

Designing conservation funding for Peat Landscapes

Case Study: Fostering harmony between wild elephants and human communities in peat ecosystems through agroforestry practices and multi-stakeholder partnership

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Introduction

South Sumatra's peatland, characterised by lowland dipterocarp forest, is home to diverse flora and fauna. This includes the critically endangered Sumatran elephant (*Elephas maximus sumatranus*) according to the IUCN (2021). The east coastal peat ecosystem of Ogan Komering Ilir District, particularly the Sugihan landscape, serves as a vital habitat for these large mammals. However, human-wild elephant conflict poses a significant challenge to elephant conservation efforts. Deforestation and habitat fragmentation exacerbate this conflicts, which typically occur in areas where human activities, such as transmigration, plantations, and industrial forestry, overlap with elephant habitats. This study aims to provide guidelines for designing business model and conservation funding strategies at landscape scale, with a particular focus on preserving the biodiversity of elephant mega-species.



Business design guidelines: principles and methodology

1. Funding and financing of conservation business models at landscape level

Conflict among stakeholders poses a significant threat to successful conservation (Pimid 2022). Therefore, a participatory multi-stakeholder approach is required for effective wildlife conservation (Muashekele, 2021). Research by Nayak and Swain (2022) on elephant conservation in India highlights key strategies for stakeholder engagement: 1) developing human-elephant conflict prevention methods with various land managers; 2) establishing an inter-area information sharing system to collaboratively monitor elephant migration; and 3) disseminating conservation education and research findings among stakeholders.



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2. Defining landscape scope and identifying land cover and land use to determine wildlife habitat, home range, and conflict zone.

Mapping and documenting wildlife presence are essential steps in identifying natural habitats, food sources, and movement patterns of wildlife. By integrating information on community land-use and areas frequented by wildlife, researchers and conservationists can identify potential human-wildlife conflict zones.

3. Multi-stakeholder consultation on problems, interventions, and technical and financial gaps in conflict areas

Consultations with various stakeholders gather valuable insights on:

- Problems affecting conservation and community livelihoods, such as crop damage and attacks on humans by elephants, and habitat destruction due to fires.
- Current and ideal interventions to address these problems.
- Technical and financial gaps in effectively implementing these interventions.



4. Developing conservation business models at the landscape level

Creating a landscape-level business model involves tailoring a diverse range of business designs to specific unit areas, intervention types, and appropriate business models. This includes financial analysis of these interventions. The table below outlines conservation funding and incentive schemes based on different area statuses. These approaches are also used in the case study of elephant harmonisation in Sugihan landscape.



5. Financial analysis of conservation business models

Conservation business model includes ecosystem restoration, conservation-based commercial business design, and implementation of economic instruments, such as Payment for Environmental Services (PES). The financial analysis includes the following steps:

- a Identification of options and net-benefit analysis of various options to mitigate wildlife conflicts.
- b Estimation of unit costs associated with each wildlife conflict mitigation option.
- c Identification of financial needs and options to mobilise funding for conservation business models.

Table 1. Conservation funding and incentive schemes by area status and functions

Land tenure	Land uses	Conservation funding and incentive schemes
Production Forest with Forest Use Permit – Ecosystem Restoration (PBPH-RE)	Ecosystem restoration by optimising business opportunities related to environmental services and other conservation-based businesses.	<ul style="list-style-type: none"> ● Funding through commercial conservation-based business for sustainable, self-sustaining ecosystem restoration management. ● Payment for Environmental Services (PES) to enhance biodiversity. ● Result-based payment and carbon trading as per national regulations. ● Community partnership with conservation cost-benefit sharing. ● Grants from impact investors or conservation organisations.
Production Forest with Forest Use Permit – Plantation Forest (PBPH – HT)	Primary business focus on sustainable timber production, adhering to principles of sustainability and forest conservation.	<ul style="list-style-type: none"> ● Funding through Corporate Social and Environmental Responsibilities (CSER) ● Partnership with conservation organisations and local communities. ● Recognition through the PROPER award (by the Ministry of Environment and Forestry).
Non-Forest Area (APL)	Land used for community livelihood needs, with efforts to harmonise human activities with wildlife conservation.	<ul style="list-style-type: none"> ● Microfinance, technical assistance, and limited grants for agroforestry using plants that deter elephants. ● Compensation through PES for wildlife-related damages. ● Partnerships with companies, non-governmental organisations, and governments for patrolling and establishing elephant habitats and corridors.

6. Financial analysis of community agribusiness models

When comparing profitability of conservation-based agribusiness to conventional agribusiness, it is crucial to account for additional factors such as opportunity costs and compensation costs. Both costs, along with transaction costs, (which include pre-intervention and post-intervention expenses), are necessary.

7. Design of agroforestry business models using vegetation elephants tend to avoid.

In areas frequently visited by elephants, agribusiness models can be designed using plant species that elephants tend to avoid. According to Berliani . (2017), elephants avoid most parts of chilli, candlenut, coffee, and patchouli (stem, bark, leaf veins, leaves, and fruits). Elephants also avoid coriander, mint, ginger, shallots, garlic, lemongrass, and citrus due to their strong aroma.

Case Study on management of human-wild elephant harmony in peat ecosystems

Types of intervention

The Sugihan landscape contains various land use types. Given the very vast home range of elephants, elephant conflict should be resolved by advancing collaborative efforts among stakeholders across different land use types in question. The following interventions have been formulated for land use types in Sugihan landscape. These interventions aim to manage elephant habitat, extending their visit to forest areas, and prevent them from intruding into human settlements.

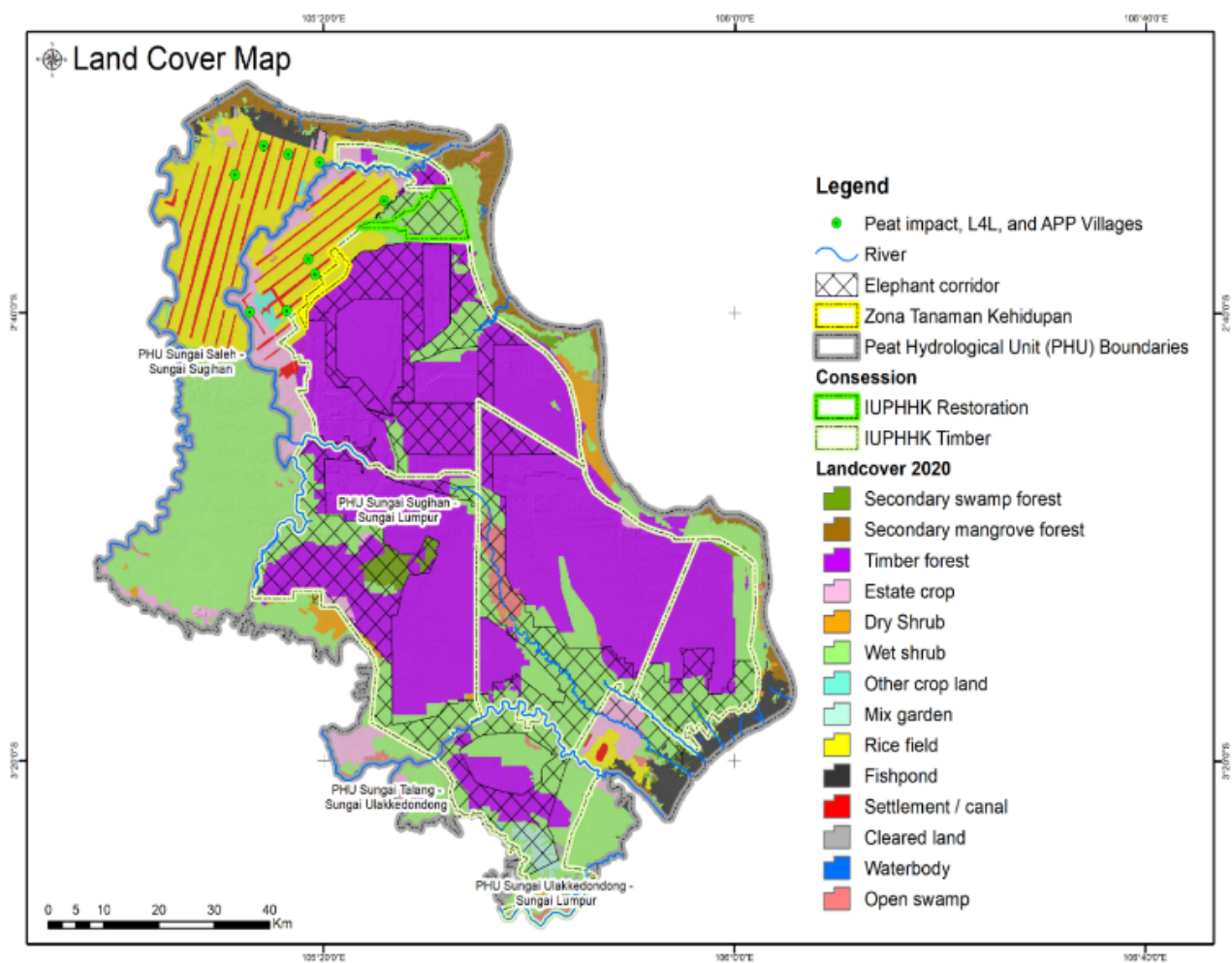


Figure 1. Study area map

Table 2. Intervention, incentive, and financing option for different landscape structures

Land tenure	Landscape structure	Intervention	Incentive and partnership	Financing options	Legal basis
Production forest	<p>Conservation concession company</p> <ul style="list-style-type: none"> - PT Karawang Ekawana Nugraha (KEN) (8,046 ha) 	<ul style="list-style-type: none"> Improvement and enrichment of elephant habitat in concessions Development of agroforestry plots for elephants by in partnership areas with local communities Wild elephant ecotourism by engaging community members through Forestry Partnership and recruiting them as workers. 	<p>Source of income from biodiversity PES agreement and ecotourism</p> <p>Source of income from carbon stock</p>	<p>Fiscal policy</p> <ul style="list-style-type: none"> Provide incentives for companies that commit to biodiversity conservation (e.g., tax deduction) <p>Non-fiscal policy</p> <ul style="list-style-type: none"> Assessment of companies' performance in maintaining ecosystem health and conserving biodiversity (e.g., Proper Program by MoEF) Give awards/ appreciation to the company that is committed to biodiversity conservation and human-wildlife harmonisation. 	<ul style="list-style-type: none"> Regulation on HCV: Law No. 5/1990 and Gov. Regulation No. 23/2021, Regulation of Agri. Ministry No. 38/2020 PROPER Program by MoEF
	<p>Timber Concession Company</p> <ul style="list-style-type: none"> - PT Bumi Mekar Hijau (BMH) (180,959 ha) - PT SBA Wood Industries (136,612 ha) - PT Bumi Andalas Permai (BAP) (189,529 ha) 	<p>Establishment of wildlife corridors:</p> <ul style="list-style-type: none"> Development of elephant monitoring infrastructures Habitat management and infrastructure development to support elephant movement. Participatory monitoring and increasing local community engagement. Enforcement of regulations (SOP establishment, corridor management, and information dissemination) 	<p>Incentives for companies to contribute to conservation.</p>	<ul style="list-style-type: none"> Grant/investment from impact investor to provide funding for land restoration. Green bond Carbon trading for carbon sequestration activities 	<ul style="list-style-type: none"> Regulation on HCV: Law No. 5/1990 and Gov. Regulation No. 23/2021, Regulation of Agri. Ministry No. 38/2020 Regulation of payment for ecosystem services: Law No. 32/2009 and Gov. Regulation No. 46/2017
Other land uses	<p>Village</p> <ul style="list-style-type: none"> - Jadi Mulya Village (14,344 ha) 	<ul style="list-style-type: none"> Development of agroforestry plots with plants avoided by elephants, on village areas bordering elephant corridors 	<ul style="list-style-type: none"> Technical assistance and agroforestry training for the farmer groups. Incentives for farmer groups to change agricultural behaviour and practices from rice farming system to agroforestry 	<ul style="list-style-type: none"> Microfinance schemes - Community Business Credit (KUR) Fiscal transfer to villages with specific indicators related to human-wildlife conflict resolution, agroforestry, and biodiversity initiatives. Green bond Village funding CSR and philanthropy Technical assistance from NGO, university, research org 	<ul style="list-style-type: none"> Regulation on CSR (District Head Regulation No.8/2020) Regulation of payment for ecosystem services: Law No. 32/2009 and Gov. Regulation No. 46/2017



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Development of agroforestry using unpalatable plants to elephants

Agroforestry design in Jadi Mulya Village

To mitigate human–elephant conflicts, an agroforestry system using plants that elephants tend to avoid was designed for Jadi Mulya Village, which border elephant corridor areas and company concessions. The development of buffer areas is crucial to prevent elephants from intruding into settlements. Currently, the community in Jadi Mulya Village cultivates paddy in these border areas, which attract elephant and leads to their intrusion into the village area. To address this challenge, the primary intervention involves converting rice farming

areas into agroforestry systems using plants avoided by elephants. The agroforestry system design is conducted in a participatory manner with community members, ensuring alignment with the available plant species in the village. The selected species selected include candlenut, chilli, lemongrass, and stink bean plants.

Financing simulation of agrobusiness model using Community Business Credit (KUR)

The Indonesian Government implements a micro-credit programme called Special Community Micro-Business Credit (KUR Khusus) to support agricultural development. This scheme enables farmers to access financing for converting their rice farming system into agroforestry.

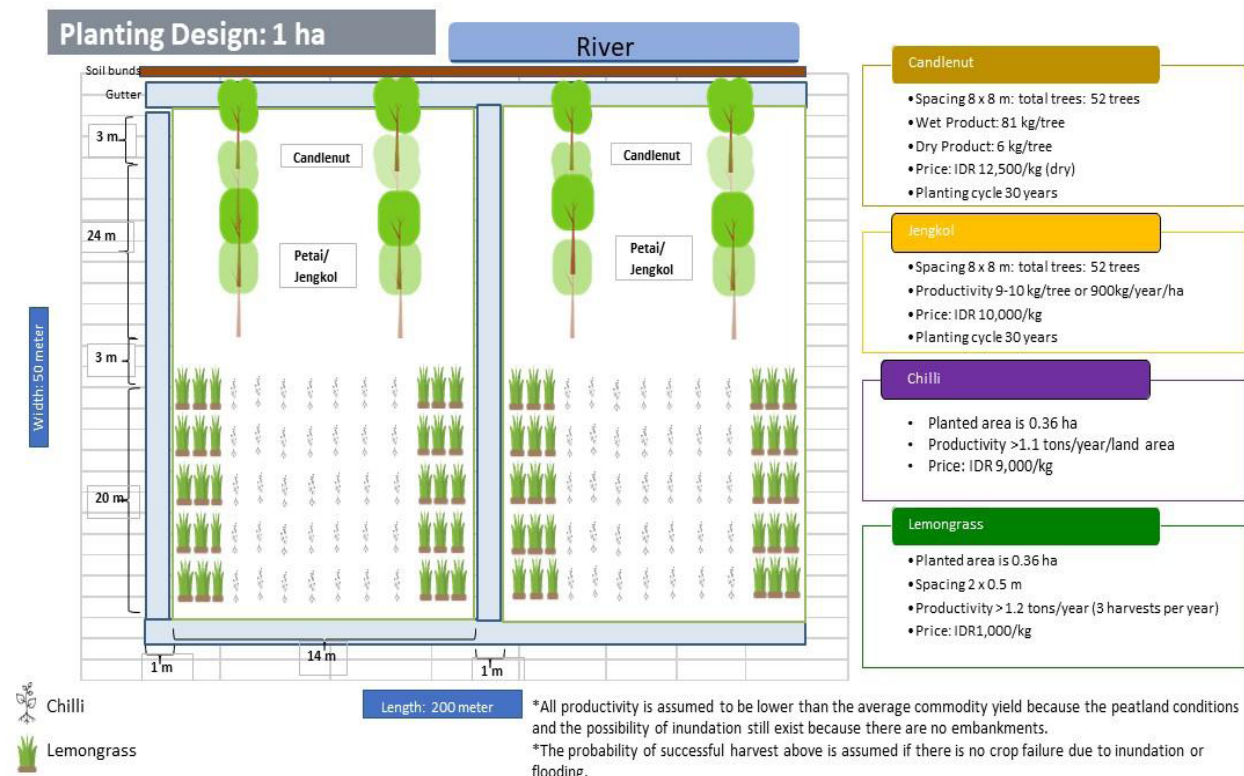
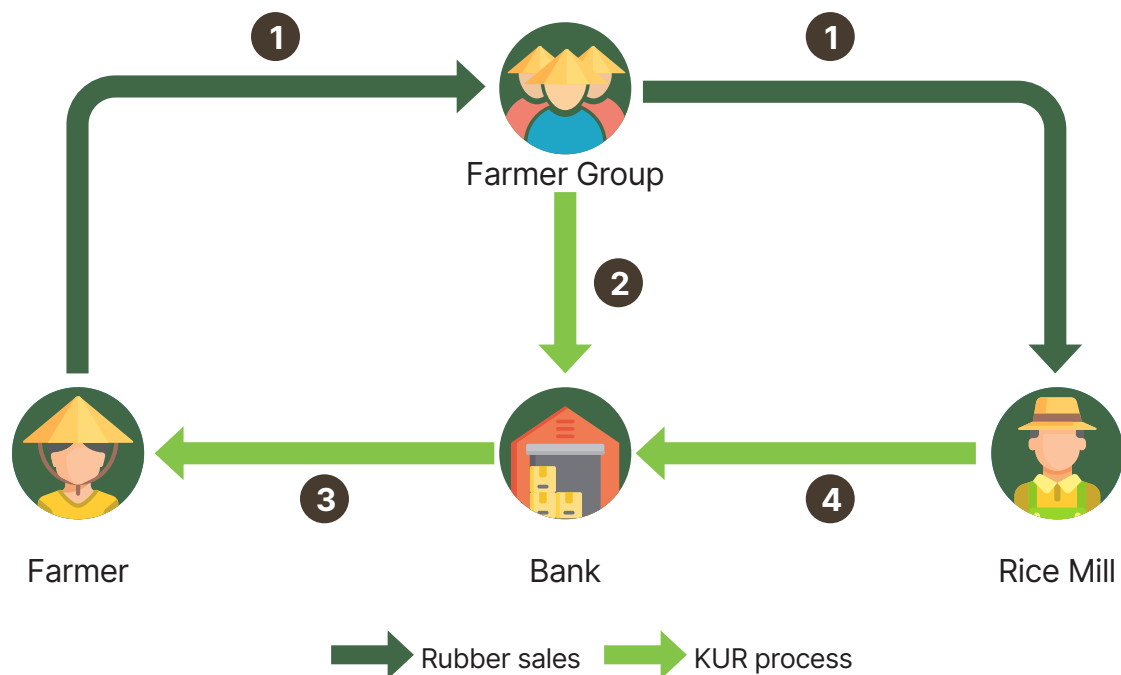


Figure 2. Agroforestry implementation scheme in community land



1. Farmers deliver dried paddy to their cooperative (farmer group), which then sells it to traders (rice mills).
2. After receiving a request from a cooperative to apply for KUR, the bank inputs the farmer's administrative details into the Rural Credit Information System (SIKP).
3. Farmers who meet the KUR requirement receive loan payments in as per the agreed contract terms.
4. Rice mills serves as off-takers, ensuring the purchase of all farmer's produce, thereby enabling farmers to fulfil their KUR repayment.

Figure 3. Special KUR scheme to convert rice farming system into agroforestry in Jadi Mulya Village

Table 3. Financing requirements for converting entire area into an agrobusiness model.

	Area (Ha)	Establishment cost/Ha	Total Establishment Cost	Profit/Ha	Total Profit	IRR (%)
Monoculture rice farm	521	Rp12,962,603	6,753,516,163	5,636,632	2,936,685,272	-
Agroforestry	521	Rp20,506,855	10,684,071,455	18,010,386	9,383,411,106	19

Assumptions

1. Rainfed rice farming typically involves a single harvest season per year using local seedlings. In the proposed agroforestry system, paddy crops will be replaced by candlenut, stink bean, chilli, and lemongrass.
2. The establishment cost for implementing agroforestry system is estimated to be 58% higher compared to that of traditional rice farming system.
3. The total funding required for the shift to agroforestry system is directly proportional to the area of rainfed rice field being converted.
4. NPV (Net Present Value) of the agroforestry system is calculated over a 30-year period from the time of planting. However, crops like chilli, lemongrass, and paddy, which are harvested annually, their respective NPVs are calculated accordingly.
5. A discount factor of 7.11% per annum is used to calculate financial ratios.
6. The Internal Rate of Return (IRR) of the agroforestry system is projected to be 19% higher than the prevailing interest rate on deposits and the return on government bonds.



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KUR Financing Simulation for 1 Farmer

A farmer manages a rice field of 0.5 ha with productivity rate of 6 tonnes/ha and a market price of IDR7,300/kg. Two (2) loan scenarios are considered:

- Scenario 1: A 5-year repayment period, with 52% (0.26 ha) of the rice field converted into agroforestry land financed by the KUR programme. Repayment is sourced from the remaining productive 0.24-ha rice field.
- Scenario 2: A 7-year repayment period, with 0.3 ha (60%) of rice field converted into agroforestry lands. The loan is repaid from the remaining 0.2 rice field over an extended repayment period, allowing for manageable monthly installments.

This simulation demonstrates that feasibility of converting to agroforestry with the available financing schemes, showcasing its benefits over monoculture rice farming system.

Table 4. Financing Simulation for 1 Farmer

	Unit	Scenario 1 (5-year repayment period)	Scenario 2 (7-year repayment period)
Rainfed rice field	ha	0.24	0.2
Profit/ha	IDR	5,636,632	5,636,632
Agroforestry	ha	0.26	0.3
Establishment Cost AF	IDR	5,331,782	6,152,057
Loan term	months	60	84
Installment	IDR	106,636	93,746
Rice farmin rofit	IDR	6,763,958	7,891,285
Monthly income	IDR	112,733	93,944
Surplus	IDR	6,097	198

Note: The financing analysis adopts a conservative approach, considering only the farmer's income from a rainfed rice field of 0.5 ha on average. Income from annual crops such as chilli and lemongrass,, which are planted in the first year, is excluded from the repayment capacity calculation due to lack of empirical field testing.



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