



## Final report on Integrative protection of endangered lemur and tortoise species in south-west Madagascar

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# 1 Introduction

South-western spiny forest of Madagascar is a biodiversity hotspot and among the “Global 200” ecosystems that are globally unique with an outstanding degree of endemism. It is the most economically and climatically disadvantaged region, mostly inhabited by the Mahafaly and Antandroy people, who depend on the exploitation of goods and products of the spiny forest. As a result, this extraordinary diversity of Malagasy flora and fauna is now being alarmingly weakened by the rapid degradation of the native forests. The spiny forest is threatened by human activities, resulting in about 50% forest loss during the last 40 years. A large number of animal and plant species are at risk of disappearing before they are even known and studied.

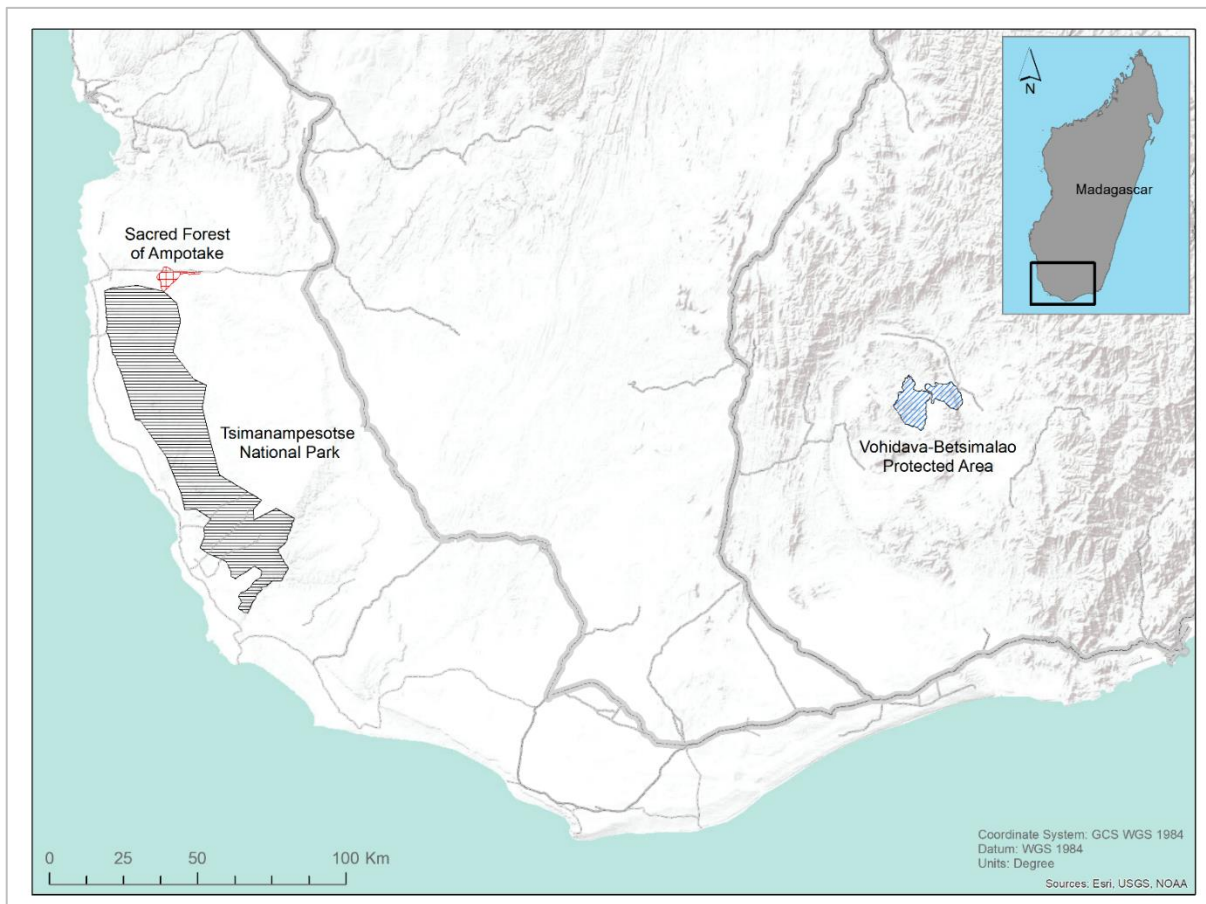
The local people are not aware of the uniqueness of the biodiversity that surrounds them. It is seen as a resource that ensures survival especially in times of crisis (such as during the current 2021 drought). Biodiversity is protected by superordinate "protected areas". We want to supplement this "protection from above" with the component "protection from below", in which the local people understand biodiversity as a cultural value (sacred forests) or as economic added value (Fritz-Vietta et al. 2011).

Nature conservation is the protection and management of animal and plant species, natural habitats and ecosystems to preserve their biodiversity and long-term ecological functions. It aims to maintain healthy ecosystems, protect endangered species and prevent the destruction of the natural environment. Nature conservation can be achieved through actions such as restoring habitats, regulating human activities by raising public awareness and scientific research by integrating local community initiatives. The contribution of local communities, in particular the children who will be the future generation, plays a crucial role in the development and implementation of biodiversity conservation strategies. In cooperation with schools in particular, awareness of the globally unique flora and fauna is to be promoted and, together with the children and their parents, ways of preserving biodiversity are to be developed in the interests of the local population.

## 2 Project site

The project site is located in south-west Madagascar, specifically the Ampotaka sacred forest with no official protection status, Tsimanampesotse national park, and in the south-east of Madagascar with the Vohidava-Betsimalao community-managed protected area, which are considered to be among the world's highest priority conservation sites ("hotspots").

The site comprises different habitats from Mahafaly plateau to Vohidava Betsimalao protect area, including Madagascar's southwestern spiny forest, riparian forest and gallery forest. The dry spiny and the gallery forests of southwestern and South-east of Madagascar represent a unique and highly diverse ecosystem with an exceptionally high number of endemic species, but one of Madagascar's most threatened vegetation types. The high degradation rate results from direct and indirect anthropogenic pressure, such as fire, grazing, slash-and-burn agriculture, logging, and production of fuelwood and charcoal for cooking.



**Map 1:** Localization of project sites in Southwestern (Tsimanampesotse National Park and Ampotaka) and in South-east of Madagascar (Vohidava Betsimalao).

## 3 Completed project activities

### 3.1 Standardized inventories of endangered animal

The factors affecting the distribution of animals, particularly lemurs, are numerous and complex. To better understand the distribution of animals in the three different locations, animal inventory methods were standardised using transects and plots. The data collection process is based on a participatory approach, in which community members, whether para-ecologists, research students or schoolchildren, contribute to the monitoring and animal observations. This participatory approach has given us several advantages, including the direct involvement of local communities (young and old) in animal protection, large-scale and long-term data collection, and raising public awareness of environmental issues.



2a. Field data collection with national and international students



2b. Local community members for biodiversity conservation in Vohidava Betsimalaho.



2c. Observation of diurnal lemurs in Ampotaka sacred forest.



2d. Vohidava BeTsimalaho biodiversity monitoring team.



2e. Children from Club Vintsy help to collect data on turtles in Tsimanampesotse.



2f. Data collection on radiated tortoises by local team at Vohidava-Betsimalao.

**Photo 1:** Participatory approach to collecting data on endangered animal species.

### 3.1.1 Target species

Target species are tortoises (*Astrochelys radiata*, *Pyxis arachnoïdes*) and lemurs (*Lemur catta*, *Microcebus griseorufus*, *Microcebus murinus* and *Propithecus verreauxii*), as well as an endemic species of civets (*Galidictis grandidieri*), which, however, only occurs in two of the proposed study areas. All species are classified as Endangered or Critically Endangered by the IUCN.

Lemurs and tortoises are recorded along established line transects using standard methods. Transects are walked once a day and once a night per season at a speed of about 0.5 - 1 km / hour with 2-3 people. Due to the very heterogeneous habitat, these methods are not equally suitable for all species. They are supplemented by roost counts for *Lemur catta* (Kasola et al. 2020) with 4 records per roost per year. Tortoises are also recorded during transect passages and the data are supplemented by systematic search for tortoises on defined areas of 1 ha each ("1 ha plot"; 2 recordings per plot per year) (O'Brien et al. 2003; Hammer and Ramilijaona 2009; Rasoma et al 2010; Walker and Rafeliasoa 2012a,b; Marzec 2013).

The regionally endemic civet cat *Galidictis grandidieri* is caught twice a year in the national park using established trap grids and tagged to determine population development.

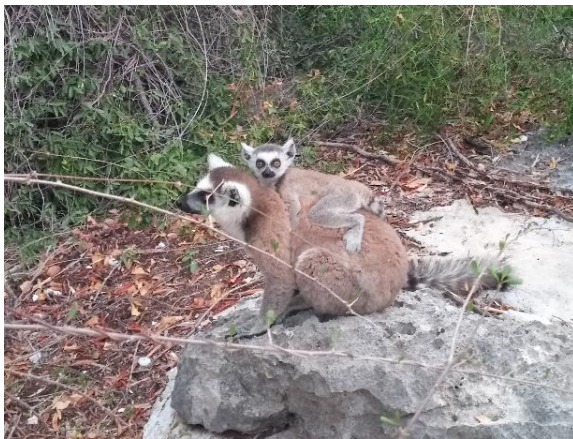
(Marquard et al. 2011).



*Astrochelys radiata*



*Pyxis arachnoïdes*



*Lemur catta*



*Microcebus griseorufus*



*Propithecus verreauxii*



*Galidictis grandidieri*

**Photo 2:** The six target species, classified as Endangered or Critically Endangered.

### 3.1.2 Distribution and density of target species at project sites

The species are distributed differently in three localities (Ampotaka, Tsimanampesotse and Vohidava-Betsimalo), and this distribution varies according to species and habitat. In terms of spatial distribution, the species *Lemur catta* and *Microcebus griseorufus* are well represented, occurring in 3/3 of the sites, followed by *Galidictis grandidieri* in 2/3. The remaining three species (*Astrochelys radiata*, *Pyxis arachnoïdes* and *Propithecus verauxiii*) have restricted distributions (Table 1).

Among the 6 target species, three are classified as Critically Endangered (*Propithecus verreauxii*, *Astrochelys radiata* and *Pyxis arachnoids*), two (02) are classified as Endangered (*Lemur catta* and *Galidictis grandidieri*) and one (01) species is classified as Least Concern (*Microcebus griseorufus*). It should be noted that deforestation and the destruction of natural habitats are the main major threats to these animals. Many species are now considered endangered or endangered due to mainly human pressure (Table 01).

The presence of Gray-brown Mouse Lemur (*Microcebus griseorufus*) was almost uniform at all sites. The density of this species is very high at Tsimanampesotse, with a density of 211 ind/km<sup>2</sup>, compared to the other two location. For ring-tailed lemurs (*Lemur catta*), it is well represented with a density ranging from 59 to 70 ind/km<sup>2</sup> at Vohidava-Betsimalo and Tsimanampesotse. In Ampotaka, this species is present, but the density is very low (Fig. 01).

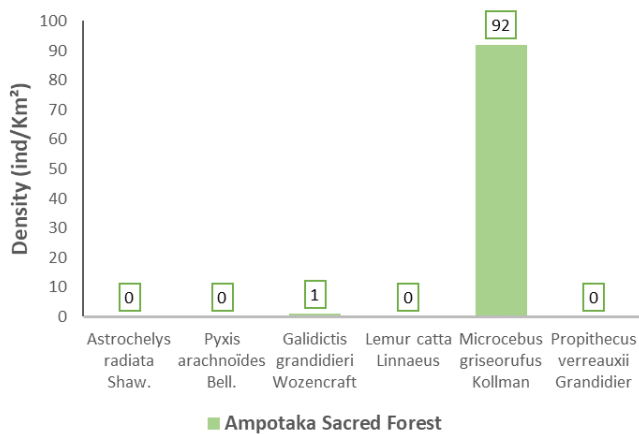
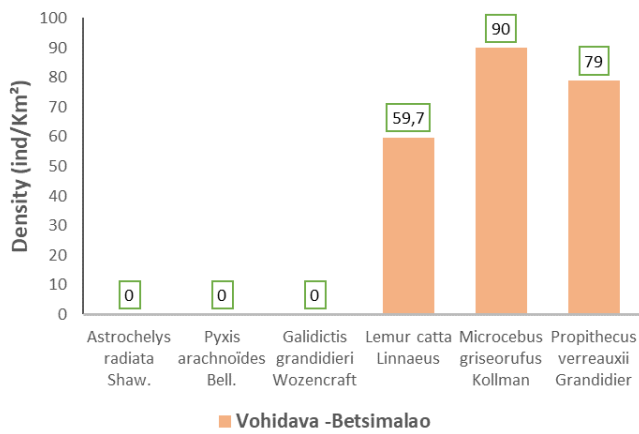
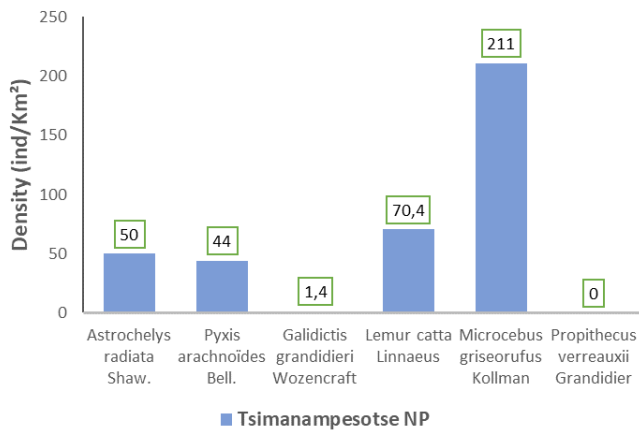
As for tortoises (*Astrochelys radiata* and *Pyxis arachnoïdes*), its density at Tsimanampesotse is 50 ind/km<sup>2</sup> and 40 ind./kù<sup>2</sup>, indicating a higher density than at the other two sites. The absence or low density of this two especies in the Vohidava-Betsimalo region and the Ampotaka sacred forest may be related to the substantial illegal exploitation of this species (Fig.01).

**Table 1:** Distribution of target species on the three project sites

Target species	Conservation Status	Vohidava Betsimalao	Ampotaka Sacred Forest	Tsimanampesotse NP
<i>Propithecus verreauxii</i> Grandidier	CR	Yes	No	No
<i>Lemur catta</i> Linnaeus	EN	Yes	Yes	Yes
<i>Microcebus griseorufus</i> Kollman	LC	Yes	Yes	Yes
<i>Galidictis grandidieri</i> Wozencraft	EN	No	Yes	Yes
<i>Astrochelys radiata</i> Shaw.	CR	No	No	Yes
<i>Pyxis arachnoïdes</i> Bell.	CR	No	No	Yes

\* Critically endangered (CR); Endangered (EN); Least concern (LC)





**Figure 1:** Species average density (ind/km<sup>2</sup>) at the three project sites.

### 3.2 Raising awareness of children and their parents

To instill a sense of respect and protection of the environment and biodiversity, it is important to develop conservation awareness among children and adults. By starting with young children, we can help develop responsible future citizens who are aware of their impact on the environment and thus ensure a sustainable future.

A number of activities have been carried out to raise awareness among local people of the importance of conserving and protecting biodiversity, such as organising festivals, producing seedlings and planting trees, discussing the problems of biodiversity loss (particularly endangered species), organising nature schools and walking with children to teach them to appreciate the beauty of nature and understand the importance of conserving it.

#### 3.2.1 Realisation of the Lemurians festival in Tsimanampesotse NP et Vohidava -Betsimalao

The purpose of this lemur festival is, among other things, to raise awareness of the importance of conserving endemic and iconic species of southern Madagascar, most of which are endangered. Through posters, sports, song and poetry contests, and documentaries, children will be proud that the forest is home to these species.



**Photo 3:** Vohidava-Betsy Marao celebrates World Lemur Day



**Photo 4:** Carnival in Tsimanampesotse to celebrate World Lemurian Day

During the celebrations, 100 to 150 children and youngsters from various local public schools were mobilised in Tsimanampesotse and Vohidava-Betsimalo to inform both the community and local leaders about the importance of lemurs, their habitats, the threats to the species and also to encourage every member of society to take action to conserve the species. Between 600 and 1400 people were reached during the festival. Similar to the Vohidava Betsimalao case, we raised awareness among 1117 people, including 562 children under the age of 14, which 305 girls and 257 boys. There were 170 young men aged between 14 and 29. There are 121 men and 160 women over 30.

Apart from raising awareness of environmental protection, we also carried out other activities such as :

- a.) Animations and games on the protection of biodiversity,*
- b.) Showing of nature protection documentary films*
- c.) Singing and poetry competitions*
- d.) Sports meetings between children from each local community.*



**Photo 5:** Animation and example of games used during events in Tsimanampesotse.



**Photo 6:** Sports meetings between children and Screening of documentary films on biodiversity in Vohidava-Betsimalao.

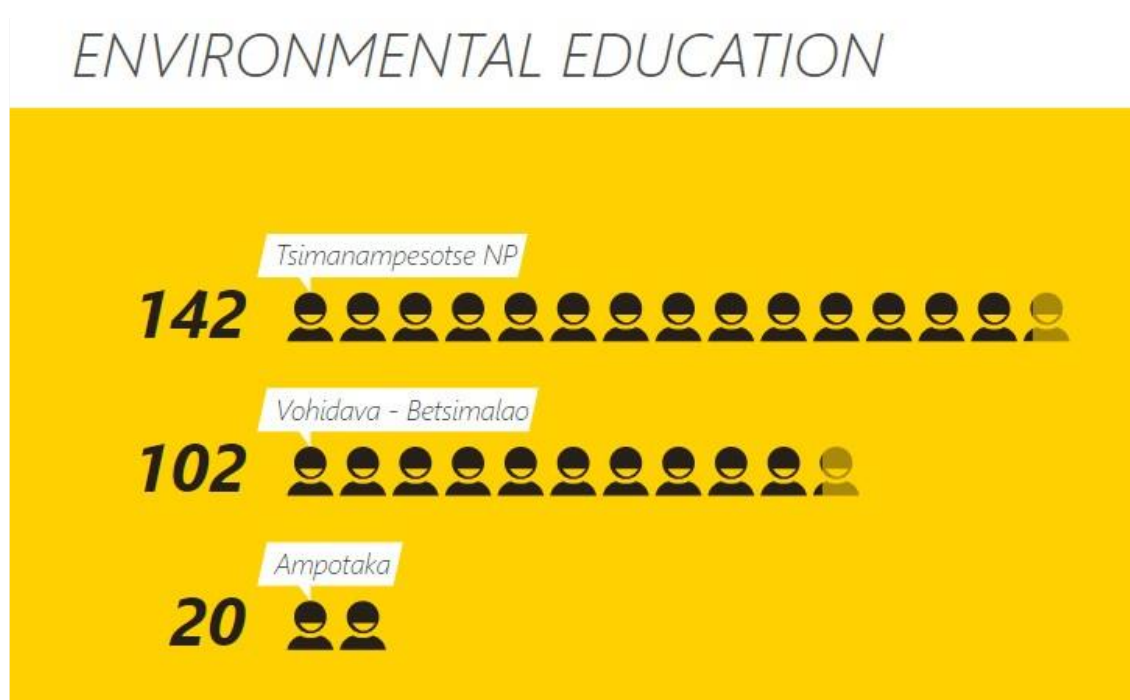
### 3.2.2 Children's environmental education

Local populations are not aware of the unique nature of the biodiversity that surrounds them. Goods derived from nature are considered to be the most important resource for survival, especially in times of crisis. Against this backdrop, how can environmental education be used to raise awareness effectively and collectively? The question of the impact of children on adults has been the focus of our approach over the last three years, as raising children's environmental awareness has been seen as a catalyst for change in the conservation of biodiversity in three project sites. Children's actions to protect their environment have led to improvements in the knowledge, attitudes and

behaviour of adults. The environmental education provided in local schools aims to enable each pupil to acquire a basic knowledge of the environmental issues in the region, such as the loss of biodiversity due to hunting, the destruction of animal habitats by slash-and-burn agriculture and selective logging. Our results in environmental education are mainly based on two concepts:

- a.) **concepts of environmental value**, by introducing them to the scientific and cultural value of environmental heritage and its connection to human activity.

The environmental education programme is modulated according to the age of the child, ranging from 5 to 15 years. Two nature clubs (Club Vintsy and Club Fanantenana) were created in Tsimanampesotse as a result of environmental education programmes. A total of 264 children from Vohidava and Tsimanampesotse benefited from the programme, including 132 girls and boys in Tsimanampesotse, 20 children in Ampotaka and 102 children in Vohidava-Betsimalo. Children are taught the concepts of environmental protection directly in the forest, allowing them to understand the beauty and diversity of nature.



**Figure 2:** Repartition of number of children with environmental awareness by project area.



a) Tsimanampesotse nature tour (EPP Marofijery)



b) Learn about forest management (Vohidava)



c) Learning about the importance of natural resources (Tsimanampesotse)



d) Learn more about environmental value (Vohidava)



e) Ampotaka children's perception of the environment



**Photo 7:** Environmental education with children in Tsimanampesotse and Vohidava-Betsimalao.



b.) **the concept of environmental citizenship**, by encouraging children and young people to learn about respecting the environment, conserving natural resources (especially useful plants) and their implications for ecosystems conservation through ecological restoration, to secure and preserve their natural assets for future generations.

To conserve resources such as *Euphorbia stenoclada*, an important local forage plant, children are encouraged to take part in ecological restoration. Ecological restoration programs involve revitalizing and restoring damaged or degraded ecosystems. This can include activities such as tree planting, creating nurseries, reintroducing native species and raising awareness of environmental conservation. In this context, a seedling production center has been set up in the Tsimanampesotse National Park. With the support of other local environmental NGO, over 150 children have been mobilized to take part of this restoration programs in and around the park. In 2021, the children restored 2,2 hectares of habitat using 1600 saplings, and in 2022, a further 6,6 hectares were restored using 2600 saplings of different plants species. From 2023 onwards, the restoration methods have been enhanced to involve more children under the theme "One child, one tree", as they are the future custodians of our planet and their education on environmental issues is essential to ensure a very important sustainable future. Since this year, the children of Club Nature members have planted 114 well-maintained saplings (fenced and watered every week), with each planted tree bearing their respective names.



**Photo 8:** Environmental education on the conservation and management of natural resources (*Euphorbia stenoclada*) with children.





**“Restoring Degraded Habitats with Children's Involvement”**



**Photo 9:** Active participation of Tsimanampesotse children in ecological restoration program.



### **3.3 Let the people speak up about biodiversity protection**

Protecting biodiversity is an important issue for the inhabitants of southern and southwestern Madagascar and the future of all the species that live there. Our aim in this activity was to gather the views of the local community, in order to raise awareness, advocate and act on the conservation of biodiversity. Local people were encouraged to share their experiences, knowledge and concerns about biodiversity, their potential participation in conservation activities and ecological restoration. Local marketplace discussions, personal stories, testimonials, social media, blogs, online videos and community events achieved a sense of sharing.

In Vohidava Betumarao, exchanges took place with 64 individuals (Lonaky and leaders) from each member of the local grassroots community (VOI). In addition, a poetry and song competition about biodiversity conservation was organized to generate dialogue on biodiversity conservation. On the Tsimanampesotse side, open exchanges and discussions took place at the local market, where theatre was followed by personal questions about environmental issues (loss of natural habitats and endemic species). Of the 90 respondents, 85% agree with the need to protect the environment and conserve biodiversity, while the remaining 25% continue to use natural resources (charcoal, wood construction, fodder) for the benefit of the local population. Opinions will also be collected on social networks to assess the impact of our actions on participatory biodiversity protection.



**Photo 10:** Discuss environmental issues with local leaders (Vohidava-Betsimalao)



**Photo 11:** Local market survey on the concept of environmental protection (Tsimanampesotse)

## 4 Prospect and recommendations

The southern and south-western regions of Madagascar have less favourable climates, where the local population relies heavily on the use of natural resources. During the implementation of our projects, we sometimes face various challenges related to environmental issues that are mainly linked to human activities.

Between biodiversity conservation goals and local communities' interests in natural resources, we were confronted with conflicts of interest that made it difficult to raise awareness among some local communities and can subsequently influence our approach to their children's perceptions of the concept of preserving biodiversity for future generations.

To help the local population sensitive to the current biodiversity loss, we found that our approach lacked representativeness in relation to the spatial extent of the Tsimanampetse region. It is essential to include all the villages and communities surrounding the park, but it can be difficult to ensure a fair and meaningful representation of our approach across the whole region with limited resources.

In summary, it can be seen that adults are not aware of environmental problems compared with children's perception. Indeed, it's important to create a positive and encouraging learning environment, where children feel valued and supported in their endeavours, by providing them with the necessary tools and knowledge.