

Final Evaluation Report

Your Details	
Full Name	Anoop Nadukkalathil Ravi
Project Title	Assessing the impact of the invasive tree <i>Senna spectabilis</i> on elephant habitat and mitigation of human-elephant conflict in Wayanad plateau.
Application ID	39310-B
Date of this Report	03-07-2024

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
To evaluate the impact of the invasive tree <i>Senna spectabilis</i> on the habitat of Asian elephants in the Western Ghats.			x	<p>The project mapped the distribution of <i>Senna spectabilis</i> and assessed its impact on the abundance and richness of native plant species, as well as on elephant distribution. The study revealed that <i>S. spectabilis</i> negatively affects native plants, including the percentage of grass cover, and causes elephants to avoid areas with high abundance of this invasive species.</p> <p>Based on these findings, we submitted a report to the forest department recommending immediate management actions for <i>S. spectabilis</i>. Additionally, we raised public awareness about the harmful impact of <i>S. spectabilis</i> on elephant habitats through newspaper articles and television interviews, which garnered over 10,000 views.</p> <p>Currently, the forest department, along with several NGOs, has initiated management efforts to control <i>S. spectabilis</i> in the Wayanad Sanctuary. We hope more organisations will join in the</p>

			<p>future to eradicate this species. We are also working on multiple scientific manuscripts for publication. Given the rapid colonisation of <i>S. spectabilis</i> in other landscapes across the country, we hope these scientific publications will draw the attention of policymakers, emphasising the need for early detection and eradication efforts.</p>
Individual identification of crop-raiding elephants in the landscape		×	<p>Due to limited manpower and the availability of camera traps, we focused our efforts on three out of the six forest ranges to identify crop-raiding elephants. The project successfully identified the maximum number of crop-raiders, both persistent and occasional, and tracked their seasonal movement patterns in the Chedelath, Begur, and Tholpetty forest ranges.</p> <p>We trained several volunteers in this component of the project, equipping them with skills to handle GPS devices, cameras, and camera traps. One of our researchers, Anurag Varakil, played an active role in the project and subsequently secured a permanent position at the Wildlife Trust of India.</p> <p>Currently, we are preparing scientific manuscripts based on our findings. Additionally, we will provide a detailed photo</p>

				library of elephants to relevant stakeholders.
Initiating community base eco-restoration of elephant habitat		×		<p>Since the inception of the first project, community-based eco-restoration efforts have been initiated. This project successfully planted around 1,500 saplings of native plants in the Thirunelli area (North-Wayanad Forest Division). The main collaborators for this activity were the Forest Department and Pazhassiraja Smaraka Ghrandhalayam (Pazhassi Library), Mananthavady. Approximately 30 participants were actively involved in these eco-restoration activities. We plan to continue these efforts in the future to raise awareness and improve habitat quality.</p>

Assessing various types of human-elephant conflict situations in the Western Ghats		×		<p>The project has expanded to new regions within the Wayanad district to investigate various types of human-elephant conflict situations and their drivers. The project has identified areas with differing levels of fragmentation, elephant density, corridors, landscape connectivity, mitigation methods, human population density, vegetation types, and crops cultivated. I plan to continue this aspect in Wayanad and other landscapes of the Western Ghats to gain a deeper understanding of the different conflict contexts and to develop more effective mitigation strategies. This objective also examines how various conflict mitigation methods impact elephant behaviour and movement.</p>
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2. Describe the three most important outcomes of your project.

a) Management of *Senna spectabilis* for elephant conservation: One of the most significant outcomes of our project was mapping the distribution of the invasive tree *Senna spectabilis* and understanding its impact on native plant species and elephant habitats. We raised awareness about the adverse effects of *S. spectabilis* on Wayanad forests and biodiversity through scientific articles, general articles, newspaper reports, YouTube videos, awareness classes, and television interviews. As a result, both the forest department and local communities have recognised *S. spectabilis* as a major threat to biodiversity and a contributing factor to increasing human-wildlife conflicts. We published the first scientific article on *S. spectabilis* from the Western Ghats (see <https://doi.org/10.1111/btp.12996>), which has spurred the forest department, research institutes, and NGOs to initiate management efforts in the Wayanad Sanctuary and other parts of the Western Ghats. The map we created during the project has been instrumental in helping the forest department understand the extent of the species' spread within the Thirunelli–Kudrakote elephant corridor. This corridor is a critical pathway through which *S. spectabilis* is

spreading to the Brahmagiri hills from the Tholpetty Range. Our findings and resources will aid in preventing the further spread of this invasive species into new landscapes.

b) Identification and Tracking of Crop-Raiding Elephants: Another key outcome was the identification and tracking of crop-raiding elephants within selected forest ranges. By focusing on three critical ranges-Chedelath, Begur, and Tholpetty-we were able to identify both persistent and occasional crop-raiders and understand their seasonal movement patterns. Training local volunteers in using GPS devices, cameras, and camera traps was an integral part of this outcome, enhancing community involvement and capacity building. This component also led to one of our researchers, Anurag Varakil, securing a permanent position at the Wildlife Trust of India.

c) Community-Based Eco-Restoration: The third major outcome was the initiation and implementation of community-based eco-restoration activities. This project involved planting approximately 1,500 saplings of native plants in the Thirunelli area, with the collaboration of the Forest Department and Pazhassiraja Smaraka Ghrandhalayam (Pazhassi Library), Mananthavady. With around 30 participants actively engaged, this initiative not only contributed to habitat restoration but also raised awareness about the importance of native vegetation.

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

During the project, we faced several unforeseen difficulties. One major challenge was the ongoing conflict between wildlife and farmers, particularly incidents of people being killed by elephants and tigers. These events led to continuous protests by farmers and local political parties, including some violent demonstrations, which hindered our work in the landscape. To mitigate this issue, we adjusted our work calendar to avoid protest days and focused on building strong relationships with forest fringe villagers to ensure smooth project activities. When directly approaching people to raise awareness became difficult, we opted to give detailed interviews on YouTube channels about the drivers of increasing conflict situations in the landscape (See [video 1](#) & [video 2](#)). These interviews reached a broad audience, with over 10,000 views, helping to educate the community about the underlying issues and potential solutions. We also encountered logistical challenges with our equipment. Limited camera traps and frequent malfunctions prevented us from covering the entire landscape. To address this, we strategically used the available traps in three forest ranges and extended the fieldwork schedule. Ideally, we would need around 100 camera traps to cover the entire area effectively. Additionally, the rough field conditions led to frequent vehicle maintenance and engine breakdowns, which exceeded our project budget as these costs were not anticipated.

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

Youth from tribal communities and tribal watchers were actively engaged in assisting with field sampling. This involvement provided them with monetary benefits and the opportunity to learn various field techniques and handle equipment such as GPS devices, binoculars, and camera traps. The farmers and forest department officials were very supportive, sharing their knowledge and expertise to help address the conflict situation in the landscape. Our team maintained continuous contact with most community members, fostering a collaborative environment. Forest watchers and farmers requested better quality equipment (e.g., torches, headlights, and raincoats with the Rufford logo) for the next phase of the project. We plan to provide these items to selected farmers and forest watchers, which will help reduce human-elephant conflict incidents, safeguard lives, and promote a harmonious relationship between humans and elephants. This support will also boost the morale of key stakeholders, encouraging them to work hard toward conserving elephants and understanding their importance in the ecosystem.

Such activities also generate awareness among locals about conservation efforts. During the project, around 30 people participated in eco-restoration activities, which educated them on the importance of elephants and their habitat. They have expressed a strong interest in continuing these activities to improve habitat quality in the future. By involving local communities, we not only enhanced their skills and knowledge but also fostered a sense of ownership and responsibility toward wildlife conservation. This collaborative approach has proven to be a crucial element in the success of our project and will continue to be a focus in future endeavours.

5. Are there any plans to continue this work?

Yes, I plan to continue the project in Wayanad and expand it to other landscapes. The research has generated more intriguing testable hypotheses than definitive answers. One of the significant challenges of wildlife conservation in Kerala in recent years has been the increasing human-wildlife conflicts and continuous protests by people. Unfortunately, baseline information about the drivers of these conflicts is unavailable from many landscapes. Therefore, I aim to extend the project into new landscapes, particularly the conflict hotspots of Kerala, to better understand the behaviour of elephants and various human-elephant conflict contexts. I will also empower forest department staff to identify individual crop-raiding elephants. This understanding is crucial for effective conflict management. Additionally, more awareness programmes are needed to help communities coexist with elephants. It is important to continue raising awareness about elephant behaviour and ecology among the local community, especially those residing in fringe areas.

The continuation of this work is also essential for the ecological restoration of degraded elephant habitats, particularly those infested with *Senna*. I intend to study the forage utilisation patterns of elephants in Wayanad and other landscapes to see how forage availability is affected by livestock grazing, the spread of invasive plants, and fire. In the next phase of the project in addition to what is mentioned above, I plan to distribute torches, headlights, and raincoats with the Rufford logo to farmers and forest department staff. This will help reduce human-elephant conflict incidents, safeguard lives, and promote a harmonious relationship between humans and elephants. Additionally, I am interested in training more forest department staff in various research methods and data analysis. To support our envisaged work, we plan to apply for the next booster grant from Rufford.

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

We have shared our work in various impactful ways:

1. **Scientific Publications:** We have published two peer-reviewed scientific manuscripts and two general articles from the project. Additionally, two manuscripts are under review, and one is in preparation. These publications will be shared with forest department officials and policymakers for reference and implementation.
2. **PhD Thesis:** One of the significant outputs from the last three projects is my PhD thesis. It is available to the public, and I will provide a copy to higher officials of the forest department and researchers working in the landscape.
3. **Reports:** We have submitted a report to the Forest Department regarding the spread of *Senna spectabilis* in the Thirunelli-Kudrakote elephant corridor. This report has helped them understand the impact of the species and manage it immediately in the corridor.
4. **Documentary:** We have sourced videos and images to create a documentary film aimed at raising awareness about elephant and habitat conservation in Wayanad. The documentary will be released soon.
5. **Media Engagement:** During violent protests in Wayanad due to a high level of conflict following an elephant killing a person (see [The Hindu article](#)), I gave interviews to a popular YouTube channel (see [video 1](#) and [video 2](#)) and wrote an article about the conflict issues and possible solutions (see [article](#)). These videos and articles received significant attention and response from politicians, the local community, and forest department officials.
6. **Conference Presentations:** The output of our work has been presented at prestigious conferences such as SCCS Cambridge, British Ecological Society (BES), and the International Congress for Conservation Biology (ICCB), and Sugadaira Research Station, Mountain Research Center (MSC), University of Tsukuba, Japan.

7. **Community Engagement:** Researchers involved in the project regularly interact with various stakeholders, such as students, forest department staff, and the local community, to share findings and discuss implications.

By utilising these diverse platforms, we aim to disseminate our research findings widely and engage various stakeholders in meaningful discussions about elephant conservation and human-wildlife conflict management.

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

First, I extend my heartfelt gratitude to The Rufford Foundation for the financial support in undertaking this crucial project. Moving forward, it is essential to continue our efforts in Wayanad to provide guidance to the forest department and NGOs in developing effective conservation strategies for elephants and their habitats based on the best available knowledge. Additionally, several key actions are necessary to maintain harmony between people and elephants. To support these endeavours, we intend to apply for a Booster Grant to undertake the following activities:

1. **Restoring Degraded Habitats:** The elephant habitats in Wayanad are significantly degraded due to the spread of invasive species such as *Senna spectabilis* and *Lantana camara*, forest fires, and livestock grazing. It is crucial to restore these areas, ideally with the full involvement of local communities.
2. **Extending Conflict Studies and Awareness Programs:** Human-elephant conflict is a severe issue in many landscapes of Kerala. Therefore, we plan to extend our field study and awareness programmes to different landscapes in Kerala to understand the various conflict contexts and processes better. This includes building capacity among forest department staff.
3. **Conserving Key Micro-Habitats:** We identified that low-lying swamps are vital micro-habitats for elephants in Wayanad during the summer. However, these swamps are rapidly degrading due to uncontrolled livestock grazing, forest fires, and invasive plant spread. To ensure the long-term survival of elephants in the Brahmagiri-Nilgiri landscape, it is essential to demarcate all swamps in Wayanad and study the patterns and drivers of their use by elephants.
4. **Creating Educational Resources:** There is a scarcity of resources in the local language to improve awareness of elephant conservation. We plan to write a book on elephants in Malayalam to address this gap.
5. **Producing a Documentary:** We aim to prepare a documentary on the impact of the invasive tree *Senna spectabilis* on elephant habitats. This documentary will help politicians, planners, conservationists, and donors understand the issue and formulate practical solutions. It will also raise awareness among farmers and nursery owners about the problems associated with planting these species.

6. **Enhancing Economic Resilience:** To reduce human-elephant conflicts and enhance the economic resilience of farmers, we will introduce fruit trees (such as avocado, orange, and lemon) that elephants do not prefer and promote beekeeping.
7. **Studying Habitat Impacts:** It is crucial to study the impact of invasive species, livestock, and fire on elephant habitats and how these factors are linked to human-elephant conflict.
8. **Training in Conflict Management:** We will train farmers in community-based conflict management techniques, including using chili and beekeeping as deterrents against elephants.

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?

Yes, I have prominently featured the Rufford Foundation logo across all materials related to the project. This includes posters, leaflets, reports, and letterheads. Additionally, I have included the Rufford logo in the introductory slides of conferences and other PowerPoint presentations I have given. I have also acknowledged the Rufford Foundation in all my publications. Furthermore, the Rufford logo was always displayed on the project vehicle.

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

The project team consists of nine dedicated members, each playing a vital role:

1. Dr. Anoop NR - Principal Investigator (PI)
2. Dr. T Ganesh - Co-Principal Investigator (Co-PI)
3. Mr. Anurag Varakil - Researcher
4. Mr. Muneer P.K - Researcher
5. Mr. Ajayan PA - Researcher
6. Mr. Madhavan M - Researcher
7. Mr. Sujin N.S - Collaborator
8. Mr. Onan - Field Assistant
9. Mr. Nanjappan - Field Assistant

10. Any other comments?

I would like to extend my heartfelt gratitude to The Rufford Foundation for your invaluable funding support for this crucial project. This endeavour has been an exceptional learning experience for the entire team. The grassroots-level conservation work supported by Rufford has significantly contributed to the career

growth of young researchers, particularly those from developing countries like India. Many researchers involved in this project have secured better job opportunities in the conservation field because of your support.

The successful completion of this project in Wayanad, a key elephant conservation area in the Western Ghats, would not have been possible without your assistance. I deeply appreciate Rufford's commitment to supporting young researchers and students across developing and underdeveloped countries. Your support has been instrumental in the successful completion of my PhD work. We are hopeful that Rufford will continue to support us in the next phase of our work.

Field photographs

During the project, I organized an eco-restoration and awareness program named 'Vitha' along the Thirunelli-Kudrakote elephant corridor in collaboration with the Kerala Forests and Wildlife Department and Pazhassi Raja Smaraka Ghandhalayam, Mananthavady. This initiative resulted in the planting of around 1,500 seeds and saplings of native tree species.









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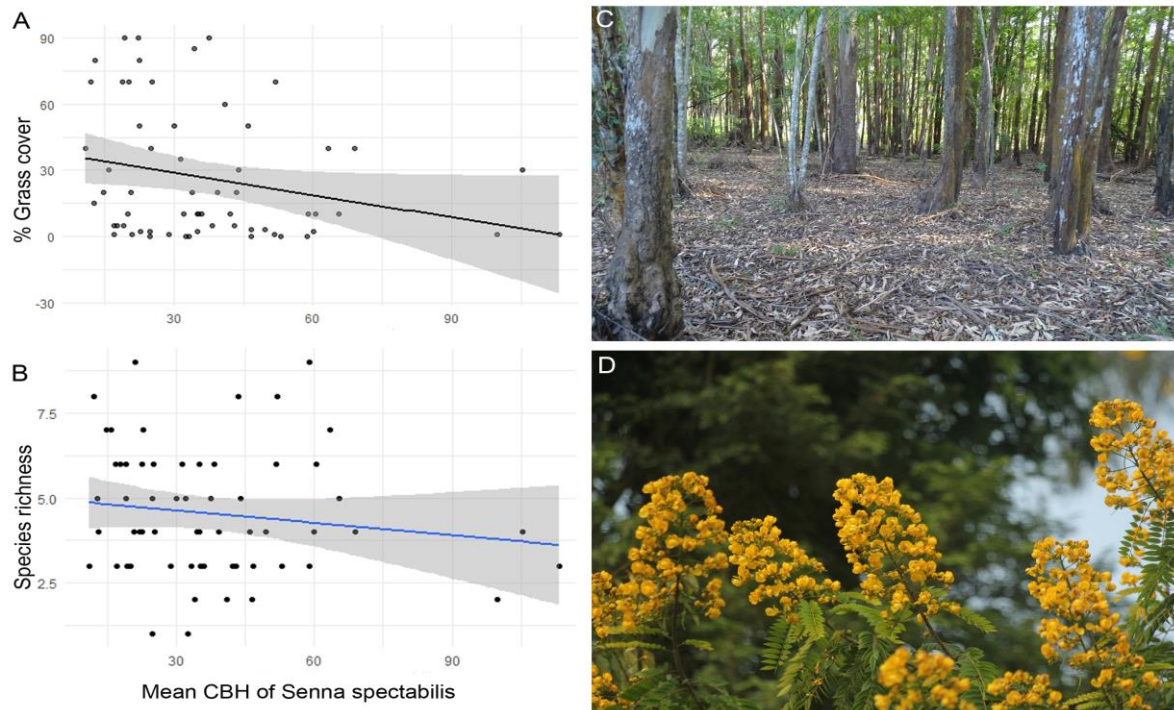
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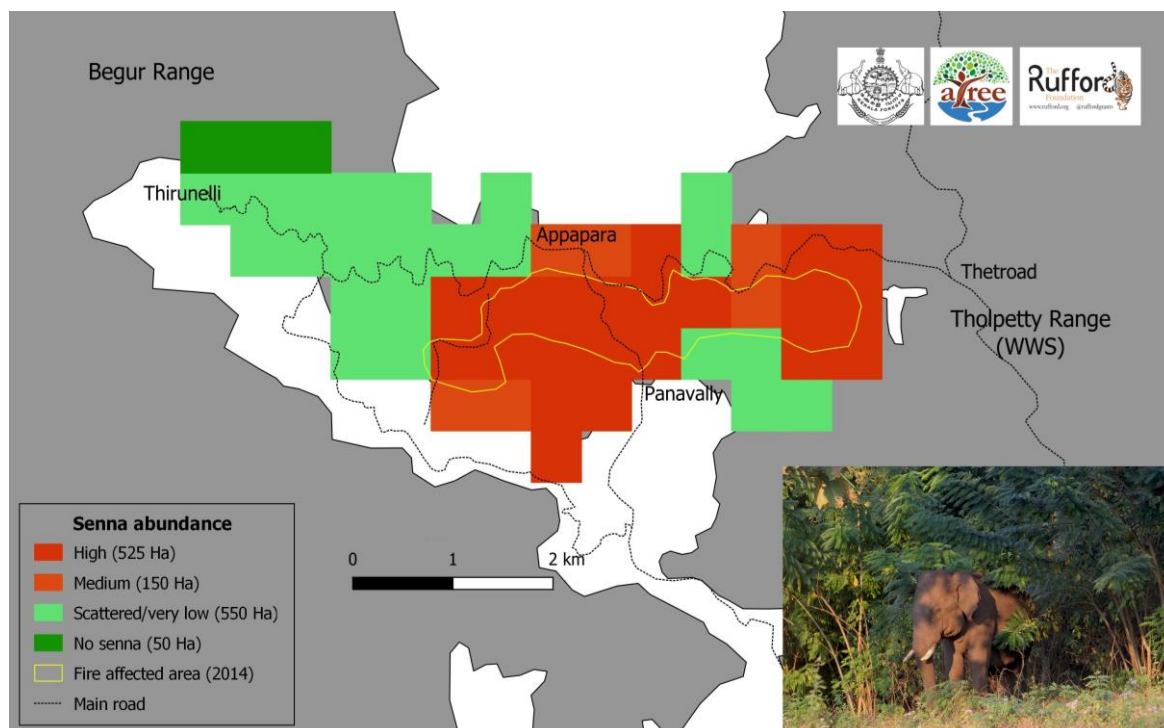
Field sampling to assess the impact of *Senna spectabilis* on native vegetation, elephant distribution, and human-elephant conflict, as well as the identification of crop-raiders through camera trapping.



Relationship between *S. spectabilis* and (A) grass cover and (B) Species richness (C) Heavily *S. spectabilis* infested area support poor native vegetation and other invasive plants (D) massive synchronised flowering of the species from Wayanad Wildlife Sanctuary.



Map showing the distribution and abundance of *S. spectabilis* in the Thirunelli-Kudrakote elephant corridor



**List of publications (peer-reviewed journal articles and general articles)
and media coverage**

Anoop, N. R., Krishnan, S., & Ganesh, T. (2023). Elephants in the farm—changing temporal and seasonal patterns of human-elephant interactions in a forest-agriculture matrix in the Western Ghats, India. *Frontiers in Conservation Science*, 4, 1142325.

<https://doi.org/10.3389/fcsc.2023.1142325>

Anoop, N. R., Krishnaswamy, J., Kelkar, N., Bunyan, M., & Ganesh, T. (2023). Factors determining the seasonal habitat use of Asian elephants in the Western Ghats of India. *The Journal of Wildlife Management*, 87(8), e22477. <https://doi.org/10.1002/jwmg.22477>

Anoop, N. R. & Ganesh, T. (2023). Impact of alien plants on Western Ghats causes concern. [The Hindu](#).

Anoop, N.R. and C.M. Manila (2024) - <https://truecopythink.media/environment/forest-wildlife-human-conflict-nr-anoop-interview-manila-c-mohan>

Anoop, N.R. and C.M. Manila(2024). <https://www.youtube.com/watch?v=g3UI--MmxZM&t=1331s&pp=ygUOYW5vb3AgKyBtYW5pbGE%3D>

Anoop, N.R. and C.M. Manila (2024).
<https://www.youtube.com/watch?v=qWvoNuAFjZw&t=1872s&pp=ygUOYW5vb3AgKyBtYW5pbGE%3D>

Kedlaya, G. (2023). Elephants in the farmlands. *Deccan Herald*. [Deccan Herald](#).

Menon, A. (2023, October). Wayanad is summer home for elephants, says a study. *Mongabay*. [Mongabay](#).

Menon, A. (2024). Wayanad: A Summer Destination for Elephants. *Roundglasssustain*.
[roundglasssustain](#).