Researchers join forces to conserve red colobus (*Piliocolobus badius temminckii*) in West Africa

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Abstract

The recent development of the Red Colobus Conservation Action Plan (ReCAP) has spurred momentum to promote site-based conservation of red colobus while forging partnerships among researchers and building local capacity. Communities for Red Colobus (C4RC) is a community-centered conservation organization in The Gambia, West Africa that aims to protect Temminck's red colobus (*Piliocolobus badius temminckii*) while advancing opportunities for local people. We highlight the inception and initial development of C4RC with its educational and ranger teams and describe how local and international collaborations have positively impacted the organization through training and mentoring programs. This conservation program has the potential to become sustainable with plans for continued ecological monitoring, reforestation efforts, use of alternative methods of cooking and the expansion of ecotourism. We hope that the dissemination of project information through Gambian broadcast and social media channels and wider community outreach activities will improve perceptions and conservation of primates and inspire the development of other red colobus initiatives at suitable forest sites based on the C4RC model of community-based conservation.

Keywords

community, conservation, environmental education, red colobus, Gambiaj

Abbreviations

C4RC - Communities for Red Colobus

DPWM - Gambian Department of Parks and Wildlife Management

ICCA - Indigenous Community Conservation Area

IPS – International Primatological Society

KBA – Key Biodiversity Area

NGO – Non-governmental organization

ReCAP – Red Colobus Conservation Action Plan

TRC – Temminck's red colobus

VDC – Village Development Committee

Introduction

There are 18 taxa of red colobus monkeys (*Piliocolobus* spp.) in Africa, all of which are threatened with extinction, with more than 75% of the species listed as Endangered or Critically Endangered (Linder et al., 2021). Hunting, habitat loss and habitat degradation are the primary threats to their survival. To address the threats to red colobus monkeys, a **Red Colobus Conservation Action Plan** (ReCAP) was initially proposed by the IUCN SSC Primate Specialist Group in collaboration with the African Primatological Society and was successfully adopted in 2018 by a consortium of research scientists during the International Primatological Society (IPS) Congress in Nairobi, Kenya. The **Red Colobus Conservation Action Plan** (Linder et al., 2021) aims to achieve a number of priority objectives including: 1) the improvement of site-based conservation of all 18 taxa of red colobus monkeys, 2) taking action to elevate red colobus to a flagship species status across their range, 3) establishing continent-wide initiatives to facilitate collaboration (e.g. standardized protocols; a range-wide genomic database; proper management to oversee administration, implementation and evaluation of funds and activities), and 4) building capacity through training and mentoring programs, especially for African professionals committed to red colobus conservation (Linder et al., 2021; Nakkazi, 2019).

Temminck's red colobus monkeys (TRC) (*Piliocolobus badius temminckii*) (Fig. 1), are present in The Gambia, Senegal, Guinea Bissau, Guinea, and possibly Sierra Leone, but are Endangered and face continued threats from habitat loss, hunting and infectious diseases (Linder et al., 2021; Minhós et al., 2020). Forest loss and degradation is especially acute in The Gambia, where trees are cut to supply wood and charcoal for cooking (Schroeder, 1999). Wood charcoal output increased by 48% between 2000 and 2019 (Uzu et al., 2022). Woodland ecosystems have been modified through cultivation and fire (Minhós et al., 2020), and a recent assessment using

remotely sensed satellite imagery revealed drastic losses in forest cover (approx. 18%) over the past 35 years in the southwestern region of the country (Dampha, 2021). Here, we highlight collaborative efforts in The Gambia to implement a number of the priority objectives identified in the Red Colobus Conservation Action Plan in order to study and protect remaining populations of Temminck's red colobus and their habitats.

Establishing Communities for Red Colobus (C4RC), The Gambia

Systematic surveys of Temminck's red colobus (TRC) monkeys in forested areas of The Gambia revealed that their populations were in decline or extinct at most survey sites (Mayhew et al., 2020). However, the community forests around Sambel Kunda in the Central River Region retained an abundance of red colobus monkeys (587 individuals observed) across an area of 30 km^2. Following these surveys, and in coordination with the Gambian Department of Parks and Wildlife Management, Jennifer Cramer organized and hosted the first local Temminck's red colobus conference in 2019. Using virtual conferencing tools, international experts in red colobus biology and conservation, including Drs. Mic Mayhew, Christy Wolovich, Joshua Linder, and Tânia Minhós contributed presentations. Topics included background about the ReCAP, population survey data from the Sambel Kunda area, gut parasite research and behavioral research on TRC in the Gambia, and genetic research on TRC in neighboring Guinea-Bissau. Attendees included representatives from government agencies and NGOs as well as local university students. The group also held a discussion with Gambian stakeholders that focused on red colobus conservation sites and priorities. These activities, along with the development of the ReCAP presented the opportunity for a community-focused primate conservation program to implement ReCAP priorities in The Gambia (Fig. 2) (Mayhew et al., 2020).

In 2020, Communities for Red Colobus (C4RC) was initiated by Dr. Mic Mayhew (https://www.facebook.com/C4RCproject/) with the aim of sustaining a community-centered approach to protect Temminck's red colobus and its natural habitats. C4RC strives to achieve this goal through primate monitoring and research, community engagement and education, reforestation, and responsible primate-based ecotourism. Such community-centered conservation includes constructing multilevel networks and collaborative partnerships, elevating the role of women as agents of positive change, ensuring a rights-based approach to conservation that supports local decision making, and creating local institutions that provide legitimate and adaptive strategies for the stewardship of biodiversity (Armitage et al., 2020). Despite The Gambia being a patriarchal society with socio-cultural barriers that often preclude women from leadership roles (Nabaneh, 2022), the C4RC project aims to achieve gender balance within the project team to enable the engagement and empowerment of local women in the communities who are often the end users of charcoal and have great potential for skills development. During its initial development stage (2020-2023), C4RC was funded primarily through grants and managed by Mic Mayhew with a focus on building capacity within the local team. The project has now shifted to Gambian leadership and management with a blend of funding secured from ecotourism revenue and grants. Now in its fourth year, C4RC employs a project manager and a team of six rangers (Fig. 3) including two women who work closely with local community members and government agencies while being supported by international partners who provide mentorship training in capacity building.

Building Local Capacity to Protect TRC and Forests in the Sambel Kunda Area

Effective conservation programs improve local capacity by building sufficient working knowledge of the primary environmental threats in the area, training about techniques to monitor populations, engaging in strategies to garner community support (Ardoin et al., 2020; Armitage et al., 2020) and raising sufficient funding to support conservation activities (Struhsaker et al. 2005; Waldron et al., 2013). The C4RC team has extensive local knowledge about their environment and the primary environmental threats faced at the project site. Through training with international partners, the team members have expanded their knowledge of the research related to monitoring and mitigating environmental threats, enabling them to improve community awareness and engagement in environmental protections at the Sambel Kunda site.

The C4RC's Gambian ranger team protects one of the largest remaining populations of Temminck's red colobus in West Africa. To this end, forest rangers have received training in primate ecology, survey techniques, data management and the use of spatial analysis software. A network of transects is established and regularly used to collect data on the abundance and distribution of the red colobus monkeys. The ranger team patrols the community forests for illegal cutting, charcoal production, and poaching. Initial survey results suggest these efforts may be reducing these activities in the C4RC project area. Surveys in 2019, prior to the project, identified 12 active charcoal production sites, whereas only two new sites have been located since the inception of C4RC. In the last three years, only one poaching incident was detected (3 adult Temminck's red colobus, May 2021) in the community forest of Sambel Kunda, and the TRC population across the C4RC project area remains stable (Barry, unpublished data).

To further reduce cutting of trees for charcoal production, C4RC is providing information and materials to promote the use of more sustainable cooking practices in the local villages.

C4RC consulted with Michael Stern (New Nature Foundation) to learn about the Kibale Fuel Wood Project (http://newnaturefoundation.org/what-we-do/stove-building/), which has successfully implemented the use of fuel-efficient rocket stoves in communities around Kibale National Park in Uganda. These stoves are built from inexpensive and readily available materials, such as traditional mud blocks, and may reduce fuelwood consumption by up to 60% (Stern, pers comm.). The stoves produce less smoke and particulate pollution than traditional three stone open fires and can burn a variety of waste biomass materials in addition to wood. In 2023, students from Florida Southern College visited the C4RC project and began informing the local community about the widespread benefits of fuel-efficient stoves and explored the potential to scale up their use across the C4RC project area. Funds have been raised to test out additional stoves, evaluate their effectiveness at reducing charcoal, and to systematically assess people's perceptions toward them over time.

In addition to primate monitoring and research, the forest rangers participate in reforestation, act as guides for responsible primate-based ecotourism, and facilitate community engagement and education. In 2020, C4RC rangers set up a tree nursery and subsequently planted tree seeds including cashew (*Anacardium occidentale*), mango (*Mangifera indica*), mahogany (*Khaya senegalensis*), beechwood (*Gmelina arborea*) and eucalyptus (*Eucalyptus* spp.) in polythene grow bags. The fruit tree seedlings are distributed to the communities, whereas the *Gmelina* and eucalyptus seedlings are transplanted to woodlots on marginal agricultural land to provide alternative sources of timber for fencing, roofing and firewood. To sustain local capacity and funding streams, a new visitor center was constructed as a base for the ranger team and a multipurpose hub for ecotourists, community groups and visiting scientists (Fig. 4). Ecotourism revenues are distributed annually on the basis of a benefit sharing agreement

between C4RC and the communities. Alkalos (chiefs) and Village Development Committees (VDCs) are informed of the annual allocation and asked to submit proposals with costs of goods and services that contribute to the sustainable development of each village and benefit all sectors of the community. Funds have been used to improve water infrastructure, support agricultural yields and install solar lighting along the village streets.

Formal ranger training and capacity building are not only leading to stable red colobus populations and possibly reducing threat levels at the local level, but are also supporting attempts to formally recognize this site as an indigenous protected area. Efforts are ongoing with the Department of Parks and Wildlife Management and the Department of Forestry to designate the C4RC site as an Indigenous Community Conservation Area (ICCA) within a Key Biodiversity Area (KBA). The community forests in the C4RC project area are owned and managed by the local people based on a Forest Management Agreement between the communities and the Department of Forestry, which grants extended user rights according to a set of rules and regulations in line with sustainable principles of forest use. Local people are mandated by the Forest Act 1998 (https://faolex.fao.org/docs/pdf/gam19052.pdf) to protect the forest from illegal activities including logging, charcoal production and hunting (Lamin Jallow, Department of Forestry, pers. comm.).

Over the past two years, the C4RC team has received training and skills development opportunities from visiting researchers and practitioners. The U.S.-based organization Partners for Red Colobus helped C4RC develop their education program by designing a bespoke framework that is scalable and inclusive of all demographic groups and by provisioning specific resources such as lesson plans and learning materials. Experienced primatologists have trained rangers in behavioral sampling and plant survey techniques to systematically assess the

behavioral ecology of the red colobus monkeys, facilitated virtual training in online data management and presentation tools, promoted scientific literacy and shared strategies for successful community based primate conservation projects. Though capacity-building strategies are not always enough to counteract primary environmental threats that are beyond a community's control, these strategies are part of the foundation of effective, long-term, locally-led conservation efforts.

Building on the success of the 2019 meeting, the C4RC team organized and hosted a conference in 2022 to strengthen stakeholder networks for the protection of primates and their forest habitats in The Gambia. Local leaders from the C4RC team, national representatives from the Gambian Department of Forestry, Gambian Department of Parks & Wildlife Management, and international researchers gave presentations. The conference was followed by a visit to the C4RC field site at Sambel Kunda in the Central River Region. This trip enabled the representatives from local government agencies to meet with the alkalos of five villages neighboring the community forest, providing an opportunity to discuss efforts to designate the C4RC site as an Indigenous Community Conservation Area (ICCA).

Developing youth conservation education and outreach programs

The C4RC education team led by rangers Meta Barry and Buba Bah delivers an inclusive outreach and education program to all sectors of the community with a focus on marginalized groups. Classroom based environmental education is delivered twice a week to approximately 150 students (11-16 years old); outreach groups for 90 local women are hosted monthly in Sambel Kunda and Misera and up to 50 children participate in weekly extracurricular activities

205 through the C4RC wildlife club at Sambel Kunda. The wildlife club provides field trips for local
206 children to embed sustainability and conservation principles and inspire them to change their
207 perceptions of primates. Youth are invited to join the wildlife club and selected students are
208 given incentives to participate in the community ranger training program with a provision of a
209 monthly allowance and a certificate of completion of the six-month course. This structured
210 ranger training program is led by the C4RC team with support from James Slade at Re:wild
211 (https://www.rewild.org/), and provides local youth with employability skills, identifies new
212 ranger recruits and effectively grows community capacity for primate conservation. These
213 opportunities for continued community engagement and education has resulted in growing
214 awareness of Temminck's red colobus as a flagship species (ReCAP priority 2).

215 International collaborators have supported the Gambian education team by offering
216 supplemental instruction and supplying materials to assist in the classrooms. To grow
217 understanding of Temminck's red colobus, Christy Wolovich and Megan Boemio created an
218 educational book specifically geared toward children in West Africa (Wolovich & Boemio,
219 2020). With the initial support of donations through a GoFundMe® site, over 100 copies were
220 provided to the C4RC team to use during their school visits. Questionnaire and quiz-based
221 evaluation results over two years from local school children and their parents revealed that the
222 book has substantially increased their knowledge of Temminck's red colobus ecology,
223 distribution and reproductive biology and reinforced the threats facing local primate populations,
224 which can be mitigated through community action (Barry, unpublished data).

225 Undergraduate students visiting The Gambia have also assisted education efforts by
226 designing play-based activities that spread awareness of conservation biology. After students
227 from Florida Southern College spent a semester researching specific environmental threats and

mitigation strategies, they shared this information with Gambian youth. The undergraduate students used interactive games to demonstrate how primates are impacted by deforestation and to suggest ways to mitigate human-wildlife conflict (e.g. deforestation and crop raiding) (Fig. 5). Over 75 children and their teachers and parents in Dumbuto, The Gambia as well as members of the C4RC wildlife club participated in these activities. Classroom materials and instructions for the activities were provided to the local educators for future use.

Future goals

We are encouraged by the current local support of the C4RC program and hopeful that the active monitoring of the primate populations coupled with the extensive educational initiatives and enhanced ecotourism capacity will ensure that the local population of the Endangered Temminck's red colobus monkeys will remain stable into the future. To continue to build capacity for the C4RC program, immediate goals include 1) the appointment of a research student (PhD/MSc level) who would conduct their research in the Sambel Kunda area and formally connect C4RC with Gambian higher education institutions, 2) completing a detailed study of the behavioral ecology of the Temminck's red colobus monkeys in a region where they have been understudied, and 3) the regional expansion of community education initiatives including the use of national media outlets to develop Temminck's red colobus as a flagship species and an ambassador for primate protection in The Gambia.

TAKE ACTION

- Support efforts to improve equity and representation through capacity building efforts at primate conservation sites. To build trust and to achieve lasting community and primate conservation benefits, recruit local staff on an equitable basis from the villages within the project area who are more likely to take ownership of the project and be accepted by the village chiefs and Village Development Committees (VDCs)
- Join the Red Colobus Conservation Network to stay informed about red colobus conservation https://www.redcolobusnetwork.org/
- Review the Red Colobus Conservation Action Plan (Linder et al., 2021)
- Make a contribution to help distribute children's books to schools and libraries in The Gambia. Each book includes photos of the Temminck's red colobus, information about their biology, ecology and behavior, suggestions for sustainable forms of local income, conservation-related questions to guide teachers and students in meaningful discussion and a fun activity that encourages excitement about red colobus monkeys. Please email Christy Wolovich, Florida Southern College (christy.wolovich@gmail.com) to help.
- Support the following collaborative efforts that aim to inform people about the plight of red colobus monkeys and ways to help conserve them.

  Communities for Red Colobus https://www.facebook.com/C4RCproject/

  @C4RCproject

  Partners for Red Colobus, a program of The Forest Collective (www.theforestcollective.org) https://www.facebook.com/Partners4redcolobus

  @Partners4redcolobus

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Author Contributions

Michael Mayhew: Conceptualization (lead); data curation (lead); formal analysis (equal); funding acquisition (lead); investigation (lead); methodology (lead); project administration (equal); resources (lead); software (supporting); visualization (equal); writing—original draft (equal); writing—review and editing (equal). **Christy Wolovich:** Data curation (supporting); funding acquisition (supporting); methodology (supporting); resources (supporting); writing—original draft (equal); writing—review and editing (equal). **Lamin Saho:** Conceptualization (supporting); Data curation (supporting); formal analysis (supporting); funding acquisition

(supporting); investigation (supporting); methodology (supporting); project administration (lead); resources (supporting); software (supporting); visualization (supporting); writing—original draft (supporting); writing—review and editing (supporting). **Samsideen Barry:** Conceptualization (supporting); data curation (equal); formal analysis (equal); funding acquisition (supporting); investigation (equal); methodology (equal); project administration (equal); writing—original draft (supporting); writing—review and editing (supporting). **Meta Barry:** Conceptualization (supporting); data curation (equal); formal analysis (equal); funding acquisition (supporting); investigation (equal); methodology (equal); project administration (equal); writing—original draft (supporting); writing—review and editing (supporting). **Idrissa Njie:** Data curation (equal); formal analysis (equal); funding acquisition (supporting); investigation (equal); methodology (equal); project administration (equal); writing—original draft (supporting); writing—review and editing (supporting). **Buba Bah:** Conceptualization (supporting); data curation (equal); formal analysis (equal); funding acquisition (supporting); investigation (equal); methodology (equal); project administration (equal); writing—original draft (supporting); writing—review and editing (supporting). **Abdourahman Sidibeh:** Data curation (equal); formal analysis (equal); funding acquisition (supporting); investigation (equal); methodology (equal); project administration (equal); writing—original draft (supporting); writing—review and editing (supporting). **Zainab Badjie:** Data curation (equal); formal analysis (equal); funding acquisition (supporting); investigation (equal); methodology (equal); project administration (equal); writing—original draft (supporting); writing—review and editing (supporting). **Jennifer Danzy Cramer:** Data curation (supporting); funding acquisition (supporting); methodology (supporting); resources (supporting); writing—original draft (equal); writing—review and editing (equal).

Joshua Linder: Data curation (supporting); funding acquisition (supporting); methodology (supporting); resources (supporting); writing—original draft (equal); writing—review and editing (equal).

Conflict of Interest Statement

The authors declare no conflict of interest.

Data Availability Statement

Data sharing not applicable as no new data were generated.

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373 **Figure Legend**

374

375 Figure 1. Endangered *Piliocolobus badius temminckii* from The Gambia

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377 Figure 2. Map of the community-based conservation program Communities for Red Colobus in
378 Sambel Kunda, The Gambia.

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380 Figure 3. Communities for Red Colobus forest ranger and education team.

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382 Figure 4. Recently constructed visitor center (top) and roundhouse (bottom) near Sambel Kunda,
383 The Gambia can accommodate tourists

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385 Figure 5. Gambian youth engaged in play-based conservation education activities.

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