Final Evaluation Report

Your Details	
Full Name	Mama Sadam
Project Title	Community conservation of White-thighed Colobus (*Colobus vellerosus*), a Critically endangered species in the gazetted forest of Wari-Maro, Benin
Application ID	38516-1
Date of this Report	02/02/2024

1. Indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Determine the factors of degradation of the habitats of *C. vellerosus* in the gazetted forest of Wari-Maro				Surveys were conducted among the local population through direct interviews and focus groups to identify the factors responsible for the degradation of *C. vellerosus* habitats in the Wari-Maro gazetted forest. The triangulation technique was used to control the information received from the interviewees. This technique consists of asking the same question to respondents in several ways in order to obtain real information. At this step, we have already surveyed 480 people and realised 10 focus group discussions. After the survey phase, a prospection was conducted in the forest with the local population to assess the factors of habitat degradation. Ten points representing habitat loss/degradation were selected on the land use and land cover map of the forest. The coordinates of these points were entered into the GPS and a survey was conducted with representatives of the population in the forests. At each point, habitat degradation factors were recorded, and the reliability of the data collected during the survey was discussed in the field with the population.
Assess the degree of regression of the habitats of *C. vellerosus* in the gazetted forest of Wari-Maro				Spatio-temporal occupancy dynamics of *C. vellerosus* habitats were studied using a time series of Landsat images all multispectral (Biga *et al.*, 2020). The images were obtained from Landsat 7 ETM+ and OLI 2 sensors with a spatial resolution of 30 m. The year interval considered is 10 years to observe the shift in habitat occupancy (Jaffrain *et al.*, 2021). All images were acquired at approximately the same time of year, during the high dry season to ensure that

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				the phonological stages of vegetation cover were nearly the same between dates (Ruelland *et al*., 2010). The image set used was acquired from the United States Geological Survey (USGS) Earth Resources Observation Systems (EROS) data center via the website (https://earthexplorer.usgs.gov/). A ground prospection was also performed during the dry season in accordance with the image acquisition period. Images were geometrically corrected and geocoded to the WGS (Datum 1984) and Universal Transverse Mercator (UTM) Zone 31N coordinate system. The automatic method based on scene connection was applied with ENVI version 5.0 software, ITT Corporation (Zayoun *et al*., 2020). The study area was then extracted from the obtained image mosaic to determine the land cover and natural habitat use types by classifying the images. A supervised classification was performed using the Maximum Likelihood algorithm based on the 173 training points available to us (Maiga *et al*., 2020). The official nomenclature of land use classes in Benin was used to identify the classes present in our study area (Ahononga *et al*., 2021). The supervised classification was chosen because of the study area. The classification was parameterized by digitising the training areas. Prior to the determination of the training areas, the number of classes was defined to the information collected in the field. The post-classification images were subjected to a 3x3 pixel filter to homogenise the classification. Then, to improve the quality of the classification, a computer-assisted visual interpretation (Biaou *et al*., 2019) was used to map the different habitat occupancy classes of *C. vellerosus* in the Wari-Maro

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				gazetted forest. Some classes were spectrally confused and could not be well separated by supervised classification and thus visual interpretation was needed to separate them. In order to facilitate the correction of classification errors using computer-assisted visual interpretation, the results from ENVI are exported as a vector file (.shp), to be grouped into land cover classes in Quantum GIS (QGIS version 2.18). Google Earth Pro software is consulted for the confirmation of land use units made possible by the Gearth view extension. The change in land use was assessed from the area of each class. To obtain these areas, the GroupStats extension (QGIS 2.18) allowed us to generate two-way tables presenting for each of the dates taken in pairs in order to bring out the cumulative areas of each class and their changes over time. To this end, criteria for assessing the evolution of the occupation of *C. vellerosus* habitats in the Wari-Maro gazetted forest were considered as (i) Gross deforestation: conversion of natural plant formations into plantations and anthropogenic plant formations; (ii) Degradation: decrease in the density within natural plant formations.
Identify and restore the most degraded *C. vellerosus* habitats				Nurseries of *Afzelia africana* and *Vitellaria paradoxa* were realised for the *C. vellerosus* degraded habitats restoration. Maintenance was carried out under the supervision of forestry officers, with technical and financial support from the project.
Raise awareness of the dangers of degrading *C. vellerosus* habitats in order to initiate a community conservation base to save it from extinction				In order to reduce anthropogenic pressures on the species, we conducted environmental education meetings in the villages bordering the Wari-Maro gazetted forest, in collaboration with the NGO SOS Savane. We also produced and distributed posters with key messages,

Objective	Not achieved	Partially achieved	Fully achieved	Comments
				picture boxes and t-shirts to participants. Before the beginning of the awareness activities, the LEB (Laboratory of Ecology, Botany and Plant Biology) sent information notes to the local authorities of the villages bordering the forest and to the forest managers, informing them about the beginning of the project's environmental education activities and asking for their assistance in making them a success. School directors were also informed.

2. Describe the three most important outcomes of your project.

a). Factors of degradation of *C. vellerosus* habitats

Investigations conducted with local populations and surveys conducted in the forest have identified four factors responsible for the degradation of the habitats of *C. vellerosus* in the Wari-Maro gazetted forest. These are agriculture (66.42%), forest exploitation (12.69%), pastoralism (8.21%) and climate change (4.47%).

b). Degree of regression of White-thighed Colobus habitats in the Wari-Maro gazetted forest

The rate of regression of natural formations in the Wari-Maro gazetted forest is 0.90% from 2002 and 2012 (Table 1) and 16.55% from 2012 to 2022 (Table 2). In 20 years, the species has experienced a regression of 17.45% of these natural habitats. Plantations increased by 166.90% and 22.11% in the intervals from 2002 to 2012 and 2012 to 2022, respectively (**Fig. 1**). Crops and fallow land also increased significantly.

Table 1: Rate of change of plant communities in the Wari-Maro gazetted forest between 2002 and 2012

	Natural forest formations	**Plantations**	**Crops and fallow land**
Area in 2002 (ha)	110239,73	142,85	722,20
Area in 2012 (ha)	109242,11	381,26	112586,20
Annual rate (ha)	-99,76	23,84	11186,40
Rate of Change (%)	-0,90	166,90	15489,34
Annual Rate (%)	-0,09	16,69	1548,93
Rate of Regression (%)	0,90		

Table 2: Rate of change of Plant communities in the Wari-Maro gazetted forest between 2012 and 2022

	Natural forest formations	**Plantations**	**Crops and fallow land**
Area in 2012 (ha)	109242,11	381,26	112586,20
Area in 2022 (ha)	91159,21	465,55	130584,81
Annual rate (ha)	-1808,29	8,43	12910,34
Rate of Change (%)	-16,55	22,11	8714,87
Annual Rate (%)	-1,66	2,21	871,49
Rate of Regression (%)	16,55		

c). Awareness and *C. vellorosus* habitat restoration

We organised 12 awareness meetings involving more than 360 people from villages bordering the Wari-Maro gazetted forest (Bétérou, Sinahou, Samba, Wari-Maro, Agramarou, Alafiarou, Agbassa, Oubérou, Banagri, Koda, Igbèrè, Wannou). During these meetings, we briefly presented the results of our research to the participants (degradation factors and regression degree of *C. vellerosus* habitats in the Wari-Maro gazetted forest) through oral communications. We also raised local population awareness of the species' ecological and economic roles, the decline in its population mainly due to hunting, the extensive destruction of its habitat and the contribution of the local population to save it from extinction. To raise young people's awareness, we organised competitions focusing on the species for schoolchildren in seven schools. In all, 580 schoolchildren were involved.

In collaboration with local people, forestry officers and forestry guides, we planted 2350 plants of *Afzelia africana* (1300 plants) and *Vitellaria paradoxa* (1050 plants) in degraded habitats.

3. Explain any unforeseen difficulties that arose during the project and how these were tackled.

The only difficulty encountered during the execution of our project was the non-availability of Parkia biglobosa and Khaya seneglansis seeds during the nursery establishment period. We were therefore unable to purchase seeds for these species from the LERF (Laboratory of Forest Studies and Research) at the University of Parakou, as planned. To remedy this, we have increased the quantity of seeds of two other remaining species (Afzelia africana and Vitellaria parodoxa) and consequently the number of plants reforested in order to achieve the project's objectives.

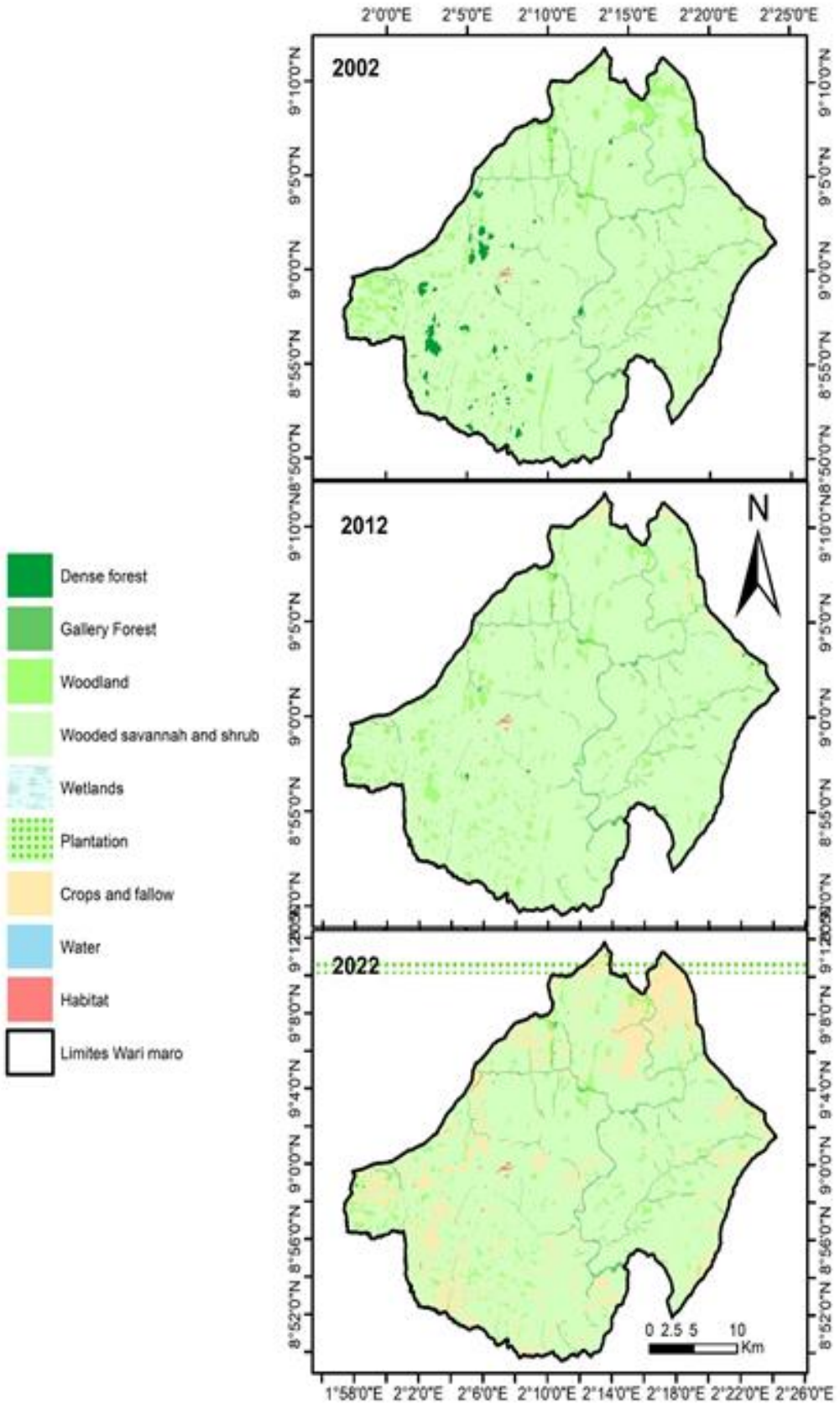

Fig. 1: Land use map of the Wari-Maro gazetted forest

4. Describe the involvement of local communities and how they have benefitted from the project.

Local communities have been a major support in the implementation of project activities. They took part in all the project field activities. Local hunters and sawyers acted as guides for the track reconnaissance during forest prospecting to confirm habitat degradation factors. During the establishment of nurseries, site maintenance, potting, sowing, watering and nursery maintenance were carried out with the support of the local population. Similarly, local authorities and school directors facilitated the organisation of awareness and environmental education workshops. In addition, young people from the surrounding villages facilitated the access of seedlings to the reforestation sites, actively participating in the planting of the seedlings. Reforestation activities were also carried out under the supervision and participation of local forestry officers and forest guides. Thanks to the community and participatory conservation approach, local populations have been made aware of the risk of habitat degradation and the hunting of *C. vellorosus*, as well as the decline in its population. They recognised that the species has become increasingly rare in the Wari-Maro gazetted forest, mainly due to hunting, and promoted their participation in the conservation of the species to avoid its extinction. Through environmental education activities, this project has introduced schoolchildren to the ecological and economic roles of *C. vellorosus*, the current status of its population, the threats it faces and their contribution to ensuring its survival.

5. Are there any plans to continue this work?

C. vellorosus is a species that performs a very important ecological, economic and cultural role, but is threatened with extinction. Given the significant impacts of this project, we plan to extend our next activities in the other protected areas surrounding where the species is present to know Kikélé sacred forest. We also plan to continue reforestation activities in degraded habitats in order to increase the surface area of restored habitats. There is also an urgent need to continue awareness activities in local communities, with particular emphasis on popularising Benin's wildlife and biodiversity laws.

6. How do you plan to share the results of your work with others?

The results of this project will be made available to the scientific community through the publication of an article in an international journal with open access, in order to share the data generated as widely as possible with a large scientific community. The project results will also be presented at national and international symposia/conferences to biodiversity conservation NGOs, political decision-makers and protected area managers. A printed report will be deposited with the general directorate of the forestry office, the SOS Savane NGO and the University of Parakou library, to be used by students in writing their dissertations and biodiversity conservation projects.

7. Looking ahead, what do you feel are the important next steps?

For the conservation of *C. vellorosus* and other threatened wildlife species in the Wari-Maro gazetted forest and other surrounding protected areas, it is important to:

- Carry out inventories to find out the exact size, distribution and trends of the *C. vellorosus* population in Benin's protected areas, especially in the Kikélé sacred forest. Indeed, according to the latest IUCN evaluation, the Kikélé sacred forest shelters the largest population of *C. vellerosus* in Benin, but we had noted in the field the absence of recent, reliable data on the exact size of the *C. vellerosus* population and its habitats in the forest. It is therefore urgent to carry out a wildlife enumeration in order to update the size of the *C. vellerosus* population in the sacred forest of Kikélé.

- Develop environmental education and awareness programmes for the Kikélé population on the conservation of *C. vellorosus* and its habitats. Because of the proximity of the forest to the Kikélé village, some residents dump their waste in the forest. They also use the forest as a toilet. Open defaecation is a risk factor of zoonotic diseases that threaten human and primate health (Muehlenbein, 2017). Also, non-biodegradable waste can have negative effects on forest biodiversity (Zohra, 2018).

- Reinforce connectivity conservation through ecological corridors between the Wari-Maro gazetted forest and surrounding protected areas (Monts Kouffé and Upper Ouémé). Because we have observed during our fieldwork that *C. vellorosus* and other endangered species make cyclical movements between these protected areas, but the migration spaces are taken over by fields and other anthropic activities. Securing the endangered species in their movements is crucial.

- Raise awareness of local populations of the issues involved in conserving ecological corridors, endangered species and their habitats.

8. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?

The Rufford Foundation logo was used on all materials produced as part of this project. The poster, picture boxes and t-shirts with key messages focusing on the species, produced for environmental education and awareness, carried the Rufford Foundation logo. Also, the two progress reports produced as part of this project carried the foundation's logo. These two reports, containing images of our publicity materials, were sent to The Rufford Foundation.

9. Provide a full list of all the members of your team and their role in the project.

MSc. Agbatan Marc KOUTCHORO
He holds a Master of Science in Natural Resource Management and is currently a research assistant in Biomonitoring and Conservation of Protected Areas and Wildlife

(UR-BiCAF) at the Laboratory of Ecology, Botany and Plant Biology (LEB) at the University of Parakou. He has 6 years' experience in data collection from rural populations and environmental education. He has coordinated activities to investigate the factors of degradation of *C. vellorosus* habitats and the awareness of local communities.

Kenneth Gwenael DEGAN
Informatics specialist and member of the SOS Savane NGO, he produced the publicity materials (poster, picture boxes and T-shirts).

MSc. Nicanor KOUTON
Specialist in Geographic Information Systems (GIS) and remote sensing, he is a research assistant at LEB. He has 5 years' experience in ecosystem mapping. He was responsible for the GIS operations carried out in the project.

Laurent HOUESSOU, PhD
Associate Professor in the Natural Resources Management Department of the Faculty of Agronomy at the University of Parakou. He is head of LEB's UR-BiCAF. He contributed his expertise to the development and validation of the survey and awareness methodology, and to the evaluation of the project's success.

10. Any other comments?

We thank The Rufford Foundation for funding this project on the conservation of *C. vellorosus*, an endangered species in Benin.