Farmers' experiences of mobile electric fences for human–elephant coexistence

Insights and recommendations from service design research in Gabon

Katarzyna Mikołajczak, Christian Mikolo Yobo, Eric Chehoski, Claudel Tshibangu and Maurice Schutgens

Research insight

October 2024

Grantham Foundation for the Protection of the Environment

The Grantham Research Institute on Climate Change and the Environment was established in 2008 at the London School of Economics and Political Science. The Institute brings together international expertise on economics, as well as finance, geography, the environment, international development and political economy to establish a world-leading centre for policy-relevant research, teaching and training in climate change and the environment. It is funded by the Grantham Foundation for the Protection of the Environment, which also funds the Grantham Institute – Climate Change and the Environment at Imperial College London. www.lse.ac.uk/granthaminstitute

The Tropical Ecological Research Institute (IRET) at the **National Center for Scientific and Technological Research (CENAREST)** in Gabon is an institution dedicated to the study and preservation of tropical ecosystems. Established to enhance scientific understanding and promote sustainable management of natural resources, IRET is instrumental in addressing ecological challenges and fostering conservation efforts in Gabon and the Central African region. The management and mitigation of human–elephant conflict is a critical objective at IRET, to contribute to the protection of both human and elephant populations, and promote coexistence and sustainability. www.cenarest-gabon.org

Space for Giants is a conservation non-governmental organisation (NGO) working across 10 countries in Africa to unlock the full value of nature by protecting biodiversity and remaining populations of megafauna, while expanding economic, cultural and social value for local communities and governments for generations to come. Bringing the discipline of good management, conservation investment and adaptive innovation, it works to halt the degradation Africa's iconic landscapes and expand them through a combination of public and private management strategies. Space for Giants is headquartered in Kenya and is a registered charity in England and Wales and a 501(c)(3) non-profit organisation in the US. www.spaceforgiants.org

About the authors

Katarzyna Mikołajczak is a Research Officer at the Grantham Research Institute on Climate Change and the Environment.

Christian Mikolo Yobo is a Technical and Scientific Coordinator at CENAREST.

Eric Chehoski is Country Director for Gabon at Space for Giants.

Claudel Tshibangu is a Conservation M&E Manager for Gabon at Space for Giants.

Maurice Schutgens is Managing Director of Conservation at Space for Giants.

Acknowledgements

The authors are grateful to the interviewees and workshop participants who supported the production of this work. Special thanks to the Field Research Assistants, Margeorie Babicka and Michel Mbazonga, our dedicated driver Dan Mambo, and members of the Space for Giants team who supported the fieldwork. The authors also thank Ganga Shreedhar, Anomitro Chatterjee and Declan Conway for their helpful comments on earlier drafts.

This research insight is based on a research project titled 'Applying a behavioural service design approach for human–wildlife coexistence: the case of electric fences against elephant crop depredation in Gabon', funded by a grant from the LSE's Research Impact Support Fund in 2023. Further information on this research will be published in forthcoming academic papers.

This research insight was edited by Natalie Pearson.

This paper was first published in October 2024 by the Grantham Research Institute on Climate Change and the Environment.

Suggested citation: Mikołajczak K, Mikolo Yobo C, Chehoski E, Tschibangu C and Schutgens M (2024) *Farmers' experiences of mobile electric fences for human–elephant coexistence: insights and recommendations from service design research in Gabon*. London: Grantham Research Institute on Climate Change and the Environment, London School of Economics and Political Science.

Cover photo: A Gabonese farmer stands by her mobile electric fence battery unit, displaying the corn harvest gathered from the field protected by the fence. Credit: Space for Giants.

Contents

A solitary African forest elephant (*Loxodonta cyclotis*) standing near the edge of a dense forest in Gabon. Photo: Space for Giants.

Summary

Background, findings and challenges

- Human–elephant conflict can threaten both livelihoods and conservation efforts. Mobile electric fences offer a potential solution to this problem.
- However, local uptake and the long-term success of such fences are not guaranteed, requiring careful consideration of the local context and the needs and perspectives of the farmers that use them.
- We assessed a mobile electric fencing programme in Gabon, where rural communities face crop damage from elephants, using the innovative tools of service design and behavioural insights to explore how the intervention can work well and the challenges that arise.
- Our study finds overwhelmingly positive experiences from participating farmers due to the efficacy of fences in deterring the elephants and their compatibility with farmers' needs and agricultural practices.
- Factors contributing to the programme's success include effective fence design and behaviour change techniques that motivate upkeep. These include ongoing support from Space for Giants, the non-governmental organisation responsible for implementation, and the requirement to adequately maintain fences for a year before gaining ownership.
- The greatest challenge encountered by farmers is the tension and lack of cooperation around fence maintenance among groups of farmers that use fences collectively.
- In the long term, the programme may become vulnerable to systemic challenges around human and elephant behaviour. As elephants learn to breach the current fence models, new designs will have to be more complex and possibly fixed to a single location. This would require traditional 'shifting' agricultural practices to be replaced with sedentary methods, which could conflict with traditional land governance systems.

Recommendations for practitioners

- To maintain local trust and engagement in the mobile electric fencing programme as it expands, it is critical that farmers continue to receive sufficient training and technical support.
- The programme's effectiveness and inclusivity could be improved through expanded outreach, awareness-raising and communication efforts, such as disseminating key information and reminders on correct procedures for operating fences, providing materials and training in the local languages, and encouraging greater engagement by women.
- The programme should continue to provide fences to individual users while restricting the option of shared fences to associations or informal groups that have a track record of successful cooperation.
- Further innovation is needed to improve the safety of fences and reduce efforts required for their ongoing maintenance.
- People living in communities that share space with elephants should be thoroughly engaged in constructing visions and pathways to peaceful coexistence.
- An inclusive strategy for long-term human–elephant coexistence should account for behavioural and cultural factors such as cultural norms, preferences and traditional practices.
- Any behaviour change campaigns required, such as for the adoption of sedentary farming techniques, should be aligned with the needs and motivations of the target audience.

1. Introduction

Mobile electric fences can be used to support peaceful coexistence between people and elephants, but their successful implementation relies on many factors. This section outlines the aims and approaches of this research insight, which focuses on the Gabonese mobile electric fencing programme.

Human–elephant conflict is a common problem in places where human activities and elephant habitats overlap, posing a serious threat to livelihoods and elephant conservation (Shaffer et al., 2019). In Gabon, the growing intensity of these conflicts in recent years has made it a key political issue (GWP and ANPN, 2017). In 2022, Space for Giants, an international conservation non-governmental organisation (NGO), in support of the Ministry of Water, Forests, the Sea and the Environment (hereafter referred to as the 'Ministry of Water and Forests'),[1] introduced a national mobile electric fencing programme to protect farmers from crop devastation by elephants.

Solar-powered electric fences are a popular tool for mitigating human–elephant conflict, yet local uptake is not always successful (Kamdar et al., 2022; Montgomery et al., 2022). The adoption of electric fences is a complex intervention that requires numerous and sustained adjustments in farmers' routine practices and behaviours. Even when they demonstrate effectiveness and show promising early-stage results, technical interventions such as this often fail to take hold or ultimately achieve the desired impact (Osborne et al., 2022). This can be due to unforeseen misalignments with the needs of the target groups or other elements of the wider socio-ecological system, such as local agricultural practices or social norms (Datta and Mullainathan, 2014; Lambe et al., 2020).

For an intervention to work, its design must cater to the diverse needs and motivations of the users (in this case, farmers) and remain responsive to how these needs and contexts change over time. Therefore, despite the present success of mobile electric fences in Gabon, their sustained adoption and use require a deeper understanding of farmers' interactions with and perspectives on this technology.

Aims of the research project

The research upon which this insight is based investigated the experiences of early beneficiaries of a mobile electric fencing programme in Gabon, using service design methods and complementing these with behavioural insights. It examined what has worked for the users, the challenges they encountered, and the potential impact of these challenges on the programme's viability.

The specific objectives were to understand users' experiences with fences over time and explore with them potential solutions to the challenges identified. This required gaining understanding of the socio-ecological system of Gabonese subsistence farmers and the farmers' perceptions of the problem of crop damage by elephants that the fencing programme seeks to address. The study intended to find ways to improve the compatibility of Gabon's mobile electric fencing programme with the local context and farmers' needs and motivations, while taking into account wider feasibility (e.g. relating to political arrangements, networks and ecological conditions).

The project involved three weeks' fieldwork carried out by researchers from the Grantham Research Institute and the Tropical Ecological Research Institute (IRET) in July 2023. This consisted of 18 interviews with individual and group fence users around the town of Makokou, Gabon, and a workshop with other stakeholders including local representatives of the Ministry of Water and

[1] The Ministry of Water, Forests, the Sea and the Environment was in charge of the programme at the time of its inception until a government coup in August 2023. The programme continues to work with the Ministry of Water and Forests but also cooperates with the new Ministry of Environment, Climate and Human-Wildlife Conflict, which is now the parent ministry for this programme. As the study was conducted during the old regime, we refer to the Ministry of Water and Forests in this research insight.

Forests, the Ministry of Agriculture, the Ivindo National Park authorities and liaison organisations between the National Park and the local communities, representatives from Space for Giants and another conservation NGO, and representatives from the fence beneficiaries. Field data was supplemented with information gathered from online discussions with NGOs. The research was approved by the Ethical Committee at LSE and the National Center for Scientific and Technological Research (CENAREST).

Aims and structure of this research insight

This research insight outlines the findings and recommendations from our study of farmers' experiences with the mobile electric fencing programme in Gabon. The recommendations aim to reduce the programme's chance of failure and promote a more sustainable and harmonious relationship between humans and forest elephants.

In addition to providing guidance for the Gabonese fencing programme, this work serves as a useful resource for other practitioners in the area of human–elephant conflict mitigation – particularly those working with electric fences.

The research insight also aims to showcase to the broader conservation audience that service design methods, complemented with a behavioural science lens, can provide a practical approach to improving conservation interventions involving people.

Section 2 gives an overview of the mobile electric fencing programme's history, eligibility criteria and procedures, and performance to date. Section 3 explains the service design approach and presents the user journey of the programme's beneficiaries, along with details of their positive experiences, challenges encountered and proposed solutions. Section 4 presents the four key insights from the study and related recommendations to enhance the programme. Section 5 concludes.

A solar-powered mobile electric fence unit, featuring a solar panel, battery, control box with wiring, and wooden posts for support. Photo: Space for Giants.

2. Gabon's mobile electric fencing programme

This section provides background information on the mobile electric fencing programme, which seeks to tackle crop raiding by elephants, including how it came about and has developed over time, its requirements and procedures, and performance to date.

Programme history and development

The solar-powered electric fencing programme in Gabon was launched in 2016 by the Government, with technical support provided by Space for Giants. The first few years involved experimentation with large and fixed high-specification electric fences, which were highly effective with proper upkeep. However, their maintenance proved too burdensome for the local communities and their use became limited to large, commercial projects.

By March 2022, Space for Giants had developed a pioneering mobile fence design that was tailored to the needs of farmers in Gabon. These fences were simple to install, affordable, easy to operate (including for elderly farmers), moveable to enable 'shifting' cultivation methods and, most importantly, effective.

Space for Giants then initiated an awareness campaign among rural communities and began the installation of the first 100 pilot mobile fences in different parts of the country to serve as proof of concept. The majority of the fences were concentrated in three focal areas to facilitate monitoring and feedback: around Franceville (Haut Oguée province); Mandji (Ngounie province); and Makokou (Oguée-Invindo province). Twenty-six of the 97 fences installed by the end of 2022 were erected around Makokou, with roughly two fences in each village, the precise number depending on local interest and an occasional surplus of fences created when villages refused their allocation.

An aerial view of a village in Gabon, surrounded by a mosaic of forest and plantations at different stages of growth, illustrating the local shifting cultivation system. Photo: Space for Giants.

Beneficiaries of fences in this trial phase of the programme were selected from willing farmers in the participating villages with active plantations threatened by elephant intrusions. Initial interest was low due to widespread scepticism around the efficacy of fencing. Moreover, in multiple villages, damage by elephants had caused most people to abandon planting, leaving only a few farmers that could make use of the fences. However, in some villages the pool of eligible and willing candidates exceeded two persons, and in those cases fence allocation was decided by the community itself, often through a lottery.

Following positive feedback on fence efficacy and user commitment over the first six months, and no reports of major problems, the programme continued to expand. As of September 2024, 882 fences had been installed across Gabon, benefitting just over 12,253 people. The current aim is to expand the programme to all the remaining provinces and install a further 1,000 fences per year for the foreseeable future.

Current eligibility criteria and procedures

To qualify to receive a mobile electric fence, individuals must live in a village in Gabon and rely on agriculture as their main source of livelihood. They must have experienced crop damage by elephants, have filed a formal complaint with the Ministry of Water and Forests or the Ministry of Agriculture, and be willing to receive and maintain a fence. Fences must only be placed around existing plantations or sites already prepared for planting, and only one fence can be allocated per legal entity, such as a farmer or a formal association. As farmers often practise shifting cultivation methods across different sites, they may have several plantations needing protection. To address this, farmers are able to group their plantations under fences belonging to different persons across various sites.

Farmers can express their interest in obtaining a mobile electric fence during field visits conducted by agents of the Ministry of Water and Forests or the Ministry of Agriculture to evaluate elephant-related damage, or the risk of such damage. This interest is recorded in a national register and farmers are then contacted by Space for Giants to arrange installation. Alternatively, farmers can contact the local Ministry authorities directly for guidance on how to receive a fence.

To obtain a fence, a farmer must sign an agreement with Space for Giants and the Ministry of Water and Forests outlining their responsibilities for daily fence monitoring, record keeping, reporting and maintenance. Beneficiaries are required to demonstrate proper fence upkeep for a full year before the fence becomes their permanent property and they receive an official certificate of ownership. If beneficiaries fail to demonstrate adequate upkeep, the fence may be removed from them, after warnings are issued. Daily checks involve measuring voltage to ensure it stays within the required range. If the voltage drops, the farmer must inspect the fence for damage and repair it, or call Space for Giants if needed. Regular maintenance includes clearing vegetation around the fence to prevent it from reducing voltage and effectiveness. Under the agreement, beneficiaries agree to keep a record of daily measurements and any signs of elephant interactions with the fence. An interaction is defined as signs of elephant activity within two metres of the fence and interactions are categorised as 'repelled', 'breached without damage' or 'breached with crop damage'. Beneficiaries must report the daily records of fence voltage, elephant interactions and any other observations to Space for Giants agents during phone check-ups every two to four weeks. This information is then compiled into a central database. To support these duties, users receive a voltmeter, notebook, spare wire and a pen.

Programme performance to date

To date, Gabon's electric mobile fencing programme can be considered a success. Although the results of the first national impact survey were not available at the time of writing, positive evidence includes an efficacy rate of 95% as reported by users, [2] further anecdotal user feedback gathered by Space for Giants, and the sustained growth in demand for fences, shown by the volume of requests in the national register.

Our analysis also supports a positive evaluation of the programme. Interviewees consistently reported high satisfaction with the mobile electric fences: they work as intended for the vast majority, relieving farmers of the anxiety and exhaustion of attempting to protect their plantations against elephants. With harvests becoming more reliable thanks to the fences, people have started to return to villages that were previously abandoned due to elephant damage. The beneficiaries expressed gratitude for the fences and emphasised the crucial role of the support they receive from Space for Giants.

Nonetheless, the programme faces several ongoing and emerging challenges, the most critical of which relate to fences that are used collectively and the possible need to shift towards fixed fences and sedentary agriculture to maintain efficacy. These challenges should be addressed to sustain and build on the programme's achievements.

One of the first beneficiaries of the mobile electric fencing programme in Gabon standing by the power unit of her fence. Photo: Space for Giants.

[2] The efficacy of fences is determined by the proportion of recorded interactions in which elephants were successfully repelled over the total number of interactions, based on the database compiled from users' daily fence monitoring records.

3. Employing service design and behavioural insights to improve interventions

To explore users' experiences with the electric fencing programme in Gabon, our study employed methods from service design and used behavioural insights to complement the findings. This section outlines the approach and presents one of the key outputs: the 'user journey', which maps the full experience of the fencing programme's participants and the challenges encountered at the different stages.

What are service design and behavioural insights?

Service design is a flexible and adaptable approach to innovating systems such as services, processes or interventions. It is particularly useful in low-income settings that are characterised by complex and rapidly-changing conditions (Osborne et al., 2022). Service design is human-centred, meaning that it prioritises the needs, motivations and perspectives of stakeholders – especially the end-users. Key principles of service design include co-creation and iteration, whereby stakeholders and designers explore the issues and solutions together to first define the problems from the users' perspective, and second tailor interventions to the local context and the genuine (rather than assumed) needs of stakeholders.

Service design follows an iterative process that begins with qualitative research, such as interviews and observation, to deeply understand the wider system and the users' needs within it. Collaborative brainstorming, development of prototypes and testing of solutions follow, incorporating user feedback at each step. Insights are verified with other stakeholders through workshops. Data-gathering, analysis, prototyping and solution-testing proceed in rapid – even daily – iteration to enable fast learning and refinement of insights and solutions. Applied at an early stage in intervention planning or delivery, service design can help to avoid costly mistakes by identifying and eliminating critical design deficiencies.

Service design can be usefully integrated with behavioural insights (Lambe et al., 2020), a body of knowledge that draws on diverse disciplines including psychology and behavioural science to understand how people behave in real-world contexts. Together, service design and behavioural insights can enable deeper understanding of the likely psychological mechanisms underlying people's experiences and responses to an intervention (Michie et al., 2013; National Academies of Sciences et al., 2023). This can help to determine which features of an intervention work, which do not and why, and additionally to identify future challenges that may not have manifested in users' experiences yet.

User journey

One of the key methods and outputs of service design is the user journey: a visual representation of the entire experience of users' interactions with an intervention, from initial awareness to regular use or disengagement (Lambe et al., 2020). This method tracks and organises user actions, expectations and perceptions across different stages, consolidating large amounts of complex information about behaviours and needs.

Breaking down the user experience into specific steps makes it possible to identify the critical moments at which users face challenges, thus highlighting opportunities for implementing timely solutions. The user journey also provides insights into the positive experiences that are important to maintain as the intervention expands.

Applying service design and behavioural insights to the assessment of Gabon's electric mobile fencing programme

To explore the problem of human–elephant conflict in Gabon and potential solutions in line with the principles of service design, we used interviews and plantation visits to gain an understanding of the daily challenges of life as a subsistence farmer. Alongside in-field analysis and mapping the user journey, we explored local residents' views on potential solutions that emerged throughout the research process. After the fieldwork, we applied a behavioural lens to our findings to identify the programme's features, the behaviour change techniques they correspond to, and the likely psychological effects they engage.

The user journey for the electric fencing programme describes the different phases and steps that users go through as participants of the intervention, and pinpoints the challenges that arise at different stages (see Figure 3.1). These challenges and possible solutions are detailed further in Table 3.1 and discussed in Section 4.

Figure 3.1. The user journey for electric mobile fence users around Makokou, Gabon

Steps involved		Phase description	Design challenges
Awareness Express interest, verify eligibility Wait for contact from Space for Giants Contact from Space for Giants to confirm interest	Before installation	Farmers first hear about electric mobile fences in village meetings or through word of mouth. They register interest with the Ministry of Agriculture or the Ministry of Water and Forests, typically during field visits, to verify complaints about elephant damage. They then wait for Space for Giants to confirm their expression of interest. Farmers were initially sceptical about whether the fences would work against elephants and interest was low. But as they proved effective, demand surged. Currently, wait times can be longer than desirable.	1. Raising awareness 2. Engagement with women 3. Correct fence extension 4. Enhanced safety 5. Cooperative fence-sharing 6. Dependence on Space for Giants
Site preparation; clear buffer strip; install poles Contact Space for Giants to arrange installation Wait Sign agreement protocol Installation and training by Space for Giants	Onboarding	After receiving confirmation of fence allocation from Space for Giants, users must clear a 2-metre wide strip around the plantation, place wooden poles at 10-metre intervals, then contact the NGO to schedule installation. On the day of installation, the user signs an agreement with the Ministry of Water and Forests and Space for Giants. They become participants in the baseline impact survey. Space for Giants install the fence and train the users in battery operation, voltage measurement, surveying for damage, small repairs and record keeping. The user receives a voltmeter, spare wire, notebook and pen. *Note: There can only be one legal owner of fences but some protect multiple users' plantations.*	2. Engagement with women 3. Correct fence extension 5. Cooperative fence-sharing
First weeks: learning to use, monitor and maintain Observe and evaluate effectiveness Regular monitoring calls with Space for Giants Adjust and repair fence as needed	Exploratory phase	Users adjust to routine surveillance, operation and fence maintenance. They begin to face issues such as repairing damage from falling wood and making adjustments to deter baby elephants. With regular calls and support from Space for Giants, these issues are managed smoothly. Users quickly observe the effectiveness of fences in deterring elephants. This positive experience typically boosts confidence and motivation to uphold fence care, but it sometimes leads farmers to think that ongoing upkeep is no longer necessary. Warnings from Space for Giants emphasise the importance of regular maintenance.	2. Engagement with women 4. Enhanced safety 5. Cooperative fence-sharing 7. Good fence governance
Fence extension Use, monitoring and maintenance become habitual over a year Fence ownership formally transferred to beneficiary Continued use	Long-term use	After a few months, the use, monitoring and maintenance of fences become part of the farmers' routines. Most want to expand their fence with the next growing season to protect new nearby plantations, often including those of relatives. This involves opening up the existing fence, typically with physical assistance and extra wire provided by the NGO. Ownership officially transfers to users after a year of compliance. Space for Giants continues to provide support with regular phone calls.	2. Engagement with women 3. Correct fence extension 4. Enhanced safety 5. Cooperative fence-sharing
Relocate fence to new plantation Replace fence with new model	Future	In the future, following traditional farming practices, it is anticipated that users will relocate fences to new fields. As elephants learn to breach the current model of fences, the programme plans to replace them with more complex designs, which may require sedentary agricultural methods.	5. Cooperative fence-sharing 6. Dependence on Space for Giants 7. Good fence governance 8. Easy maintenance 9. Incentivise coexistence 10. Keep up with elephants' learning

Table 3.1. Design challenges and potential solutions identified by the study in order of occurrence in the user journey

Design challenge and context	Potential solutions	Origin and reasoning of proposed solutions
1. How might the effectiveness of awareness campaigns be increased? Despite an initial awareness campaign about the electric mobile fencing programme, and some community members already benefitting from it, a notable lack of clear information and inconsistent messages within the village communities about how to obtain or expand fences were observed during fieldwork. Potential beneficiaries and some existing users faced confusion over whom to contact and the steps to take to request or expand a fence. Interviewees also encountered conflicting rules about fence acquisition, with some incorrectly informed that individual fences were available only during the pilot phase and that any new requests must be made in groups of three or more to obtain a fence.	• Supplement existing awareness campaign with posters placed in public spaces in villages and towns (e.g. village chiefs' bulletin boards, churches and schools). • Ensure campaign materials are available in French and the local languages. • Media campaigns on radio and TV to supplement, but not replace, face-to-face meetings with villagers. • Harmonise messaging on the procedures to obtain a fence across all levels of Space for Giants, including among field agents.	These solutions were discussed primarily at the workshop. Existing awareness campaign efforts included village meetings and small brochures. Participants suggested that media such as radio and TV could be useful to increase awareness, while noting that they have limited reach in rural areas. Posters were suggested as an inexpensive way to increase access to key programme messages and further details. Interviewees suggested that some groups, especially older women, can feel intimidated by the presentation of information in French. This signalled an opportunity to broaden outreach and engagement by preparing materials in the local languages. Discrepancies in understanding about the distribution of fences to individuals versus groups became apparent first in the interviews and later in the contrasting accounts from discussions between Space for Giants agents and senior management. This indicates the need to strengthen internal communications and harmonise messages within the organisation.

Design challenge and context	Potential solutions	Origin and reasoning of proposed solutions
2. How might greater engagement with the fencing programme by women be encouraged? Many women are intimidated by the prospect of operating fences. Within couples or groups of users, fence surveillance and operation are typically handled by men. However, experience shows that women can operate fences just as effectively as men. Encouraging more women to develop familiarity and confidence with operating electric fences could enhance their autonomy in safeguarding plantations and ensuring food security.	• Enhance awareness campaigns and training with more materials and engagement activities targeted at women (e.g. at women's cooperatives) and ensure representation of women operating electric fences in videos, peer-to-peer learning, and via Space for Giants agents. These activities should be conducted in French and the local languages.	This solution was discussed in interviews and at the workshop and received support from participants. In Gabon there is traditionally a gendered division of most tasks. Desired behaviours (i.e. operating a fence) being modelled by people perceived as similar to the target group can be an effective way to increase a person's confidence in their ability to perform a new task or role. While existing materials such as brochures feature some women beneficiaries, there is scope to target women more explicitly.
3. How might better adherence to correct procedures for fence extension be encouraged? Poor comprehension, recall or application of instructions given by Space for Giants for fence procedures can render plantations vulnerable to elephant intrusion. In several cases, farmers wishing to extend their fence proceeded to do so without ensuring they had enough spare fence wire available. They ended up with a semi-enclosure, without a closed circuit, and some elephant intrusions have occurred as a result.	• Provide timely reminders of the correct procedures on barrier extension before each growing season. This could be done during check-up calls with Space for Giants agents or via radio. • Include information about correct procedures on posters and brochures distributed as part of the programme's awareness campaign. • Focus on conveying correct information on fence extension during training at the time of installation.	These solutions were discussed at the workshop with broad support. The incidents of incorrect attempts at extending fences predictably occurred before the onset of a growing season (around July and December), when new plantations were being established. Timely instructions and reminders can be a cheap and effective way to increase people's ability to perform the fence extensions correctly.
4. How might fences be made safer to use in villages? There is some concern within communities about the risk to children, the elderly and individuals with elevated blood pressure from accidental contact with electric fences. Some incidents of electric shocks have been reported, although those affected did not raise serious concerns. Early beneficiaries experienced mild shocks from the gate part of the fence. This has been redesigned for improved safety in subsequent installations and larger fences are equipped with warning signs.	• Complement the awareness campaign with training and materials on safety around electric fences targeted at children, parents and schoolteachers. Promote this information in churches and at village meetings.	Ideas for solutions to enhance safety were only identified at the workshop, not in the interviews. The idea to include safety information in the awareness campaign received broad support. Another proposed solution was to enforce the turning off of fences during the day, especially those placed near houses or routes used by children, but it was not clear how enforcement could be managed. Since fieldwork was completed, there has been at least one crop-raiding incident by elephants during the day when the fence was off and unmonitored.

Design challenge and context	Potential solutions	Origin and reasoning of proposed solutions

5. How might better cooperation around collectively used fences be encouraged?
 	
This challenge is identified as being critical to the evolution of the programme's strategy.
 	
With most fences being shared by multiple users, there are at least some people that neglect the maintenance effort to clear vegetation. This means that additional burden falls on a few individuals, often without compensation, creating or aggravating tensions within families and communities.
 	
Many users are also unclear about the agreement protocol and fence ownership, with limited knowledge about formal association rules.
 	
The general preference among farmers is for individual fences, likely fostered by cultural factors such as the norm of working alone, a lack of trust that others will work hard and fear of some individuals being dominant over others.
	• Distribute information via meetings, posters and brochures to popularise knowledge on:
	  ○ key terms of the agreement protocol
	  ○ discussion topics and possible rules for internal agreements between users, covering benefits, obligations and sanctions
	  ○ steps to form an association.
	
	• Engage other NGOs or government agencies to support communities to build capacity for collective governance and cooperation.
	
	• Choose to allocate individual fences over shared fences where possible, noting also that smaller groups are more likely to cooperate effectively than larger ones.
	
	• Foster collaboration in collectively used fence arrangements through shared usage agreements.
		Challenges related to cooperation with shared fences emerged early in the study, and solutions were explored in interviews and the workshop. The programme requires some collaboration as farmers are limited to one fence each but manage plantations in multiple fields, requiring them to share fences to protect all crops.
		
		Although rare, successful cooperation was observed in small, informal groups with strong personal connections and established ways of working together, or in formal associations with dynamic leadership, close relationships and clear, agreed rules.
		
		Cultivating a cooperative culture will likely be a gradual process that requires community leadership and support from external organisations, as Space for Giants is not well-positioned for social facilitation.
		
		In the short term, providing templates could support farmers to create shared usage agreements that suit the needs of each group and promote cooperation through increased transparency and accountability.

6. How might the programme's dependence on support from Space for Giants be reduced or dispersed? Whether farmers can continue benefitting from the electric fences depends on provision of support from Space for Giants. Throughout the programme, beneficiaries heavily rely on assistance from the organisation, including providing replacement parts and technical guidance for tasks like barrier extension or relocation. This dependency poses a systemic risk if Space for Giants cannot meet the demand for its services or if the funding runs out.	• Continued fundraising is crucial to ensure smooth programme operation. • Establish sale points for fence materials at a low cost, alongside the current option of obtaining free fence materials from the Space for Giants and Ministry partnership. • Promote the use of saving funds for individuals or groups, depending on the type of fence, for fence repair in case of emergency. • Identify, train and support community leaders to serve as contact points to teach and instruct others.	These solutions were discussed in interviews and at the workshop. As fences prove effective and increasingly popular, Space for Giants' capacity to meet demand is becoming stretched. The programme is reliant on donor funding and related project deadlines, making it vulnerable to funding sources drying up. Sale points and saving groups could help increase farmers' independence from the NGO, but they cannot be mandatory as many farmers feel that they are already disproportionately burdened with the costs of living with elephants and are opposed to paying towards mitigation measures.

Design challenge and context	Potential solutions	Origin and reasoning of proposed solutions
7. How might good governance be promoted in the future, as fences become more popular? As electric fences become more widespread and privately owned, and oversight by Space for Giants is reduced, potential risks could arise. Farmers using non-functional mimic fences (as has already been observed), neglecting maintenance, or unchecked expansion of fences, could allow elephants to learn to breach fences more quickly, reducing the programme's effectiveness.	No solutions were specified at this stage, leaving space to innovate. Possible approaches identified by the authors include regulation, guidelines and communication, especially to highlight the consequences of improper use of electric fences.	This future challenge was mentioned at the workshop but not discussed in detail. It was identified internally by the field team and in discussions with managers at Space for Giants and other nature NGOs after completion of the fieldwork.
8. How might fences be made easier to maintain? Maintenance and surveillance efforts are especially burdensome for fences that are situated in remote and forested areas because they are harder to reach, have greater vegetation regrowth and often have greater chances of encountering elephants.	No immediate solutions were identified, but some potentially viable ideas included: • A warning device that can send a signal to remotely alert users of fence voltage drops. • Voluntary training in sedentary farming techniques for improving soil fertility, enabling plots near villages to be used for longer.	These solutions were discussed in interviews and at the workshop. The idea of a remote 'beeper' device was popular, and was already considered by Space for Giants, but no appropriate existing technology could be identified. Devices trialled in the past include sonar and lighting signals, but they are only effective when someone is in close enough proximity to see or hear them, so do not work for remote signalling. Training in sedentary agriculture techniques received interest from some beneficiaries who were keen not to have to move their plantations away from convenient locations so often, but it did not appeal to all.

Design challenge and context	Potential solutions	Origin and reasoning of proposed solutions
9. How might the balance of costs and benefits from coexisting with elephants be improved? In Gabon, living alongside elephants is seen as costly, and most of this burden is placed on rural people. Although the fences help to reduce crop damage by elephants, maintaining the fences requires significant effort and they do not protect people from increased elephant presence in the areas around villages.	No viable solution has yet emerged, leaving space to innovate.	Solutions were proposed and discussed both in interviews and at the workshop. One proposal was to reward good use of fences, especially collectively used ones, through certificates of recognition or prizes, such as agricultural materials, that could be presented during public festivals. Another was to fence off parks instead of plantations, shifting the burden of maintenance onto the state. However, certificates of recognition received mixed support from interviewees and fencing off the parks was considered impractical as elephants are found throughout the country, not only in national parks. All the proposed solutions were considered unviable by Space for Giants and state representatives due to logistical constraints and prohibitive costs.
10. How might long-term efficacy and inclusive benefits be ensured, while keeping up with elephants' learning? *This challenge is identified as being critical to the evolution of the programme's strategy.* As elephants learn to breach the fences, more complex, stationary designs may be needed. However, such designs clash with local agricultural knowledge and shifting cultivation practices. They may also undermine traditional systems of communal land governance.	No solutions have been identified yet. Inclusive, effective solutions will require co-design with affected communities, including potentially marginalised groups. If sedentary agriculture is identified as an appropriate option, large-scale and long-term behaviour change campaigns will likely be required.	This future challenge was discussed to some extent at the workshop, internally by the field team, and in discussions with managers at Space for Giants and other nature NGOs post-fieldwork.

4. Insights and recommendations

This section presents the four main insights from our analysis of Gabon's mobile electric fencing programme. These cover the strengths and weaknesses of the programme's design and the behaviour change techniques employed. Accompanying each insight are recommended adjustments to enhance the programme's chance of continued success.

Insight 1. Factors contributing to the programme's success include effective fence design and behaviour change techniques that can motivate upkeep

Our findings suggest high user satisfaction with the mobile electric fencing programme. The simple and mobile design of the fences meets farmers' needs as the fences are effective in repelling elephants, they work within the traditional shifting cultivation practices, and their maintenance is manageable.

We have identified several behaviour change techniques within the programme design that are likely to have strengthened beneficiaries' sense of ownership over fences and commitment to their upkeep. One is the training and ongoing technical support provided to farmers by the Space for Giants agents, which helps them to overcome hurdles and builds trust between parties. Another behavioural component is the obligation for users to sign an agreement with Space for Giants and the Ministry of Water and Forests that outlines their responsibilities for the monitoring, reporting and upkeep of fences. Signing an agreement can strengthen users' sense of personal responsibility by leveraging deep-seated psychological tendencies towards consistency, adherence to social contracts and conformity to formal and social pressures.

The act of providing a farmer with a fence may in itself generate a sense of ownership and an aversion to losing the fence, known as the 'endowment' effect (Kahneman et al., 1990). Requiring users to demonstrate a year-long commitment to proper fence upkeep before they become full owners can further strengthen this by leveraging the 'IKEA effect' (Norton et al., 2012), whereby the time and effort a person invests in something elevates their sense of attachment to it and the value they place on it. Having to earn full ownership in this way could generate a deeper sense of commitment to fence upkeep even after the period of conditional ownership ends.

The regular phone check-ups with Space for Giants provide an opportunity for feedback, monitoring and support, which are behavioural change techniques that can be helpful for the adoption of new habits and technologies.

The check-ups and warnings that fences may be removed if maintenance is neglected may also promote compliance by reminding users they are being monitored and triggering a fear of loss. The warnings may also potentially leverage cognitive dissonance: the psychological discomfort that can arise from breaking commitments. So far, the warnings issued seem to have effectively corrected farmers' behaviours around fence maintenance.

Recommendations

- **The behaviour change techniques employed in the programme should be retained as the programme expands,** including the signed agreement with the obligation to earn ownership of fences through good upkeep and the threat of fence removal otherwise.
- **Quality support should continue to be provided to beneficiaries of fences to maintain their levels of trust with the programme.** This can be achieved by increasing Space for Giants' capacity for ongoing support and by training a distributed network of community contact points to carry out maintenance and small repairs, including of batteries and solar panel components. This decentralised approach could foster community ownership and resilience, in line with the goals of the intervention.

Insight 2. Collectively used fences tend to face issues of poor cooperation and internal tension between farmers

The main challenge experienced by users in the electric fencing programme is poor cooperation between farmers when fences are deployed for collective use. In many cases, group fencing results in an unfair distribution of effort, with maintenance requirements being left to one or two people – usually the owner. This causes tension between users and could lead to fence neglect, abandonment or breakdowns in community relationships. The collective use of fences represents a departure from the original programme strategy, which intended individual use, but was permitted because it offered a cost-effective and scalable way to expand the programme and accommodate the common practice of farmers grouping their plantations in adjacent blocks.

We have observed two cases where group fencing seems to work well: (i) among small, self-selected groups of between two and four farmers that are accustomed to working together; and (ii) among formal and highly cooperative associations with strong leadership and detailed, collectively agreed rules for fence use, upkeep and sanctions. However, such associations seem to be an exception rather than the rule, making this route to successful shared fence use potentially difficult to replicate.

Cooperative fence use faces cultural barriers and behavioural challenges related to communal resource governance. Observed cultural barriers include a preference for working alone, mistrust in the work ethic of others, a culture with low levels of cooperation between people, and power hierarchies skewing the distribution of effort among users. Behavioural challenges include diffusion of responsibility, where individuals' obligations are unclear, and the 'free-rider' effect, where people rely on others to carry out maintenance, without contributing themselves. These issues can lead to problems for collective action and risk the fences failing. The problem could be exacerbated when a fence is owned by just one person because the mechanisms designed to drive commitment (agreement signing, earned ownership and fear of loss) mainly target the owner. In contrast, without agreed rules and without the belief that everyone will observe these rules, non-owners are less likely to feel accountable for fence upkeep. Cultivating a more collaborative culture to promote wider and more effective collective fence use is likely to be a gradual process, requiring dynamic local leadership and external facilitation.

Members of an association that collectively manages a large mobile electric fence in Gabon. Photo: Katarzyna Mikołajczak.

Recommendations

- **The electric fencing programme's strategy should remain focused on individual fences** due to the relatively low levels of cooperation in the culture of Gabon. Group fences should remain a voluntary option open only to established groups or associations with a strong track record of working together.
- **For enhanced cooperation in group fencing arrangements, behaviour change tools can be used to promote positive social norms around collective maintenance.** We have developed two prototype tools that participants can use to establish their own agreements, to improve workload distribution, accountability and transparency, and establish clear responsibilities. These are:
    - **Questions to stimulate discussion on rules for collective fence use,** designed to promote group conversations around the rules and practices to include in an internal agreement (see Appendix 1).
    - **A model internal agreement for collective fence users,** illustrating what an internal agreement between users could look like (see Appendix 2).

  It is important to note that while users expressed support for the idea of such tools, these are untested prototypes and thus are not guaranteed to work. They should be trialled with a small number of users and improved based on user feedback.
- **Information should be provided on the steps required to create a formal association and the rules that support their effectiveness,** which are currently not well known in communities.
- **Government agencies and NGOs other than the Ministry for Water and Forests and Space for Giants should also contribute to providing community social support and cultivating a more collaborative culture throughout the evolution of the fencing programme.** This is important because Space for Giants does not have the mandate or capacity for in-depth social engagements.

Insight 3. Other challenges faced by fence users, although important to address, are unlikely to derail the programme

Most of the challenges experienced by fence users do not appear to threaten the overall approach or logic of the intervention – at least, not in the short term. These challenges include users carrying out incorrect procedures for fence maintenance and extension, a lack of engagement by women, and safety concerns around the risk of electric shocks, particularly for children, elderly people and those with hypertension. There is also user fatigue with the ongoing effort required to maintain fences, especially for fences located in more remote or forested areas.

Recommendations

- **A wider range of communication channels, including simple posters, should be used to disseminate key information,** such as how to apply for fences.
- **Timely reminders should be provided about the correct procedures for fence extensions:** these could be delivered, for example, by Space for Giants agents during check-up calls with farmers before each growing season.
- **Outreach strategies targeted at women should be developed and all outreach materials should be made available in local languages, in addition to French.**
- **Warning signage should be attached to all fences and safety training conducted for children and teachers.**
- **Targeted innovation exercises should be carried out to find better solutions to improve safety and further reduce the burden of surveying and maintaining fences.**

Insight 4. The long-term sustainability of the programme is vulnerable to wider, interacting challenges associated with changing fence use, human and elephant behaviour, and climate change, as the fences transform the socio–ecological system in which they are deployed

The growing popularity and autonomous use of electric fences could reduce their effectiveness as a deterrent to elephants. As the programme promotes widespread adoption of fences, an increasing number are becoming privately owned, decentralising control over fence placement and upkeep. Inadequate maintenance or the use of non-functional mimic fences (deployed autonomously by farmers on the assumption that the elephants have learned to avoid all fences), which is reported to already be taking place, could accelerate the rate at which elephants learn how to break through fences. Similarly, uncontrolled expansion could lead to the fences losing their deterrent effect as elephants, confronted with a sea of fences, could feel compelled to break through the barriers. However, this scenario appears unlikely in Gabon in the near future due to low human population densities in rural zones.

The challenge of keeping pace with elephants learning to breach fences requires the development of increasingly more complex, and likely stationary, fence designs. Such fences are typically harder to maintain and demand a shift towards sedentary agricultural methods, which may conflict with traditional shifting cultivation practices. Our findings indicate that only a minority of farmers are currently interested in learning sedentary farming techniques. The complex and high-specification fences required in response to more advanced elephant behaviour might compromise the key design features that currently make the mobile fences successful within the Gabonese context: mobility, ease of operation and comparatively little work to install and maintain them. Introducing both more complex fences and sedentary agriculture would require well-planned, large-scale and culturally sensitive behaviour change efforts.

A night-time camera-trap image of an African forest elephant inspecting a mobile electric fence in Gabon. Photo: Space for Giants.

Sedentary farming may also impact traditional land governance systems: all land in Gabon legally belongs to the state, but communities engage a parallel system of customary laws to govern land access rights. While the specifics of these laws vary between villages, land is generally held communally rather than by individuals. Decisions on access rights for farming, hunting, fishing, gathering and spiritual rites are made by the community leadership and authorities including chiefs and elders, and are based on considerations of ancestral rights, customary laws, spiritual beliefs and people's welfare. Sustainable sedentary farming could potentially benefit communities, including through better documentation and consolidation of their customary land rights, and improved productivity, food security and economic development. However, it could also disrupt community-based ownership and governance of land rights, potentially exacerbating conflicts and inequality within and between communities, and leading to the overuse of some areas of land.

The interplay between stationary electric fences, sedentary farming and climate change might further complicate future scenarios. A shift towards sedentary farming would involve substantial investments in specific plots of land that could make it challenging for communities to adapt to uncertain weather patterns brought about by climate change, potentially leaving them stuck in resource-depleted areas.

The systemic challenges stemming from interactions between fencing adaptations, elephant behaviour, evolving agricultural practices and climate change are unlikely to be solved through top-down, technical solutions developed outside the communities they aim to support. Lasting success is likely to hinge on deep collaboration with stakeholders and diverse expert groups to co-create solutions that are effective, equitable and culturally aligned, while also respecting the needs of elephants and people.

Recommendations

- **Design-based techniques such as 'future back-casting' or the 'vision cone' can help stakeholders and experts to envision and explore future scenarios.** Future back-casting starts with defining a desired future then works backwards to identify the steps needed to achieve it, while a vision cone explores multiple potential futures by examining current trends and uncertainties. These techniques should draw on varied expertise, including local knowledge, insights from social sciences and ecology, understanding of fencing technology, and experience from sustainable development circles and agriculture, to assess potential outcomes thoroughly, understand the complexities at play and identify pathways to preferred scenarios.
- **If sedentary farming is identified as the preferred way forward, a comprehensive, long-term behaviour change campaign may be needed.** This approach would have to be grounded in the genuine needs and motivations of the community and developed in partnership with behaviour change specialists.
- **To achieve equitable, inclusive and sustainable benefits, sedentary farming initiatives would require sensitive integration with existing customary land governance,** using participatory approaches that respect customary rights and incorporate traditional knowledge.
- **If fixed fences are introduced, their placement must protect communities' ability to adapt their farming practices as needed and navigate the uncertain future effects of climate change.**
- **The growth in the autonomous use of fences requires ongoing monitoring.** It may also necessitate information campaigns by the government or non-governmental organisations, or even government regulation to avoid negative impacts on elephants' movement patterns, their learning to breach fences, and the effectiveness of fence deterrence.

5. Conclusion

The mobile electric fencing programme in Gabon, designed to protect subsistence farmers from crop raiding by elephants, has proven successful to date. Developed in response to failed attempts to popularise older fixed fence designs, the programme illustrates how listening to the users helps to develop interventions that work for their needs. It also highlights the importance of close engagement and ongoing user support, with regular phone communication and a network of field agents enabling agile responses and adaptation as problems arise.

Applying service design and behavioural insights in our evaluation of the fencing programme allowed us to uncover hidden challenges, particularly regarding the use of shared fences. It also helped to identify the underlying behavioural factors likely influencing the programme's existing and future success. These outcomes demonstrate the value of a service design-based approach and behavioural insights in understanding the complexities of human–elephant coexistence and creating practical, effective and sustainable solutions.

However, technical solutions alone are not enough. Coexistence between humans and elephants is as much about reimagining and renegotiating relationships between species as it is about implementing direct interventions like electric fences. As the programme expands and evolves to address elephants learning to breach different fence models, the principles of close engagement and support should be upheld and strengthened. Truly inclusive approaches require deep engagement with affected communities to co-create visions and pathways to coexistence through dialogue and participatory processes. Here, service design – which emphasises empathy, collaboration and holistic thinking – can provide a tangible and valuable framework for moving towards these goals.

A small herd of African forest elephants (*Loxodonta cyclotis*) grazing near the forest edge in Gabon. Photo: Space for Giants.

References

Datta S and Mullainathan S (2014) Behavioural Design: A New Approach to Development Policy. *Review of Income and Wealth* 60(1): 7–35. https://doi.org/10.1111/roiw.12093

Global Wildlife Programme [GWP] and Gabon's National Park Agency [ANPN] (2017) *Reducing human-wildlife conflict and enhancing coexistence*. Conference proceedings. https://documents1.worldbank.org/curated/en/163981497979013597/pdf/116512-WP-PUBLIC-26p-GENDR-GWPGabonHWCConferenceReportFULLDesignJune.pdf

Kahneman D, Knetsch J and Thaler R (1990) Experimental Tests of the Endowment Effect and the Coase Theorem. *Journal of Political Economy* 98(6): 1325–48.

Kamdar A, Baishaya H, Nagendra H, Ratnam J, Smith D and Sekar N (2022) Human–elephant conflict mitigation as a public good: What determines fence maintenance? *Ecology and Society* 27(3): 24. https://doi.org/10.5751/ES-13271-270324

Lambe F, Ran Y, Jürisoo M, Holmlid S, Muhoza C, Johnson O et al. (2020) Embracing complexity: A transdisciplinary conceptual framework for understanding behavior change in the context of development-focused interventions. *World Development* 126: 104703. https://doi.org/10.1016/j.worlddev.2019.104703

Michie S, Richardson M, Johnston M, Abraham C, Francis J, Hardeman W et al. (2013) The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: Building an international consensus for the reporting of behavior change interventions. *Annals of Behavioral Medicine: A Publication of the Society of Behavioral Medicine* 46(1): 81–95. https://doi.org/10.1007/s12160-013-9486-6

Montgomery R, Raupp J, Mukhwana M, Greenleaf A, Mudumba T and Muruthi P (2022) The efficacy of interventions to protect crops from raiding elephants. *Ambio* 51(3): 716–727. https://doi.org/10.1007/s13280-021-01587-x

National Academies of Sciences, Engineering, and Medicine; Division of Behavioral and Social Sciences and Education; Board on Behavioral, Cognitive, and Sensory Sciences; and Committee on Future Directions for Applying Behavioral Economics to Policy (2023) 'Foundational Behavioral and Economic Ideas'. In Beatty A, Moffitt R, Buttenheim A (Eds), *Behavioral Economics: Policy Impact and Future Directions*. Washington D.C.: National Academies Press. https://www.ncbi.nlm.nih.gov/books/NBK593520/

Norton M, Mochon D and Ariely D (2012) The IKEA effect: When labor leads to love. Journal of *Consumer Psychology* 22(3): 453–460. https://doi.org/10.1016/j.jcps.2011.08.002

Osborne M, Lambe F, Ran Y, Dehmel N, Tabacco G, Balungria J et al. (2022) Designing development interventions: The application of service design and discrete choice experiments in complex settings. *World Development* 158: 105998. https://doi.org/10.1016/j.worlddev.2022.105998

Shaffer L, Khadka K, Van Den Hoek J and Naithani K (2019) Human-Elephant Conflict: A Review of Current Management Strategies and Future Directions. *Frontiers in Ecology and Evolution* 6. https://www.frontiersin.org/article/10.3389/fevo.2018.00235

Appendix 1. Questions to stimulate discussion on rules for collective fences – prototype tool

This is a prototype tool to help farmers who are considering the collective use of a fence allocated to them on an individual basis under the national mobile electric fencing programme in Gabon. It can be used as an example to establish rules for the effective sharing of fences.

The international NGO Space for Giants, in support of the Ministry of Water and Forests, is running a programme to assist full-time farmers who have experienced crop losses from elephants and have filed a complaint with the Ministry. These farmers can request an electric fence for protection of their plantations. Although the programme is restricted to one fence per farmer (or a formal association), farmers can group their plantations into multiple fences belonging to different persons. However, maintaining a fence to ensure it works properly takes effort. Using a fence collectively without a prior agreement on the rules for use and sanctions for neglect can lead to tensions among users. If you are a group of farmers using or considering using a fence collectively, discussing the topic below could help you to avoid such problems.

1. Do you think you can organise yourselves effectively to use a fence collectively? Clear rules help prevent disagreements. Everyone should be aware of who is the legal owner of the fence. All users (including the owner) should discuss and agree on the usage rules. This may take you several meetings. Once the rules are established, consider signing an internal agreement among yourselves, listing the rules. This can help increase accountability. Any new user joining should also be informed about the rules and sign the agreement.

2. Fences require daily inspections, turning off and on, and regular clearing of the vegetation around them – at least twice a month in the dry seasons and weekly during the rainy seasons. You could have all users do it together or pay someone to do it. How will you fairly distribute maintenance tasks within your group? How will you achieve this?

3. How will your group manage users who do not have the same strength or capacity to contribute to the maintenance effort, e.g. the elderly? Are other members willing to assist more or will these individuals have to contribute differently, perhaps financially or in other ways? If so, in what form, how much, how often, and to whom?

4. How will you ensure that everyone contributes to the tasks you agreed on?

   Note: Organising regular maintenance parties (e.g. once a week at a set time and day), where everyone participates can help make it clear who contributes and who does not. You may consider keeping an attendance list.

5. Do you plan to impose sanctions on those who neglect fence maintenance? If so, what kind, and when will they be enforced? For example, a warning, a fee (how much?), exclusion from fence use now or in the next growing season?

6. How will you handle situations where someone is unable to physically contribute to maintenance for a while, such as due to illness or travel?

7. Are you considering creating a small fund to cover costs such as fence repairs?

Appendix 2. A model internal agreement for collective fence users – prototype tool

This is a prototype tool to help farmers who are considering the collective use of a fence allocated to one of them under the national mobile electric fencing programme in Gabon. It consists of an example agreement that can be modified and completed by farmers to suit the needs of their particular group.

We, the collective users of ___[*insert name of the fence*]____ in the ___[*location name*]___, belonging to ___[*legal owner's name*]___ agree on the following rules concerning the use of this fence:

1. The person[s] designated to turn on and off the fence and do the daily voltage checks and fence inspection will be ___[*insert name/s of the designated person/s*]___. This role will be [*permanent/ rotational with changeover every X weeks/months*].

2. For maintenance, each user commits to participate ___[e.g. *in clearing the vegetation around the fence in the zone around their plantation*]___. This activity should take place ___[e.g. *every Thursday at 8am for 1 hour*]___.

3. If a user cannot participate in a clearing party, they will be [*issued a warning/be obliged to pay a fee of X/other options*].

4. If a user [*repeatedly/more than X times*] fails to contribute to the effort of maintaining the fence, they will [*be issued a warning/have to pay a penalty of X to X/be ejected from the fence for a year/be ejected from the fence permanently/not be allowed to join in the fence next time*].

Signatures

	NAME	OWNER/USER	SIGNATURE
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____
4.	_____	_____	_____
5.	_____	_____	_____

The agreement should be signed by all in the presence of all other users. The signed document will serve as an internal arrangement between all users, not as a legal document. It will not affect the rights of the legal owner and the fence will remain their property.