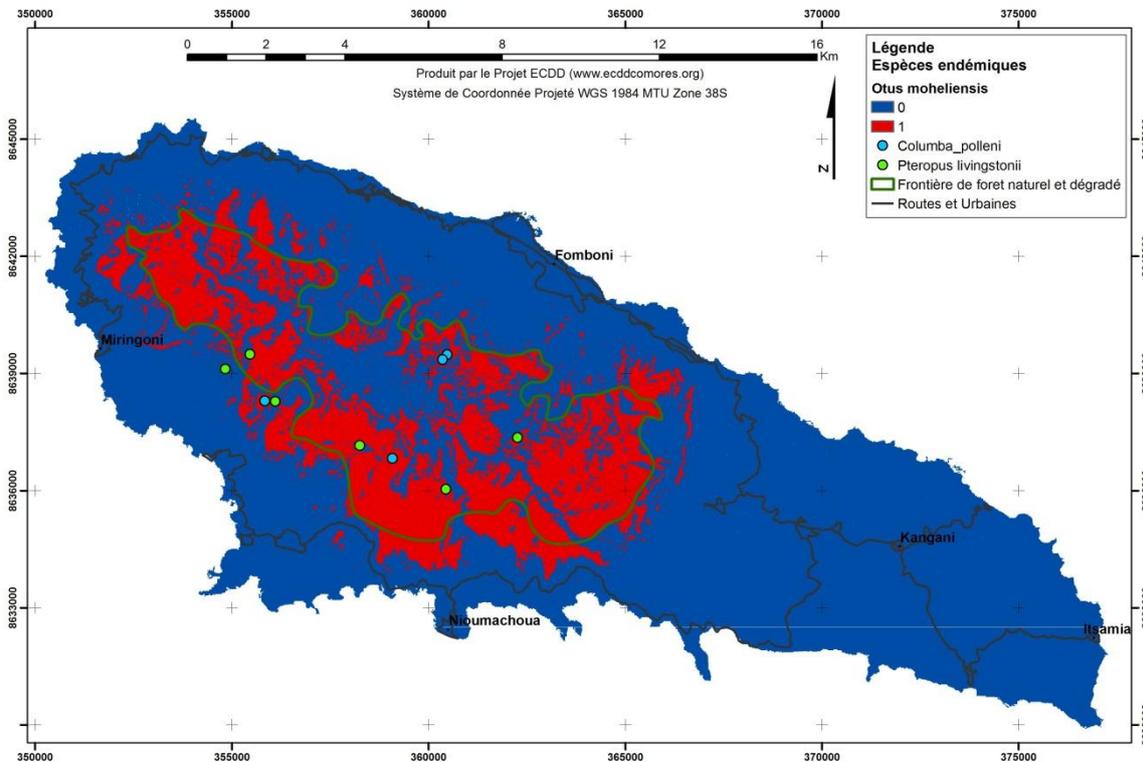




Map 15. Grande Comore – all threatened species



Map 16. Mohéli – all threatened species



## 5. Discussion

This is the first time that the results of detailed ecological field surveys have been combined with statistical modelling to provide spatial data on ecological patterns in the Comoro Islands. The results are intended to inform conservation planning by providing distribution data on individual endemic species and groups of threatened species. They can contribute to the zoning of protected areas and other conservation schemes by identifying the most important areas for protection, and the areas that if protected, will conserve the most numbers of threatened species. They also form a baseline for future monitoring and the evaluation of the impact of different conservation interventions.

The results show that the differing ecological requirements of different taxa will need to be taken into account in the zoning of protection schemes. Endemic birds seem to be more dependent on forest and present at higher altitudes, butterflies favour mid-altitudes, and reptiles lower altitudes. These last two taxa require breaks in closed canopy cover and are thus not good indicators of the health of natural forest.

Care should be taken with the use of the results as, being models, they cannot be 100% accurate. However, given that they were based on GPS records of observations, and that models were only produced for taxa with sufficient field observations, we believe they are robust. We also performed assessments of the accuracy of the different models produced for each species, selecting that which showed the best fit to the data for the final results.

The results will be made available through the project website [www.ecddcomoros.org](http://www.ecddcomoros.org), and will be exploitable by all interested parties through an open source license. All data and GIS layers are also being transferred to the relevant Comorian authorities, and are available to researchers through signing a memorandum – see contact details on page 2.

## Appendix 1. Species recorded in the field

Table 7. List of bird species observed in Anjouan, Grande Comore, and Mohéli

| No. | Species  | Island |    |    | Endemicity |         |     |
|-----|--|--------|----|----|------------|---------|-----|
|     |  | An     | GC | Mo | Island     | Comoros | Non |
| 1   | <i>Accipiter francesiae griveaudi</i>          |        | x  |    | x          |         |     |
| 2   | <i>Accipiter francesiae pusillus</i>           | x      |    |    | x          |         |     |
| 3   | <i>Acridotheres tristis</i>                    | x      | x  | x  |            |         | x   |
| 4   | <i>Alectroenas sganzeni sganzeni</i>           | x      | x  | x  |            | x       |     |
| 5   | <i>Apus barbatus mayottensis</i>               | x      | x  |    |            | x       |     |
| 6   | <i>Bubulcus ibis</i>                           | x      |    | x  |            |         | x   |
| 7   | <i>Casmerodius albus</i>                       | x      | x  |    |            |         | x   |
| 8   | <i>Nectarinia humbloti humbloti</i>            |        | x  |    | x          |         |     |
| 9   | <i>Nectarinia humbloti moheliicus</i>          |        |    | x  | x          |         |     |
| 10  | <i>Nectarinia notatus moebii</i>               |        | x  |    | x          |         |     |
| 11  | <i>Nectarinia notatus voeltzkowi</i>           |        |    | x  | x          |         |     |
| 12  | <i>Nectarinia comorensis</i>                   | x      |    |    | x          |         |     |
| 13  | <i>Circus mascroscelus</i>                     | x      |    | x  |            |         | x   |
| 14  | <i>Columba pollenii</i>                        | x      | x  | x  |            | x       |     |
| 15  | <i>Coracina cinerea cucullata</i>              |        | x  |    | x          |         |     |
| 16  | <i>Coracina cinerea moheliensis</i>            |        |    | x  | x          |         |     |
| 17  | <i>Coracopsis nigra sibilans</i>               | x      | x  |    |            | x       |     |
| 18  | <i>Coracopsis vasa comorensis</i>              | x      | x  | x  |            | x       |     |
| 19  | <i>Corvus albus</i>                            | x      | x  | x  |            |         | x   |
| 20  | <i>Coturnix coturnix</i>                       | x      |    |    |            |         | x   |
| 21  | <i>Corythornis vintsioides johannae</i>        |        |    | x  |            | x       |     |
| 22  | <i>Cyanolanius madagascariensis bensoni</i>    |        | x  |    | x          |         |     |
| 23  | <i>Cyanolanius madagascariensis comorensis</i> |        |    | x  | x          |         |     |
| 24  | <i>Cypsiurus parvus griveaudi</i>              | x      | x  | x  |            | x       |     |
| 25  | <i>Dicrurus forficatus potior</i>              | x      |    |    | x          |         |     |
| 26  | <i>Eurystomus glaucurus</i>                    | x      |    |    |            |         | x   |
| 27  | <i>Falco peregrinus</i>                        | x      |    | x  |            |         | x   |
| 28  | <i>Foudia eminentissima consobrina</i>         |        | x  |    | x          |         |     |
| 29  | <i>Foudia madagascariensis</i>                 | x      | x  | x  |            |         | x   |
| 30  | <i>Foudia eminentissima anjouanensis</i>       | x      |    |    | x          |         |     |
| 31  | <i>Foudia eminentissima eminentissima</i>      |        |    | x  | x          |         |     |
| 32  | <i>Humblotia flavirostris</i>                  |        | x  |    | x          |         |     |
| 33  | <i>Hypsipetes madagascariensis</i>             | x      | x  | x  |            |         | x   |
| 34  | <i>Hypsipetes parvirostris parvirostris</i>    |        | x  |    | x          |         |     |
| 35  | <i>Hypsipetes parvirostris moheliensis</i>     |        |    | x  | x          |         |     |
| 36  | <i>Leptosomus discolor</i>                     |        |    | x  |            |         | x   |
| 37  | <i>Leptosomus discolor gracilis</i>            |        | x  |    | x          |         |     |
| 38  | <i>Leptosomus discolor intermedius</i>         | x      |    |    | x          |         |     |
| 39  | <i>Lonchura cucullata</i>                      | x      | x  | x  |            |         | x   |
| 40  | <i>Merops superciliosus</i>                    |        |    | x  |            |         | x   |
| 41  | <i>Nesillas mariae</i>                         |        |    | x  | x          |         |     |
| 42  | <i>Nesillas brevicaudata</i>                   |        | x  |    | x          |         |     |
| 43  | <i>Nesillas typica moheliensis</i>             |        |    | x  | x          |         |     |
| 44  | <i>Nesillas typica longicaudata</i>            | x      |    |    | x          |         |     |
| 45  | <i>Numida meleagris</i>                        | x      |    |    |            |         | x   |
| 46  | <i>Otus capnodes</i>                           | x      |    |    | x          |         |     |
| 47  | <i>Otus moheliensis</i>                        |        |    | x  | x          |         |     |
| 48  | <i>Otus pauliani</i>                           |        | x  |    | x          |         |     |
| 49  | <i>Phaethon lepturus</i>                       | x      |    |    |            |         | x   |
| 50  | <i>Saxicola torquata voeltzkowi</i>            |        | x  |    | x          |         |     |
| 51  | <i>Streptopelia picturata comorensis</i>       | x      | x  | x  |            | x       |     |
| 52  | <i>Streptopelia capicola</i>                   | x      |    | x  |            |         | x   |
| 53  | <i>Tachybaptus ruficollis</i>                  | x      |    |    |            |         | x   |
| 54  | <i>Terpsiphone mutata comoroensis</i>          |        | x  |    | x          |         |     |
| 55  | <i>Terpsiphone mutata vulpina</i>              | x      |    |    | x          |         |     |
| 56  | <i>Terpsiphone mutata voeltzkowiana</i>        |        |    | x  | x          |         |     |
| 57  | <i>Turdus bewsheri comorensis</i>              |        | x  |    | x          |         |     |
| 58  | <i>Turdus bewsheri bewsheri</i>                | x      |    |    | x          |         |     |
| 59  | <i>Turdus bewsheri moheliensis</i>             |        |    | x  | x          |         |     |
| 60  | <i>Treron australis griveaudi</i>              |        |    | x  | x          |         |     |

|    |   |                        |   |   |   |   |  |   |
|----|---|------------------------|---|---|---|---|--|---|
| 61 | <i>Tutur tympanistria</i>                   | Tourerelle tambourette |   |   | x |   |  | x |
| 62 | <i>Tyto_alba</i>                            | Chouette effraie       | x |   |   |   |  | x |
| 63 | <i>Zoonavena grandidieri mariae</i>         | Martinet de Grandidier |   | x |   | x |  |   |
| 64 | <i>Zosterops maderaspatana kirki</i>        | Zostérops malgache     |   | x |   | x |  |   |
| 65 | <i>Zosterops mouroniensis</i>               | Zostérops du Karthala  |   | x |   | x |  |   |
| 66 | <i>Zosterops maderaspatana comorensis</i>   | Zostérops malgache     |   |   | x | x |  |   |
| 67 | <i>Zosterops maderaspatana anjouanensis</i> | Zostérops malgache     | x |   |   | x |  |   |

Table 8. List of butterfly species observed in Anjouan, Grande Comore, and Mohéli

| No. | Species                                 | Island |    |    | Endemicity |         |     |
|-----|---|--------|----|----|------------|---------|-----|
|     |   | An     | GC | Mo | Island     | Comoros | Non |
| 1   | <i>Acraea dammii</i>                    | x      |    |    |            |         | x   |
| 2   | <i>Acraea eponina</i>                   | x      |    | x  |            |         | x   |
| 3   | <i>Acraea igati</i>                     | x      |    | x  |            |         | x   |
| 4   | <i>Acraea lia</i>                       | x      |    | x  |            |         | x   |
| 5   | <i>Acraea masaris jodina</i>            | x      | x  | x  |            | x       |     |
| 6   | <i>Acraea masaris masaris</i>           | x      |    | x  |            | x       |     |
| 7   | <i>Acraea neobule</i>                   | x      | x  | x  |            |         | x   |
| 8   | <i>Acraea ranavalona</i>                | x      | x  | x  |            |         | x   |
| 9   | <i>Amauris comorana</i>                 |        | x  |    | x          |         |     |
| 10  | <i>Amauris ochlea affinis</i>           |        | x  |    | x          |         |     |
| 11  | <i>Amauris ochlea moya</i>              | x      |    |    | x          |         |     |
| 12  | <i>Appias sabina comorensis</i>         | x      |    |    | x          |         |     |
| 13  | <i>Belenois creona elisa</i>            | x      |    | x  |            | x       |     |
| 14  | <i>Bicyclus anynana</i>                 | x      | x  |    |            |         | x   |
| 15  | <i>Byblia anvatarea anvatarea</i>       | x      | x  |    |            |         | x   |
| 16  | <i>Catopsilis florella</i>              | x      | x  | x  |            |         | x   |
| 17  | <i>Charaxes castor comoranus</i>        |        | x  |    | x          |         |     |
| 18  | <i>Charaxes nicati</i>                  | x      |    | x  |            | x       |     |
| 19  | <i>Colotis euipe omphale</i>            |        | x  |    |            |         | x   |
| 20  | <i>Culapa comorana</i>                  |        | x  |    | x          |         |     |
| 21  | <i>Culapa comorensis comorensis</i>     | x      |    | x  |            | x       |     |
| 22  | <i>Culapa comorensis salami</i>         |        | x  |    | x          |         |     |
| 23  | <i>Culapa subrufa</i>                   | x      |    |    | x          |         |     |
| 24  | <i>Cynthia cardui</i>                   | x      |    |    |            |         | x   |
| 25  | <i>Danaus chrysippus aegyptius</i>      | x      | x  | x  |            |         | x   |
| 26  | <i>Eurytela dryope lineata</i>          | x      | x  |    |            |         | x   |
| 27  | <i>Graphium levassori</i>               |        | x  |    | x          |         |     |
| 28  | <i>Hypolimnas anthedon drucei</i>       | x      |    | x  |            |         | x   |
| 29  | <i>Hypolimnas misippus</i>              | x      |    |    |            |         | x   |
| 30  | <i>Junonia oenone oenone</i>            | x      | x  |    |            |         | x   |
| 31  | <i>Junonia orythia madagascariensis</i> | x      |    |    |            |         | x   |
| 32  | <i>Junonia rhadama</i>                  | x      | x  |    |            |         | x   |
| 33  | <i>Melanitis leda helena</i>            | x      |    |    |            |         | x   |
| 34  | <i>Mylothris humbloti</i>               | x      |    |    | x          |         |     |
| 35  | <i>Mylothris ngaziya</i>                |        | x  |    | x          |         |     |
| 36  | <i>Neptis comorarum comorarum</i>       | x      |    |    | x          |         |     |
| 37  | <i>Neptis cormilloti</i>                |        | x  |    | x          |         |     |
| 38  | <i>Papilio aristophontes</i>            |        | x  |    | x          |         |     |
| 39  | <i>Papilio dardanus humbloti</i>        |        | x  |    | x          |         |     |
| 40  | <i>Papilio demodocus</i>                | x      | x  | x  |            |         | x   |
| 41  | <i>Papilio epiphorbas</i>               |        |    | x  | x          |         |     |
| 42  | <i>Papilio epiphorbas guyonnaudi</i>    | x      |    |    | x          |         |     |
| 43  | <i>Phalanta phalanta aethiopica</i>     | x      | x  | x  |            |         | x   |
| 44  | <i>Pseudacraea glaucina anjouana</i>    | x      |    |    | x          |         |     |
| 45  | <i>Pseudacraea lucretia comorana</i>    | x      |    |    | x          |         |     |
| 46  | <i>Salamis humbloti</i>                 | x      |    |    | x          |         |     |

Table 9. List of reptile species observed in Anjouan, Grande Comore, and Mohéli

| No. | Species                                   | Island |    |    | Endemicity |         |     |
|-----|---|--------|----|----|------------|---------|-----|
|     |   | An     | GC | Mo | Island     | Comoros | Non |
| 1   | <i>Amphiglossus johannae</i>              | x      |    |    |            | x       |     |
| 2   | <i>Ebenavia inunguis</i>                  | x      |    |    |            |         | x   |
| 3   | <i>Furcifer cephalolepis</i>              |        | x  |    | x          |         |     |
| 4   | <i>Geckolepis maculata</i>                | x      |    |    |            |         | x   |
| 5   | <i>Hemidactylus brooki</i>                | x      |    |    |            |         | x   |
| 6   | <i>Hemidactylus mercatorius</i>           | x      |    |    |            |         | x   |
| 7   | <i>Hemidactylus platycephalus</i>         | x      | x  | x  |            |         | x   |
| 8   | <i>Lycodryas sanctijohannis</i>           | x      |    |    |            | x       |     |
| 9   | <i>Paroedura sanctijohannis</i>           | x      | x  |    |            | x       |     |
| 10  | <i>Phelsuma dubia</i>                     | x      | x  | x  |            |         | x   |
| 11  | <i>Phelsuma laticaudata</i>               | x      |    |    |            |         | x   |
| 12  | <i>Phelsuma vnigra anjouanensis</i>       | x      |    |    | x          |         |     |
| 13  | <i>Phelsuma v-nigra comoraegrandensis</i> |        | x  |    | x          |         |     |
| 14  | <i>Phelsuma v-nigra v-nigra</i>           |        |    | x  | x          |         |     |
| 15  | <i>Trachylepis comoriensis</i>            | x      | x  | x  |            |         | x   |
| 16  | <i>Trachylepis striata</i>                | x      |    |    |            |         | x   |

Table 10. Endemicity of the fauna observed in Anjouan, Grande Comore, and Mohéli

|                      | Endemic to the island | Endemic to the Comoros | Non-endemic | Total |
|----------------------|-----------------------|------------------------|-------------|-------|
| <b>Grande Comore</b> |                       |                        |             |       |
| Birds                | 16                    | 7                      | 6           | 29    |
| Reptiles             | 2                     | 1                      | 3           | 6     |
| Butterflies          | 10                    | 1                      | 12          | 23    |
| <b>Anjouan</b>       |                       |                        |             |       |
| Birds                | 9                     | 7                      | 16          | 32    |
| Reptiles             | 1                     | 3                      | 9           | 13    |
| Butterflies          | 9                     | 5                      | 20          | 34    |
| <b>Mohéli</b>        |                       |                        |             |       |
| Birds                | 13                    | 6                      | 12          | 31    |
| Reptiles             | 1                     | 0                      | 3           | 4     |
| Butterflies          | 1                     | 5                      | 10          | 16    |

## Appendix 2. Data available

This data has been provided to the government and is available to any interested researchers through signing a memorandum of understanding on its use - see contact details on Page 2.

Table 11. Details of the data layers

| Data                 | Details                                    | Name of file/folder  |
|----------------------|--|--|
| Anj presence         | Birds - All endemic species                | Allendcom.xlsx and .csv                                    |
|                      | Birds – Otus capnodes                      | Scops.xlsx and .csv  |
|                      | Butterflies – all endemic species          | Butterfly_allspecies.xlsx and .csv                         |
|                      | Reptile – all endemic species              | Reptile_allEnd_presence.xlsx and .csv                      |
|                      | Point distributions only                   | Pointdistonly  |
| GC presence          | Birds – all endemic species including Otus | Birds  |
|                      | Butterflies – all endemic species          | Butterflies  |
|                      | Reptiles – all endemic species             | Reptiles   |
| Mo presence          | Birds – all endemic species                | Birds_all_ends.xlsx and .csv                               |
|                      | Butterflies – all endemic species          | Butterfly_allends.xlsx and .csv                            |
|                      | Reptiles – all endemic species             | Phelsuma_vnigra and Trachylepsis_comorensis .xlsx and .csv |
|                      | Otus moheliensis                           | Otus Mo presence.xlsx and .csv                             |
| Environmental Layers | Anjouan                                    | ASCII  |
|                      | GC   | ASCII  |
|                      | Mohéli                                     | ASCII  |
| SDMs - Anjouan       | All taxa models                            | MaxEnt models.zip  |
| SDMs - GC            | All taxa models                            | MaxEnt models.zip  |
| SDMs - Mo            | All taxa models                            | MaxEnt models.zip  |
| Forest boundary      | Anjouan                                    | Forest_outline.shp   |
|                      | GC   | GC_forest_erase_smooth.shp                                 |
|                      | Mohéli                                     | Forestcore_smooth.shp                                      |
| Roads                | Anjouan                                    | Anjouan_roads_project.shp                                  |
|                      | GC   | Roads_gc_project.shp                                       |
|                      | Mohéli                                     | Rdsurb.shp   |
| Towns                | Anjouan                                    | Anjouan_urban.shp  |
|                      | GC   | GC_villages_project.shp                                    |
|                      | Mohéli                                     | Mo_towns.shp   |