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sustainable environment, education & development

SEED's Conservation Research Programme

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Executive Summary

This report summarises the activities of SEED Madagascar's (SEED) Conservation Research Programme (SCRP) throughout 2024. Since its establishment in 2010, SCRP has worked closely with SEED's Environment and Rural Livelihoods Department, the local Sainte Luce community, international institutions, and local authorities to understand the importance and use of the littoral forest and surrounding habitats and contribute towards its long-term protection.

In collaboration with the University of Antananarivo, represented by the l'Ecole Supérieure of Agronomic Science (ESSA), SCRP aims to expand scientific knowledge, support conservation of native fauna and flora, and highlight the importance of biodiversity and conservation in Sainte Luce through dissemination of learnings locally, regionally, and internationally.

Throughout 2024, SCRP has achieved success across multiple areas of the conservation programme. At the project level, SCRP completed 11 years of long-term lemur population monitoring, and six years of long-term amphibian and reptile monitoring across four forest fragments. SCRP also completed the first round of Project Palms in-situ planting of 1,009 seedlings across the six species of threatened palms. Project Ala has seen the continued use of camera traps, with photographs of Thomas' dwarf lemur (*Cheirogaleus thomasi*) captured, and invertebrate and herpetofauna surveys to monitor the changing animal community as the corridors slowly establish. New botanical surveys have been established within the Ala corridors to monitor the changes in the plant community. SCRP has now ended the monitoring of survival and growth of planted native trees in-situ within the corridors. SCRP has been working on producing an interactive map (Figure 12) to look at how different conservation and livelihood aspects interact and overlap within Sainte Luce.

Project Phelsuma began in 2024 with the aim to study the critically endangered *Phelsuma antanosy* in the main last remaining habitat in the Sainte Luce littoral forest and inform a future trial translocation of the geckos in 2025. Trial transplantations of the host plant species *Pandanus longistylus* are being conducted, with more transplantations and monitoring continuing through to 2025. SCRP national and international staff have attended a cross-visit to the other remaining habitat of *P. antanosy* in Ambatotsirongorongo, southwest of Sainte Luce to survey for the species. This information will be added to SCRP's analysis of population density and used to update the IUCN Red List threat status for the species.

This year SCRP welcomed 21 volunteers to Sainte Luce, providing integral support to the research programme.

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1. Introduction

SCRP's work is focussed in the extreme southeast of Madagascar within the littoral forests of Sainte Luce, Anosy region (Figure 3). Covering approximately 1,500-1,600 hectares, Sainte Luce's littoral forest fragments are amongst the largest and most intact examples of this threatened habitat type remaining in Madagascar. Sainte Luce's littoral forests are believed to be naturally fragmented, however a variety of pressures including reliance on natural resources by local communities and climate change are further reducing the size and quality of the 17 remaining littoral forest fragments. In addition, proposed mining operations in the region by QIT Madagascar Minerals (QMM), a subsidiary of Anglo-Australian multinational mining company Rio Tinto, proposes to exploit large areas of land, with many forest fragments standing within the mining footprint. To mitigate some of the impacts caused by the proposed mining operations, QMM has created Conservation Zones (CZ), within which mining will not take place, and it is illegal to harvest natural resources. The majority area of three (S8, S9, and S17) of the forest fragments are CZs and are protected, whilst the S6 and S7 fragments have been designated as Community Resource Zones (CRZ) and can be used to access natural resources (Figure 1). SCRP works in all five of these fragments, with transects used for long-term monitoring established in S7, S8, S9, and S17. SCRP has created two new transects in S6 to increase the amount of long-term data being collected for lemurs and herpetofauna. They continue to regularly visit S6 to conduct population assessments of the Madagascar flying fox (*Pteropus rufus*) colony.

In 2024, SCRP continued work on two main projects: the Ala Programme and Project Palms, and began working on Project Phelsuma. Field work for Project Mahampy was completed in August and SCRP was engaged with data analysis and report writing after this. As departmental capacity has increased, SCRP have continued research on smaller research areas, including Project Varika, and Project Rufus. SCRP has also assisted the SEED Madagascar Environment Programmes team with their field work when required, such as the monitoring of transplanted palms. Furthermore, SCRP has empowered members of local communities through their contribution to stand-alone conservation events for the transplantation of Project Palm seedlings, during which 1,009 seedlings were successfully transplanted from the nursery to designated sites in S8, S9 and S17. As always, SRCP collaborates continuously with local experts and local/regional forest management organisations (e.g. C.O.B.A.[1], F.I.M.P.I.A[2], and Policin'Ala[3]).

[1] C.O.B.A. – Communautés de Base – Forest Management Association
[2] F.I.M.P.I.A. - Fikambanan'ny Mpiaro ny Ala - Forestry Police Committee
[3] Policin'Ala – Local Forest Police

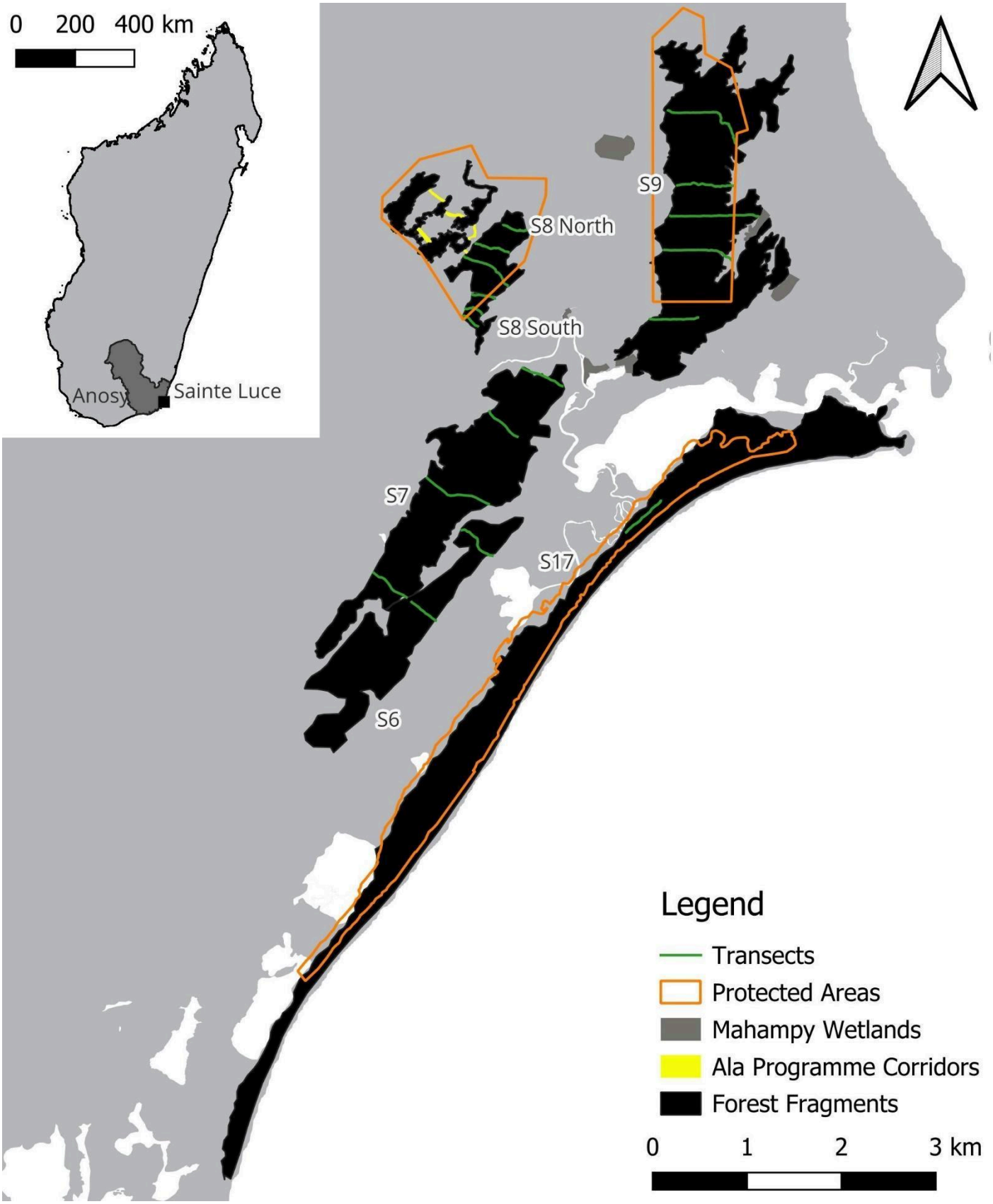


Figure 3: Map of Sainte Luce study site and the five largest and focal littoral forest fragments (S6, S7, S8 North, S8 South, S9 S17). The six Mahampy wetlands shown are the areas studied as part of Project Mahampy, and do not show the full extent of wetland habitats in Sainte Luce. The protected areas are QMM managed Category V Protected Areas.

2. Progress of Projects and Research

2.1 Long-term Monitoring of Nocturnal Lemur Species

In 2011 SCRP began visual encounter surveys (VES) along set transects (forest paths) recording sightings of three nocturnal lemur species in Sainte Luce: Anosy mouse lemur (*Microcebus tanosi*), Southern woolly lemur (*Avahi meridionalis*), and Thomas' dwarf lemur (*Cheirogaleus thomasi*). This study aims to compare population density and monitor changes in the population of each species in forest fragments over time. All three species are listed as Endangered by the IUCN Red List (Donati et al. 2020b, Donati et al. 2020c, Ganzhorn et al. 2020) and are only found in the southeast of Madagascar. Understanding the current population status and history of each of these keystone species[4] is important not only for the species' conservation, but because they are key indicators of the health of Sainte Luce's forests.

To date, monitoring has been conducted in four forest fragments: three *partially*[5] protected zones (S8, S9 and S17), and one community resource zone (S7). The protected zone of S8 is treated as two fragments (S8N and S8S) due a road which divides this fragment and impedes the natural movement of the lemurs. Two new transects have been established in S6 (a community resource zone) to add important data collection for the vulnerable fragment, with data collection having begun in November 2024. At the time of reporting, only one lemur survey has been undertaken in the new S6 transects, which is not sufficient to model any population estimates. A distance sampling approach is employed to allow population estimates to be extrapolated. Additional habitat information is also recorded of the tree inhabited at time of observation, including species, trunk circumference, height, and canopy cover.

Between January and December 2024, 64 nocturnal observational surveys were completed in four forest fragments, with 255 observations of lemurs made totalling individual 302 lemurs. The most frequently observed nocturnal species was *C. thomasi* (108 observations). The second most frequently observed lemur was *A. meriodionalis* with a total of 73 records. Least observed was *M. tanosi (*72 records).

The end of 2024 marks the completion of 11 years of data collection for the long-term monitoring of nocturnal lemurs. The data have been analysed to investigate the changes in population densities for *C. thomasi, A. meriodionalis,* and *M. tanosi*. The period analysed compared 2019 (consisting of 24-months of data collection from 2018/2019) with 2024 (consisting of 24 months of data collection from 2023/2024). These findings are presented in Table 1. Density of individuals was modelled using the *distance* package in R (Miller et al., 2019). The general trend for *M. tanosi* in all forest fragments was an increase in density (number of individuals per km^2) from the period of 2018/2019 to 2023/2024. The other two species *C. thomasi,* and *A. meriodionalis* both had lower densities in all forest fragments in 2023/2024 in comparison to 2018/2019, with the exception for *C. thomasi* in the S9 fragment. It is difficult to attest these population declines to any particular effect; however known hunting practises target these species. Whatever the cause, these population declines are highly concerning, especially considering the trend is evident across fragments regardless of protection level.

[4] Keystone species: a strongly interacting species that is disproportionately connected to more species in a food web (Mishra, Singh, and Shukla, 2019).

[5] The fragments are described as *partially* protected because the full mapped extent of the forest is not under the Category V recognized protection (see Figure 3).

Table 1: The density, with standard errors, per km2 for three species of lemur, Cheirogaleus thomasi, Avahi meridionalis and Microcebus tanosi, which are found in four forest fragments in Sainte Luce. S6 has been excluded as transects have only been completed once at the time of reporting.

	C. thomasi		*A. meriodionalis*		*M. tanosi*	
Year	2018/2019	2023/2024	2018/2019	2023/2024	2018/2019	2023/2024
S7	131 (±35.1)	50 (±8.7)	2 (±2.2)	0 (±0)	2 (±2.1)	4 (±2.2)
S8N	73 (±24.5)	51 (±6.5)	52 (±7.8)	39 (±7.8)	10 (±8.2)	19.7 (±3.1)
S8S	125 (±29.2)	21 (±22.4)	45 (±15.1)	39 (±20.6)	0 (±0)	21.6 (±1.4)
S9	50 (±12.2)	278 (±64.2)	79 (±10.9)	52 (±12.4)	29 (±5.3)	63 (±14.4)
S17	117 (±12.9)	44 (±5.6)	345 (±22.6)	80 (±8.1)	33 (±5.6)	116 (±7.2)

2.2 Long-term Monitoring of Diurnal and Nocturnal Herpetofauna Species

Madagascar exhibits high levels of endemism and threats amongst herpetofauna (amphibians and reptiles) species, with the herpetological community of Sainte Luce being no exception. SCRP has conducted herpetological studies since 2010, including specimen collection, genetic barcoding, and population monitoring through distance sampling. Based on this research, SCRP confirmed that at least 22 distinct species of amphibian and 54 species of reptile are present in Sainte Luce.

Since 2017, SCRP has conducted Visual Encounter Surveys (VES) of herpetofauna species using distance sampling methods, with the objective of monitoring species abundance and distribution in four littoral forest fragments (S7, S8, S9 and S17) over time. Two new transects have been established in S6 and data collection began in November 2024. As such, only one nocturnal and one diurnal survey have been carried out on these transects. The data for the S7, S8, S9, and S17 have been used to estimate population densities of a few key species within different forest fragments, in addition to the habitat associations and behaviour of each species.

Between January and December 2024, 128 herpetofauna surveys have been conducted across the five forest fragments; 64 nocturnal and 64 diurnal. During 2024, 4229 observations of 50 species have been made. The density calculations were completed for four fragments only (S7, S8, S9 and S17). However, anecdotally we found two individual *Anodonthyla nigrigularis* in S6 in November, proving this rare species is still present. During 2024, S8S showed the highest species diversity in accordance with a Shannon diversity index (2.57), while S8N showed the lowest (2.24). To understand the changes over time in species density, two locally common and two rare species of herpetofauna were analysed for density per forest fragment between two time periods: 2018/2019 and 2023/2024 (Table 2). *Guibemantis wattersoni*, a commonly encountered yet globally Endangered species of frog saw an increase in density in all but the S8N forest fragment. *Palleon sp. aff. nasus*, a locally common yet only recently described chameleon species, saw a decrease in density in all but the S9 fragment. Two rare species of frog *Anodonthyla nigrigularis*, showed a decrease in density from 2019 to 2024, in all forest fragments. *Guibemantis diphonus* showed a decrease in two forest fragments (S7 and S8S) and an increase in three forest fragments (S8N, S9 and S17). Although the rarity of the latter two species means obtaining accurate estimates of density is difficult, the general

trend is clear. Density of individuals was modelled using the *distance* package in R (Miller et al., 2019).

Table 2: The density, with standard errors, per km2 for two common herpetofauna species, Guibemantis wattersoni, and Palleon sp. aff. nasus, as well as two rare species of herpetofauna Anodonthyla nigrigularis, and Guibemantis diphonus which are found in four forest fragments in Sainte Luce. S6 has been excluded as transects have only been completed once at the time of reporting.

	G. wattersoni		*P. nasus*		*A. nigrigularis*		*G. diphonus*	
	2018/2019	2023/2024	2018/2019	2023/2024	2018/2019	2023/2024	2018/2019	2023/2024
S7	2221 (±214.9)	2908 (±303.1)	226 (±98.5)	174 (±53.2)	93 (±45.2)	78 (±38.06)	99 (±56.9)	46 (±18.3)
S8N	5371 (±1946.04)	4334 (±838.5)	850 (±168.8)	647 (±27.6)	268 (±92.9)	139 (±69.3)	33 (±17.7)	58 (±29.7)
S8S	623 (±402.6)	643 (±458.2)	1056 (±541.3)	821 (±319.1)	58 (±57.9)	27 (±30.2)	25 (±24.6)	0 (±0)
S9	1279 (±255.2)	1313 (±218.5)	1003 (±177.3)	1507 (±213.5)	10 (±10.8)	5 (±5.5)	137 (±51.3)	319 (±115.3)
S17	111 (±5.6)	207 (±9.02)	675 (±23.4)	529 (±19.9)	78 (±15.3)	127 (±7.7)	0 (±0)	191 (±24.9)

Figure 4: Subadult Furcifer lateralis in the research camp.

As SCRP progresses into 2025 having completed the sixth year of data collection for this research area, we aim to conduct a more comprehensive analysis of the collected data and identify patterns in abundance and distribution of particularly rare and threatened species. Findings will be shared with local stakeholders, as well as informing regional, national, and international audiences about Sainte Luce's unique herpetofauna assemblage.

2.3 Project Varika

The Red-collared brown lemur (*Eulemur collaris*, known locally as *Varika*) is the only cathemeral[6] lemur in Sainte Luce and is recognised as Endangered (Donati et al. 2020). The species is threatened throughout its range due to several pressures, including hunting for bushmeat, mining, and habitat loss. Red-collared brown lemurs play a key role in seed dispersal, pollination and maintaining forest health, while concurrently promoting regional tourism which provides supplementary income streams for the local community. In 2018, SCRP determined that this species had naturally recolonised S8, a protected forest fragment where they were previously absent from (Hyde Roberts, 2020b). This event prompted the need to evaluate the local populations of this species.

Figure 5: Male red-collared brown lemur (Eulemur collaris).

The original goal of Project Varika was to conduct an updated population assessment of *E. collaris* in the newly colonised S8 fragment to inform conservation efforts, such as corridor use. In combination with this aim, to better understand the remaining populations of *E. collaris* in S9 and S17, surveys were also conducted in these fragments. Daytime visual encounter surveys (VES) following established transects began in October 2021 and continued in 2024. Between January and December 2024, 48 surveys were conducted in S9 and S17. In total, 36 observations of *E. collaris* were made, and 178 individuals observed. Density of individuals was modelled using the *distance* package in R (Miller et al., 2019). The estimated density was also calculated from observations spanning 2023 to 2024. The results indicated that in S9 Varika had a density of 16 per km^2 (SE ±2.8), and in S17 they had a density of 30 per km^2 (SE ±4.7).

[6] Cathemeral: a pattern of activity observed in an animal that is neither solely diurnal, nocturnal or crepuscular, but instead is irregularly active during the day and night (Allaby, 2009)

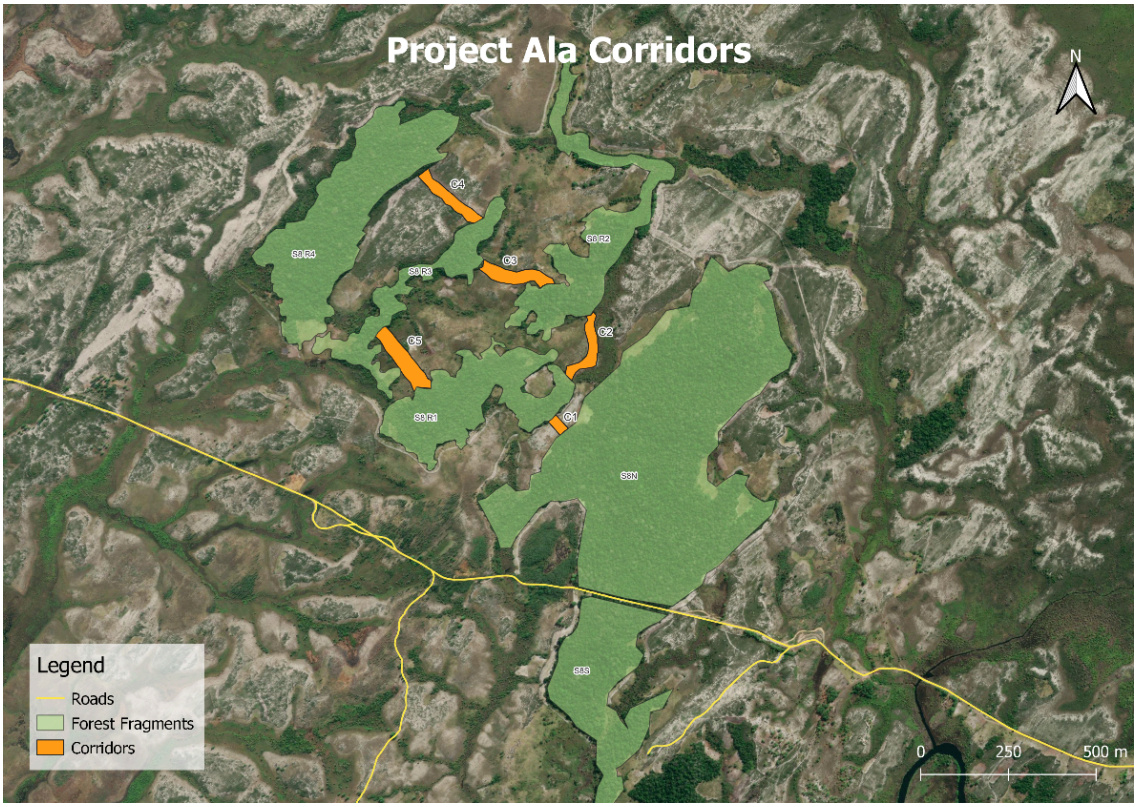
Due to the size of the S8 fragment and the small number of individuals within the colonising group, SCRP determined that transect-based VES was not appropriate for surveying this single group and instead opportunistic observations would be recorded. VES in S8 North and S8 South ended in June 2022. In May 2024 there were two opportunistic sightings of *E. collaris* in S8N. The first observation saw three individuals, two males and one female, in the southern part of S8N. The second observation was at the end of a nocturnal herpetofauna survey and saw the eyeshine of four individuals in a wetland on the western edge of S8N. Before these observations, *E. collaris* in the S8 forest fragments were last seen in April 2023, when a group of four individuals, two male and two female were seen moving through C1. This confirms the current presence of this group in S8N and their use of the Ala Programme's corridors.

2.4 Project Ala

The Ala Programme aims to re-connect isolated populations of three nocturnal lemur species in small forest remnants with a larger protected forest fragment (S8) through the establishment of forest corridors. Due to their arboreal nature, Sainte Luce's nocturnal lemur species are very reluctant to cross open ground to disperse into novel habitat, meaning that populations currently exist in isolated forest remnants surrounding S8 (Figure 6). Uniting forest remnants with each other, and with S8, will enable isolated subpopulations to merge, and increase viable habitat as well as facilitate genetic exchange. The Ala Programme planted five corridors (referred to as C1 through C5) (Figure 6). Three corridors were planted in 2019, C1, C3 and C4, one in 2020, C2, and one in 2022, C5. The corridors were initially planted with *Acacia magnium* seedlings, with the aim that this introduced plant will help native seedlings establish through the provision of shelter and shade, and improved soil fertility. In June 2024, a technical research report was completed for Project Ala for the conclusion of Phase II. Phase III of the project commenced in August 2024.

During 2024, faunal biodiversity was assessed using camera traps and VES across C1, C2, C3 and C4, (C5 is still too new to commence meaningful faunal monitoring). SCRP has continued to play a key role in monitoring the survival and growth of all planted seedlings, with 12 assessments of the native seedlings within set quadrats in each of the programme's five corridors taking place in 2024. At the end of 2023 the *Acacia* trees were deemed established and SCRP halted the monitoring of the species. Monitoring survival and growth of native seedlings continued until June 2024 when it was decided to end SCRP's involvement. The data will continue to be collected by the Programmes Team and used in the yearly analysis of survival and growth.

On the 15th of November, during a Herpetofauna VES survey in C3 two *C. thomasi* were observed within the corridor. Each of the lemurs was observed in *Acacia mangium* trees within the corridor. This is the first visual observation of a nocturnal lemur species within any of the corridors.



2.1.1 Camera Traps Surveys

Two images of a nocturnal Thomas' dwarf lemur (*Cheirogaleus thomasi*) were captured in C3 on the western edge next to Remnant 3. The images were taken on the 9th of October 2024 at 03:37am and show the tail and a small segment of body (Figure 7). This finding supports Project Ala's aim to reconnect the isolated forest fragments around S8 to increase connectivity for nocturnal lemur species through the establishment of forest corridors. As the corridors continue to develop, Project Ala expects to capture more images of nocturnal lemurs on the camera traps.

Figure 7: Thomas' dwarf lemur (Cheirogaleus thomasi) in C3 near R3.

From October 2023 there were three camera traps deployed in each of the four corridors. In July 2024 this was reduced to two cameras, one on each corridor edge. There were no sightings of lemurs during previous monitoring. As such, a concentrated effort monitoring the centre of the corridors was not required. Focusing the cameras on the edges means that any interest shown from lemurs at the edge of the forest, or any movement into the corridors, should be captured. Since October, three new cameras have been trialled that have a reduced sensitivity to leaf movement to reduce the number of non-target triggering events which occur when cameras are aimed at trees. There were 1374 trapping nights between January and November 2024 (C1: 355, C2: 328, C3: 352, C4: 339). From October 2023, the camera settings were standardised, using triple burst photos.

2.4.1 Herpetofauna Monitoring

Monitoring of amphibian and reptile biodiversity with transect-based Visual Encounter Surveys within corridors continued in 2024, with quarterly diurnal and nocturnal surveys in four corridors (169 total surveys completed in corridors since monitoring began). During 2024, 35 observations of eight herpetofauna species were made, bringing the total number of observations made within corridors to 287 since 2019. A day gecko, *Phelsuma modesta,* was observed in C2 and C4 for the first time, and a frog, *Plethodontohyla bipunctata*, was seen in C1 for the first time.

2.4.2 Invertebrate Monitoring

Invertebrate biodiversity surveys have continued in 2024, with a total of 16 surveys completed across four corridors. June 2024 was the end of the second stage of the project. As such, analysis of this year's data was combined with an overall analysis for the whole project period. Between August 2019 and May 2024, 54 invertebrate biodiversity surveys were conducted. Across all study locations (quadrats in C1 to C4, R1 to R4, and S8N), a total of 7,123 invertebrates of 20 known taxonomic orders were observed (Figure 8). This is the number of invertebrates adjusted for the difference in the number of quadrats found in the forest and the corridors. As there were two quadrats in the forest, and three quadrats in the corridor, the adjusted numbers were calculated by multiplying the number of invertebrates by 1.5. The highest number of invertebrates was observed in C1 and the adjoining forest remnants (n=2,191), with the fewest observations made within C2 and the adjoining remnants (n=1,413.5).

Within the Ala Programme's corridors, 3,248 invertebrates of 19 orders were observed, and 3,900 invertebrates of 19 orders were observed within the forest remnants. Of these observations, 215 morpho-species were identified, with several species yet to be identified. Arachnida were the most species-rich order (64). Corridors and forest remnants were also rich in Orthoptera (46), Coleoptera (22) and Hymenoptera (17). Hymenoptera were the most observed order in the corridors (n=1,389), followed by Orthoptera (n=1,002) and Arachnida (n=381) ().

With invertebrate research continuing in 2025, SCRP hopes to begin seeing similarities between invertebrate community assemblages in the corridors and forest remnants as time progresses.

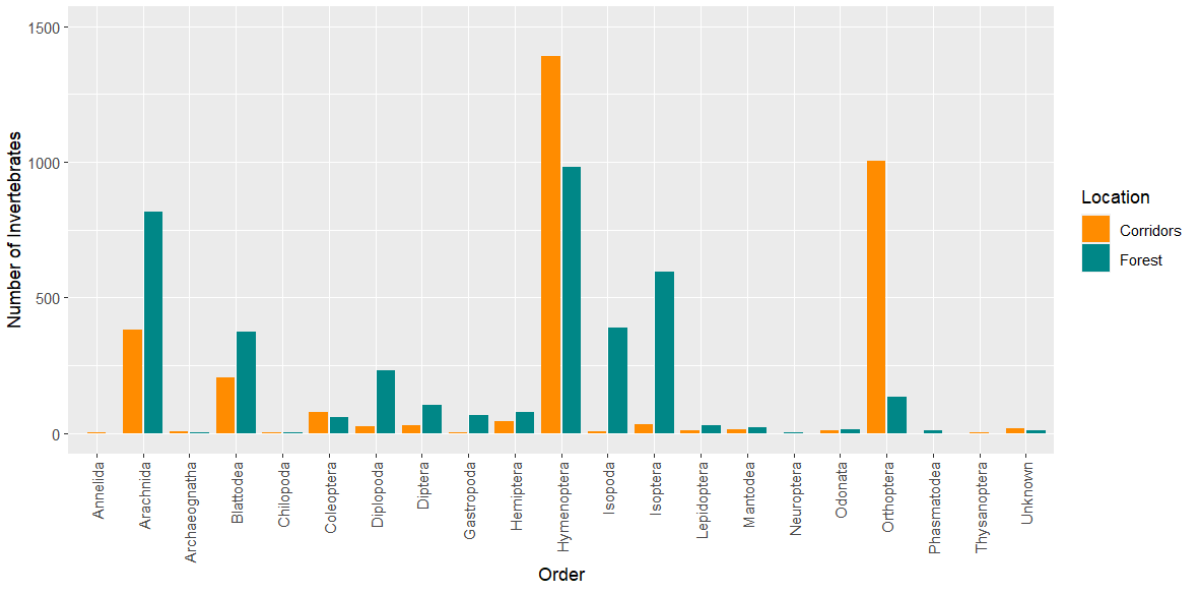


Figure 8: Adjusted number of invertebrates of each order observed within C1 to C4, R1 to R4, and S8N between August 2019 and May 2024. The number of invertebrates observed in the forest remnant quadrats was multiplied by 1.5, accounting for the fewer number of quadrats in the forest remnants compared to the corridors.

One new quadrat in the heather scrubland, parallel to each corridor was established in August 2024. The aim of the new quadrat is to gain an inventory of invertebrate species that would have been found in the footprint of the corridors before they were planted, since a baseline invertebrate study was not carried out.

2.4.3 Botanical surveys

To understand the natural changes in vegetation within the corridors, a new botanical survey was implemented in October-November 2024 to be conducted once a quarter. In July 2024 the new survey was designed and trialled in C1. The new survey monitors 6 2x2m quadrats spaced evenly throughout each of the five corridors. The survey consists of identifying every species possible and providing both a cover percentage over the plot and a height classification. Plant identification is limited by the lack of available research into the plant species found in the area. In addition, each quadrat was assessed for biotic and abiotic ground cover. During the first survey of all corridors, 33 species of plant were found, of which 24 were woody species, 7 were species of grass, one was a species of fern, and one was a herb. The 24 woody species included both self-seeded and planted individuals, 10 species of self-seeded woody plant, and 14 species of planted woody plants.

2.5 Project Phelsuma

For more details on this project, please see this progress report.

Sainte Luce is the main remaining stronghold for the *Phelsuma antanosy* (Figure 9), a species of gecko endemic to southeastern Madagascar, listed by the IUCN as critically endangered (Jenkins, 2011). The other remaining habitat is in the forests of Ambatotsirongorongo southwest of Sainte Luce. Within the forests of Sainte Luce, *P. antanosy* are found predominantly in S7 and less frequently in S9 and S8. Declines in the remaining populations of *P. antanosy* have in the past been attributed to deforestation and habitat fragmentation. The population in Sainte Luce is threatened by the proposed mining operations that would occur in S7 and elsewhere. If the clearing of the forest in S7

goes ahead, 80% of the world's population of *P. antanosy* would be extirpated. *P. antanosy* are particularly host-plant-specific, mostly encountered on *Pandanus longistylus*, a species of screw pine found in the southeast of Madagascar.

Figure 9: Adult male Phelsuma antanosy in S7.

Phase I of Project Phelsuma, begun in 2024 and runs through to April 2025. This project aims to study the ecology of the species and use the results to inform the trial translocation of a few individuals from S7 to S9 in early 2025. Alongside research into the gecko's ecology, a pilot transplantation of *P. longistylus* has taken place in S9 to increase the availability of habitat for *P. antanosy*. The results from the data will be used to inform a reassessment of the species' IUCN Red List threat category. Principal funding for the project has been provided by National Geographic.

2.5.1 Long Term Population Monitoring

Since 2017, data have been collected on all reptile and amphibian species found in Sainte Luce as part of the SEED Herpetofauna Long-Term Monitoring programme. SCRP have collected non-invasive data (via distance sampling) along 16 established transects in four littoral fragments (S7, S8, S9, and S17) as part of the programme. As of August 2024, 639 transect surveys have been conducted, with a total of 387 observations of *P. antanosy* since 2017. These data provide population estimates for P. antanosy in each of the forest fragments.

2.5.2 Behavioural and Spatial Density surveys

Behavioural and spatial density surveys are conducted in both S7 and S9. For all encountered *P. antanosy*, maturity class, sex, GPS location, height of gecko in plant, and height and species of plant is recorded. Behavioural observation sessions are conducted to observe the geckos over a 20-minute interval. Spatial density data is collected by measuring the distance between geckos seen on the same day and the distance that a gecko has moved if seen on separate days (confirmed through

photograph comparisons). Under Project Phelsuma, SCRP has been studying the species since February 2024 with 318 individuals across four day gecko species being located, with the majority being *P. antanosy*. The learnings from this trial translocation will assist with planning for large-scale translocations in future phases of the project.

Studies of *P. antanosy* will continue into 2025, and findings from Phase I will be shared with local stakeholders, as well as informing regional, national, and international audiences about *P. antanosy*.

2.5.3 Pilot Transplantation of *Pandanus longistylus*

Simultaneous to the gecko ecology surveys, SCRP have conducted transplantations of the gecko's host plant *P. longistylus* to expand the available habitat within S9. Translocated geckos will be moved to these newly established groves of *P. longistylus*. Transplantation and monitoring of the transplanted *P. longistylus* has been conducted since January 2024 with 55 plants transplanted to date and will continue through until the gecko translocation.

Figure 10: Transplanted Pandanus longistylus in S9.

2.5.4 Interactive Individual Identification System (I3S)

Novel use of computer-aided photograph identification software (I3S) has been trialled for use in Project Phelsuma. The programme compares the markings on each gecko, within a designated zone of identification, and ranks the likelihood of the unknown gecko being one from the database. Final decision relies on the user; however, it will provide a rapid method of re-identification of individuals post-translocation, during monitoring.

2.5.5 Visit to Ambatotsirongorongo – the second location of *P. antanosy*

In September 2024, SCRP conducted a four-day visit to the other remnant habitat for *P. antanosy* in Ambatotsirongorongo southwest of Fort Dauphin. SCRP staff surveyed the two forest fragments (Grand Lavasoa and Petite Lavasoa/Bemanasa) for the geckos. The team conducted spatial density and behavioural surveys on geckos present to supplement the data that have been collected in Sainte

Luce in 2024. The information will be collated into an updated census for the species and used to reassess the IUCN Red List threat status.

2.6 Project Palms

The littoral forests of Sainte Luce support a variety of endemic and threatened species, including some of the last remaining populations of a variety of Endangered palm species. Despite their importance for both biodiversity and local livelihoods, the palm species in Sainte Luce remain relatively understudied. To address these challenges, Project Palms aims to utilise research and conservation action to understand and improve the population status of six palm species identified by the IUCN Red List as Threatened, including: *Beccariophoenix madagascariensis* (Status: Vulnerable), *Chrysalidocarpus prestonianus* (Status: Vulnerable), *Chrysalidocarpus psammophilus* (Status: Endangered), *Chrysalidocarpus saintelucei* (Status: Endangered), *Dypsis brevicaulis* (Status: Critically Endangered), and *Dypsis scottiana* (Status: Vulnerable) (Rakotoarinivo and Dransfield, 2012 a; b; c; d; e; f).

In February and April 2024 in-situ planting of 1,009 palms seedlings was completed in forest fragments S8, S9 and S17, and monitoring is continuing into 2025.

As of August 2024, the *in-situ* mass planting demonstrated a high level of palm survival across the six species of palms (Table 3). For *D. scottiana,* all planted individuals survived (100%) by three months. For three species of palm, *B. madagascariensis, C. saintelucei,* and *C. prestonianus,* one individual had died after three months, leaving a relative species survival rate of 97.7% three months after planting. Three *D. brevicaulis* individuals were dead after three months, resulting in a relative survival rate of 92.6%. *C. psammophilus* had the lowest survival rate, with four individuals that died after three months, resulting in a relative survival rate of 90.3%. *C. psammophilus* was the only species which showed a statistically significant decrease in condition over time (3.1 to 2.8, a decrease of 9.7%, p = 0.0081). All other species' conditions did not differ significantly over time. For all transplanted palms (the six species combined), the overall change in mean condition after three months was not significant (condition score 3.27 to 3.2, p = 0.29).

Table 3: Number of plants alive at time of planting, one month after planting, and three months after planting, with the relative survival percentage at each interval for six endangered species on Palms.

Species	Month 0		Month 1		Month 3	
	Number of Palms monitored	Percentage of alive palms	Number of alive palms	Percentage of alive palms	Number of alive palms	Percentage of alive palms
B. madagascariensis	45	100	45	11	44	97.7
C. prestonianus	45	100	45	100	44	97.7
C. psammophilus	45	100	45	100	41	90.3
C. saintelucei	45	100	45	100	44	97.7
D. brevicaulis	45	100	45	100	42	92.6
D. scottiana	30	100	30	100	30	100

Month three of monitoring *C. psammophilus* seedlings showed that over 20% of the monitored palms had a condition of 'dead' or 'poor'. As per SEED's monitoring guidelines, this condition was reported to the Programmes team. As per their recommendation, a site-wide assessment of *C. psammophilus* was carried out to assess the palms' condition. 30% of all *C. psammophilus* were either 'dead' or 'poor' and planning is underway to replace these individuals in 2025.

As Project Palms moves into 2025, this planting effort will continue with 754 more seedlings being planted in the first half of the year to reach the project aim of planting 1,800 seedlings across all six species.

2.7 Project Mahampy

Mahampy (*Lepironia articulata*) is a reed found in Sainte Luce's wetlands that is traditionally used by local communities for weaving baskets, hats, and mats. SCRP has collaborated with Project Mahampy since 2020 to better understand the reed, the physical characteristics of Sainte Luce's wetlands, sustainable harvesting techniques, and the biodiversity within the wetlands.

2.7.1 The effect of Harvesting Technique on Mahampy regrowth

In 2024, SCRP stepped back from supporting members of the Mahampy Weavers' Cooperative (due to them being fully trained to carry out the monitoring on their own) to investigate *Mahampy's* ability to regrow after harvesting. New research quadrats were set up in 2023; October, in W9, W11 and W21, and November, in W17 and W26, to expand the research into 2024. Of the harvesting techniques, the tallest reeds were obtained from the pull method, and the shortest reeds from the cut method. Research has now been completed and more detail on the final results can be found in the Mahampy Technical Report 2024.

2.8 Project Rufus

Project Rufus focuses on the *in-situ* conservation of *Pteropus rufus* (Madagascan flying fox) through community engagement and scientific research. Declines in national *P. rufus* populations in the past have been attributed to hunting, disturbance and deforestation, with the species listed by the IUCN Red List as Vulnerable (Racey, 2016). A *P. rufus* colony exists within a botanically diverse littoral forest fragment in Sainte Luce, S6, which also faces significant environmental pressures, including deforestation and future local mining operations.

In 2016, the Sainte Luce colony was estimated to contain 130 individuals (Hyde Roberts et al. 2016), a decline from an estimated 300-350 individuals in 2000 (Bollen and Elsacker, 2002). SCRP has been collecting *P. rufus* population data since 2016, when a logging and hunting exclusion zone was established around the base of the roost in collaboration with local community members. Members from the nearby Fokontany, Tsiharoa North, have continued to monitor and manage the integrity of the exclusion zone in 2024, including marking the edge of the zone with painted trees. In November 2024, the outline of the exclusion zone boundary was mapped, and from this the area was calculated at 18.8 hectares (Figure 11).

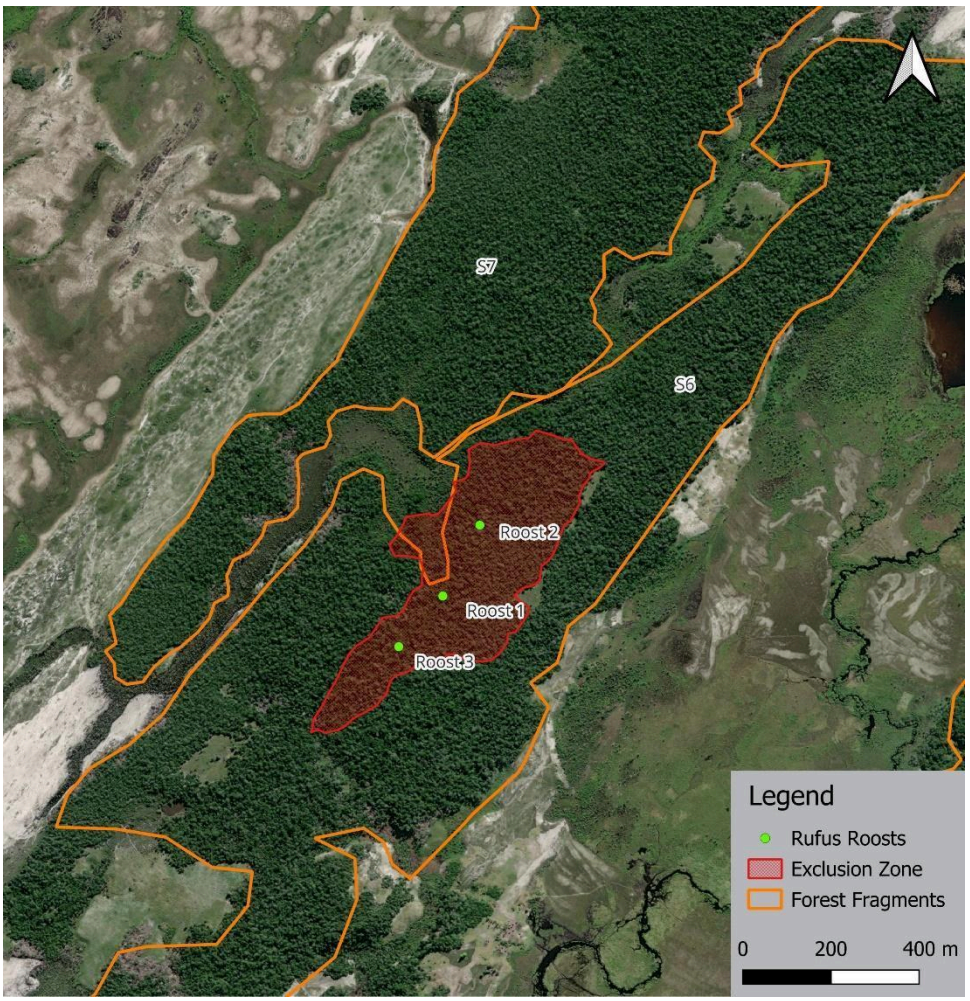


Figure 11: Map of the Exclusion Zone and Pteropus rufus roosts within S6.

SCRP has monitored the roosts in the S6 fragment (Figure 11) four times in 2024. When the Roost two was visited in January, staff and volunteers witnessed two men in the forest with hunting equipment (slingshots and buckets). In May, we found that the bats had moved to a new roost site, Roost three, within the exclusion zone. This hunting disturbance could explain the bats movement to this new set of roost trees. SCRP was able to follow the noise of the colony to locate this new roost site, approximately 350m from their previous roost. The new roost site, Roost three, was still occupied in July, however when the roosts were visited in November, bats had returned to Roost two.

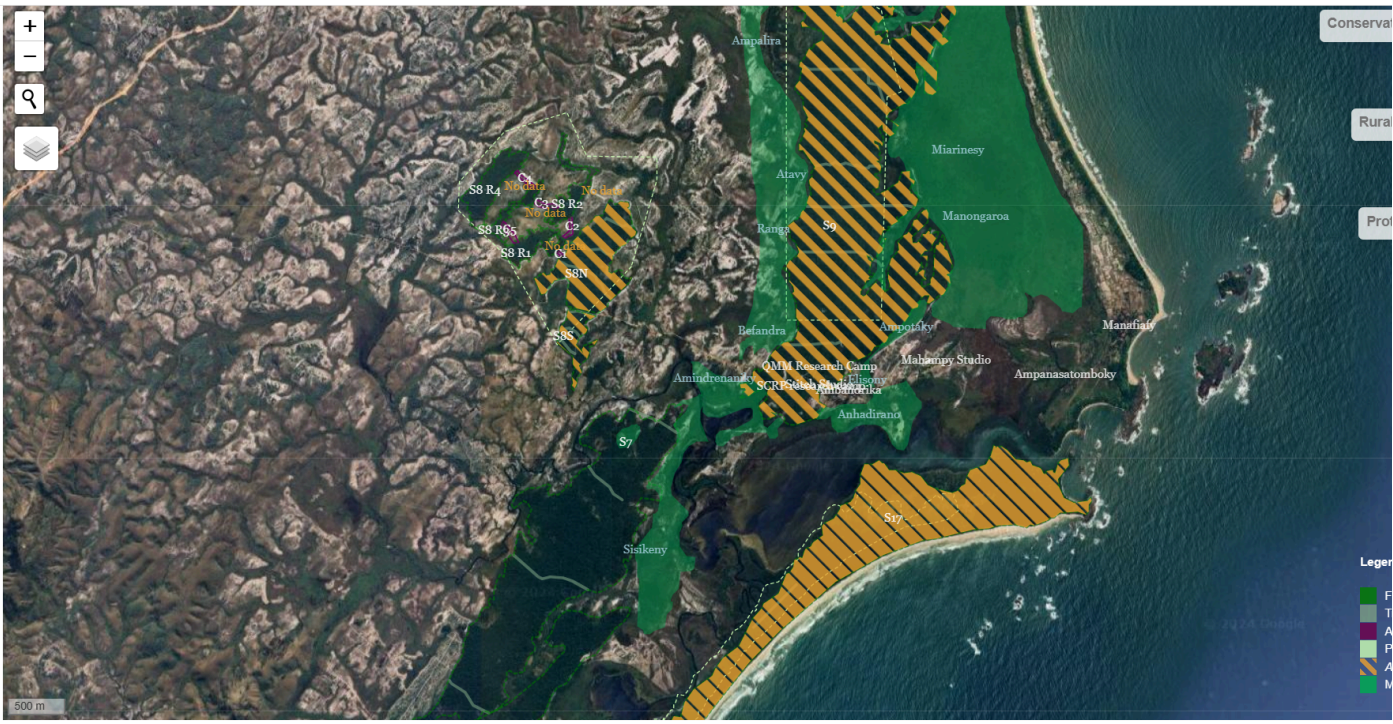
From roost and flying counts of *P. rufus* during 2024 surveys, it is estimated that the current colony population is between 300-600 individuals. The weather conditions during the survey in January (constant moderate rain throughout the survey), meant many bats were perched in the roost trees rather than flying. Therefore, we can confidently assume that all bats counted were unique individuals. There are at least 264 bats that used the roost in S6 in January.

Due to the forest's dense nature and the colony roosting across multiple trees, accurate colony counts are extremely challenging. With significant variation in quarterly population estimates, increasing dependence on natural resources by local communities, and future pressures from mining activities, it is important that monitoring of the colony continues in 2025. SCRP continues to raise

awareness of *P. rufus* and the important ecological role they play in Sainte Luce with local community members.

3 Interactive Sainte Luce Map

During 2024 SCRP have been working on producing an interactive map (Figure 12) so that all different projects in Sainte Luce, SCRP's work as well as the other Conservation and Rural Livelihoods Projects, can be visualised together. The SCRP Remote Intern used spatial map layers (produced in QGIS) to put this information into a Leaflet interactive map. This map allows the user to add and remove different layers so that different projects and research can be viewed in conjunction. For example, in Figure 12, the density of *A. meridionalis*, and the different *Mahampy* wetlands are shown on the map, along with the forest fragments, Protected Areas boundaries, Long Term Monitoring transects and Ala Programme corridors. This map will be used to look at how different conservation and livelihood aspects interact and overlap within Sainte Luce.



4 Community Engagement and Volunteer Programme

4.1 Quarterly Environmental Education Sessions

In 2024, SCRP returned to the primary schools in Ambandrika and Manafiafy villages to deliver focused and interactive environmental education sessions on a range of locally important topics. Attendance was between 60 and 80 students present for each school session. SCRP delivered eight educational sessions in 2024, four in each primary school, covering the following areas:

- Varika (Red-collared brown lemurs) – *Interesting features they have on their bodies such as toilet (grooming) claws, life cycle, their benefits to forests, the threats that they face and how we can help them.*

- Palms of Sainte Luce – *How can you identify the six species of endangered palm found in Sainte Luce? What uses do they have for the community? What benefits do they have for the ecosystem, what threats do they face, and what does SEED do to help them survive?*
- Phelsuma day geckos – *What species of day gecko can be found in Sainte Luce? What are their benefits to the ecosystem and what threats do they face? Phelsuma antanosy was the focus. What work is SEED doing to protect the critically endangered species from extinction?*
- Chameleons of Sainte Luce – *What species of chameleon can be found in Sainte Luce? What role do they play in the ecosystem? What are their threats and how can the community help them?*

At each school, two sessions were run simultaneously; one for younger students (4-8 years old) where they could develop fine motor skills (by colouring in an informative picture about the focus species); and the other session was for older students (9+ years old) and featured a presentation on the species or environmental concept. This was presented by volunteers and international and national staff. After both the sessions were completed, everyone gathered outside to play an active game featuring the topic the children learnt about. SCRP looks forward to running more sessions in 2025, raising awareness of further areas of the Sainte Luce environment affecting the lives of people across Sainte Luce, as well as the importance of ecosystem conservation.

Figure 13: Hoby (far left), Conservation Programme Team Leader and environmental education session lead, with young students from Manafiafy Primary School, showing off their colouring in of Phelsuma antanosy.

4.2 Volunteering Programme

SCRP welcomed 21 volunteers to the Sainte Luce research camp in 2024. Volunteers bring much-needed capacity to the research that takes place, particularly the long-term monitoring

programmes for lemur and herpetofauna species, as well as Project Phelsuma activities. Alongside contributing to primary data collection, volunteers also play a pivotal role in the implementation of the educational sessions; the children who attend the sessions enjoy the chance to interact with, and learn from, volunteers.

4.2.1 Volunteer Summary

Of the 21 volunteers who supported SCRP's research in Sainte Luce throughout 2024, 14 were British, three were from the USA, one Romanian, one French, one Cypriot and one Australian. The ages of the volunteers ranged from 19-62. Seven volunteers were students doing a course related to natural or environmental sciences, four were working (at the time of their visit) in an environmental science-related field or had backgrounds in ecology and 10 people were working in unrelated fields. As the programme moves into 2025, SCRP is excited to welcome more volunteers onto the programme.

5 Illegal activity sightings

In 2024, SCRP witnessed evidence of illegal activities in Conservation Zones S8 and S9. Although these have at times been exacerbated by access to Community Resource Zone being cut off (the ferry for crossing the river was either sunk or stolen at different times), evidence of illegal activity is still regularly seen. Logging of large trees or saplings is the main form of activity, however, noose traps for lemurs or crested ibis, and holes in trees being excavated to reach fat-tailed dwarf lemurs have also been found (Figure 14). SCRP staff are in close communication with the Chef Fokontany (commune mayor) and the various forest police organisations to work towards reducing the presence of illegal activity.

6 Publications

Pointer MD, **Tsimilajay H**, **Hyde Roberts S**, Gill JA, Spurgin LG (2024) Habitat use of the micro-endemic day gecko *Phelsuma antanosy* in Sainte Luce, Madagascar, and the case for translocation. Endang Species Res 54:457-468. https://doi.org/10.3354/esr01353

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Jhaveri, L., Duffell, J., **Evans, N**., Kramer, L., **Randianasolo, M., Tsimijaly, H.,** & **Hyde Roberts, S.** (in prep). Rooted in diversity: Threatened endemic palm species in southeastern Madagascar are not defined by their microhabitats. *Madagascar Conservation and Development*.

Hyde Roberts, S., Evans, N., Kramer, **L., Jhaveri**, L., Duffell, J., Parker, Q., **Bradley, G**., & **Tsimijaly Longosoa, H.** (in prep). A population assessment of six threatened palm species in Sainte Luce, southeast Madagascar: A glimmer of hope? *Palms*.

Sam Hyde Roberts, **Leo Jhaveri** (in prep). The future of the world's rarest gecko, *Phelsuma antanosy*: Action or oblivion? *Oryx*

7 Future Directions

In 2024, SCRP continued to design, organise, and complete high quality research across a range of complex subject areas. In 2025, skill sharing between national and international staff and local stakeholders will form a central pillar of SCRP's approach. 2024 has proven to be a productive and successful year. With completion of 11 years' worth of lemur population monitoring, research completed around the six threatened palm species, closer communication and collaboration with key local stakeholders and expert knowledge holders, and continued commitment to SCRP's education and outreach strategy. SCRP hopes to take these successes and learnings into 2025, continuing to develop and improve the programme across all aspects.

With localised environmental pressures mounting, SCRP is keen to evaluate its approach and identify future critical research areas helping to protect the ecosystem at large. A large area of focus in 2025 will be assessing the success of Project Phelsuma Phase I and begin planning for Phase II. SCRP is committed to analysing the significant quantity of data accumulated over previous years, and disseminating findings to local communities as well as across national and international channels. In doing this, SCRP hopes to evaluate the effectiveness of its strategy and approach to produce even more impactful, conservation-focussed research and action in the future.

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