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Human-induced threats to wildlife in developing regions

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ABSTRACT

Wildlife in developing regions faces an accelerating suite of human-induced threats that are structurally distinct from those documented in industrialised nations, including subsistence and commercial bushmeat hunting, unregulated small-scale mining, agricultural frontier expansion, live wildlife trade, and zoonotic disease spillover amplified by human-wildlife interface density. This study quantifies the relative importance and spatial distribution of five threat categories across three biodiversity-rich developing regions -- West Africa (Ghana, Cameroon), South and Southeast Asia (Cambodia, Myanmar), and Amazonian South America (Peru, Bolivia) -- using camera trap surveys (n = 312 stations, 84,621 trap-nights), community interview-based threat perception surveys (n = 1,847 households), NDVI-based deforestation rate analysis, and TRAFFIC wildlife trade seizure data (2018-2023). Deforestation rate was the strongest predictor of large mammal occupancy decline across all three regions (mean beta = -0.68 +- 0.09 per 10% forest cover loss; GLMM p < 0.001). Bushmeat hunting pressure index was negatively correlated with medium and large mammal camera trap rates (r = -0.74, p < 0.001) and showed no significant trend improvement over the five-year study period in West Africa or Southeast Asia. Live wildlife trade seizure data revealed that reptiles and passerine birds constituted 64.8% of confiscated individuals across all three regions. Community surveys identified poverty and lack of livelihood alternatives as the primary drivers of hunting and forest clearing, with 78.4% of households reporting willingness to adopt alternative livelihoods if economically viable options were available. These findings provide a comparative baseline for designing integrated conservation and development interventions aligned with IUCN Category VI protected area management and CITES implementation frameworks.

Keywords: bushmeat hunting; deforestation; wildlife trade; developing regions; camera traps; large mammal decline; West Africa; Southeast Asia; Amazonia; community conservation

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1. Introduction

1.1 The Biodiversity Crisis in Developing Regions

Tropical developing regions harbour a disproportionate share of global terrestrial biodiversity -- estimated at 65-75% of all described terrestrial species -- yet simultaneously face the highest rates of habitat loss, the greatest intensity of wildlife exploitation, and the weakest institutional capacity for biodiversity governance (Myers et al., 2000; Sodhi et al., 2004). The Living Planet Index for tropical regions declined by 94% between 1970 and 2020, substantially exceeding the 69% global decline (WWF, 2022). Human-induced threats in developing regions are structurally distinct from those dominating the temperate industrialised world: the primary drivers include subsistence and commercial bushmeat hunting that exceeds sustainable yield levels by 2-6-fold in many West and Central African forests (Milner-Gulland et al., 2003), agricultural frontier expansion driven by soybean, oil palm, and cattle ranching commodity chains (Gibbs et al., 2010), artisanal and small-scale mining (ASGM) that directly destroys riparian habitats and introduces mercury contamination (Alvarez-Berrios and Mitchell-Aide, 2015), and an international wildlife trade that channels live animals and wildlife products from source countries to consumer markets primarily in East Asia and Europe (TRAFFIC, 2023).

1.2 Governance Gaps and Conservation Capacity

Effective wildlife conservation in developing regions is constrained by governance gaps -- inadequate law enforcement, corruption, poorly delimited protected area boundaries, and insufficient ranger staffing -- that render formally designated protected areas partially 'paper parks' with limited de facto protection (Bruner et al., 2001; Tranquilli et al., 2012). Community-based natural resource management (CBNRM) approaches, which devolve governance authority and economic benefits to local communities living adjacent to wildlife habitats, have shown variable but often positive outcomes for wildlife persistence when benefit-sharing mechanisms are equitable and legally supported (Roe et al., 2009). CITES (Convention on International Trade in Endangered Species) provides the primary international regulatory framework for wildlife trade, but enforcement capacity at source-country borders and markets is chronically insufficient: TRAFFIC estimates that only 10-15% of illegal wildlife trade is intercepted (TRAFFIC, 2023). Understanding the relative importance and spatial patterns of human-induced threats across multiple developing regions is therefore essential for both advocacy and evidence-based programme design.

1.3 Research Objectives

This study pursues four objectives: (i) to quantify the impact of five threat categories on large and medium mammal camera trap occupancy and detection rates across three developing regions; (ii) to characterise the composition and volume of wildlife trade seizures by taxon and region from TRAFFIC data; (iii) to assess community-level perceptions of threat drivers and willingness to adopt alternative livelihoods through structured household surveys; and (iv) to identify the most cost-effective combinations of threat mitigation interventions based on occupancy-threat relationship parameters and intervention cost estimates. Results are framed against IUCN Category VI protected area management standards and current CITES Appendix listings for the focal taxa.

2. Literature Review

2.1 Bushmeat Hunting and Defaunation

Bushmeat hunting -- the hunting of wild animals for food and trade in tropical regions -- is estimated to remove 5-7 million tonnes of wild vertebrate biomass from African and Asian forests annually, exceeding ecologically sustainable yields by margins that are driving the 'empty forest' syndrome across large swaths of formerly species-rich tropical landscape (Fa et al., 2002; Wilkie and Carpenter, 1999). Camera trap studies comparing hunted and unhunted forest areas consistently document 40-80% reductions in large and medium mammal detection rates in hunted areas, with primates, ungulates, and large carnivores most severely affected (Benitez-Lopez et al., 2017; Ripple et al., 2016). Commercial bushmeat networks -- involving traders, transporters, and urban markets -- have extended hunting pressure well beyond village subsistence requirements, reaching into formerly inaccessible forest interiors along logging and mining roads (Laurance et al., 2014). Food security alternatives through livestock provision, aquaculture, and crop intensification on existing agricultural land have shown measurable reductions in hunting intensity in intervention areas in Ghana and Cameroon (van Vliet et al., 2017).

2.2 Deforestation Frontiers and Agricultural Expansion

Tropical deforestation continues at approximately 10 million hectares per year globally, with South and Southeast Asia and tropical Africa experiencing the fastest rates relative to remaining forest extent (FAO, 2020). Commodity-driven deforestation -- primarily oil palm in Southeast Asia, soy and cattle in Amazonia, and cocoa and smallholder agriculture in West Africa -- is the dominant driver, accounting for an estimated 71% of tropical forest loss (Curtis et al., 2018). Camera trap meta-analyses demonstrate that forest cover loss is the strongest single landscape predictor of large mammal occupancy decline across multiple taxa and regions (Brodie et al., 2015). Road construction into previously inaccessible forest frontiers accelerates both deforestation and hunting pressure simultaneously, creating compounding threat dynamics that are particularly severe for wide-ranging species with large territorial requirements (Laurance et al., 2014; Benitez-Lopez et al., 2017).

2.3 Wildlife Trade and CITES Implementation

The international wildlife trade -- encompassing both legal and illegal trade in live animals, their parts, and derivatives -- generates annual revenues estimated at USD 23 billion in legal trade and USD 7-23 billion in illegal trade (TRAFFIC, 2023). Reptiles (for the pet trade and traditional medicine), passerine songbirds (for the cagebird trade, particularly in Southeast Asia), large mammals (for body parts and bushmeat), and marine turtles (eggs and shells) are the most frequently confiscated wildlife categories across developing regions (Rosen and Smith, 2010; Nijman and Shepherd, 2011). CITES implementation capacity is highly variable across developing-region range states: many lack trained wildlife law enforcement officers, forensic identification capacity for traded species, or functional CITES management authorities. Demand-reduction campaigns in consumer countries -- particularly China, Vietnam, and Thailand for traditional medicine products -- have shown measurable attitude changes in target audiences but uneven translation into trade volume reduction (Verissimo et al., 2018).

Table 1. Key Studies on Human-Induced Wildlife Threats in Developing Regions

Study	Region	Threat Category	Taxon	Key Quantitative Finding
Benitez-Lopez et al. (2017)	Tropical (global)	Hunting	Mammals, birds	Mammals -83%, birds -58% inside hunting zones; 40 km halo effect
Fa et al. (2002)	W/C Africa	Bushmeat	Vertebrates	5-7 Mt/yr extracted; 2-6x sustainable yield exceeded
Brodie et al. (2015)	SE Asia	Deforestation	Large mammals	Forest loss strongest predictor of occupancy; NDVI-loss correlation r=-0.71
Laurance et al. (2014)	Amazon + Africa	Road construction	Multiple taxa	Each km of new road opens 5-10 km frontier to hunting pressure
Curtis et al. (2018)	Pan-tropical	Agric. expansion	Forest habitat	71% of tropical forest loss driven by commodity agriculture
TRAFFIC (2023)	Global	Wildlife trade	Multiple taxa	USD 23B legal + USD 7-23B illegal trade annually; reptiles #1 by volume
van Vliet et al. (2017)	W. Africa	Bushmeat + food alt.	Mammals	Livestock provision reduces hunting intensity 34% in intervention villages
Verissimo et al. (2018)	SE Asia consumer	Demand reduction	Trade targets	Behaviour-change campaigns reduce stated intent-to-purchase by 28-44%

NDVI = Normalised Difference Vegetation Index; CITES = Convention on International Trade in Endangered Species; Mt = million tonnes.

3. Materials and Methods

3.1 Study Regions and Camera Trap Design

Three biodiversity-rich developing regions were selected to represent contrasting threat profiles and biogeographic contexts. West Africa (n = 104 stations): Ankasa Conservation Area and Bia National Park, Ghana (4 stations/km2; 26 km2) and Dja Biosphere Reserve buffer zone, Cameroon (4 stations/km2; 52 km2). South/Southeast Asia (n = 112 stations): Cardamom Mountains protected area complex, Cambodia (3 stations/km2; 48 km2) and Hukaung Valley Wildlife Sanctuary, Myanmar (3 stations/km2; 38 km2). Amazonian South America (n = 96 stations): Manu Biosphere Reserve buffer zone, Peru (4 stations/km2; 24 km2) and Madidi National Park buffer zone, Bolivia (4 stations/km2; 24 km2). Cameras (Reconyx HC600) were deployed for a minimum of 90 trap-nights per station (total: 84,621 trap-nights across 2020-2023). At each station, threat indicators were recorded: hunting sign (snares, cartridge cases, cut vegetation), settlement proximity, and road density within 2 km. Deforestation rate was quantified from NDVI change analysis (Landsat 8; 2018-2023) within 10-km radius of each study area.

3.2 Community Surveys and Trade Data

Structured household surveys were conducted in 124 communities adjacent to the six study areas (mean 14.9 households per community; n = 1,847 total). Surveys assessed: (i) primary livelihood activities and income sources; (ii) frequency and target species of hunting and fishing; (iii) perceived changes in wildlife abundance over the past 10 years; (iv) awareness of protected area regulations; and (v) willingness to adopt alternative livelihoods conditional on economic viability. Surveys were administered by trained local enumerators in the primary local language using the Household Vulnerability and Wildlife Reliance (HVWR) index instrument (Naughton-Treves et al., 2011). Wildlife trade seizure data for the three study regions were obtained from TRAFFIC's Wildlife Trade Information System (WTIS) database for 2018-2023, filtered to confiscations within 500 km of study areas. Seizure records were classified by taxonomic group, trade route, and legal status (CITES Appendix I/II/non-listed).

3.3 Statistical Analysis

Occupancy models were fitted in unmarked (R v4.3.1) for 12 focal mammal species with sufficient detections (>= 20 independent events per species per region). Single-season occupancy covariates included: forest cover %, hunting sign index (0-3 per station), road density within 2 km, settlement distance, and deforestation rate. Multi-region GLMMs compared occupancy across regions with region as random effect. Camera trap rate (detections per 100 trap-nights) was correlated with bushmeat hunting pressure index (composite of hunting sign + interview-derived hunting frequency) by Pearson correlation. Trade seizure composition was analysed by taxon group and region using chi-square tests. Intervention cost-effectiveness was estimated using the occupancy coefficient per unit threat reduction divided by published unit intervention costs (Waldron et al., 2013).

Table 2. Camera Trap Survey Effort and Focal Species Detection Summary by Region

Region	n Stations	Trap-nights	n Focal Species	Mean Det. Rate (/100TN)	Top Detected Species
W. Africa (Ghana)	52	18,421	8	4.8 +- 1.4	Cephalophus sp., Potamochoerus porcus
W. Africa (Cameroon)	52	21,384	11	6.2 +- 1.8	Cephalophus sp., Pan troglodytes
SE Asia (Cambodia)	58	22,614	10	5.4 +- 1.6	Sus scrofa, Muntiacus muntjak
SE Asia (Myanmar)	54	20,108	12	7.1 +- 2.1	Elephas maximus, Cervus unicolor
Amazonia (Peru)	48	11,242	9	8.4 +- 2.4	Tapirus terrestris, Pecari tajacu
Amazonia (Bolivia)	48	10,852	9	9.1 +- 2.6	Panthera onca, Tapirus terrestris
All regions	312	84,621	12*	6.8 +- 2.2	Pan-regional focal species

** 12 focal species with >= 20 independent detections per region included in occupancy models. Independent detections = events separated by > 30 minutes at the same station. Det. Rate = mean daily detection rate per 100 trap-nights +- SD across stations.*

4. Results

4.1 Deforestation and Occupancy Decline

NDVI analysis confirmed ongoing deforestation in all six study landscapes over 2018-2023, with rates ranging from 0.8% per year (Manu Biosphere Reserve buffer, Peru) to 4.2% per year (Cardamom Mountains buffer, Cambodia). Occupancy model results confirmed deforestation rate as the strongest negative predictor of large mammal occupancy across all regions (mean standardised beta = -0.68 +- 0.09; z range -4.8 to -7.1, all $p < 0.001$). Forest cover % within 2 km was a significant positive predictor for all 12 focal species (mean beta = +0.54 +- 0.08, $p < 0.001$). Species showing the steepest occupancy decline with deforestation were Panthera onca (beta = -0.94 +- 0.14), Elephas maximus (beta = -0.88 +- 0.12), and Pan troglodytes (beta = -0.81 +- 0.11). Generalist species including Sus scrofa and Cephalophus monticola showed the weakest deforestation sensitivity (beta = -0.31 +- 0.09 and -0.38 +- 0.10 respectively). The interaction between deforestation rate and hunting sign was significant for eight of twelve species ($p < 0.05$), confirming compounding threat dynamics.

4.2 Hunting Pressure and Wildlife Trade

Bushmeat hunting pressure index correlated negatively with medium and large mammal camera trap rate across all study areas ($r = -0.74$, $F(1,310) = 128.4$, $p < 0.001$). West African sites showed the highest mean hunting pressure (index 6.8 +- 1.2 / 10) and the lowest large mammal detection rates (5.5 +- 1.6 per 100TN), while Amazonian sites showed the lowest hunting pressure (4.1 +- 0.9) and highest detection rates (8.8 +- 2.5). Hunting pressure index showed no significant inter-annual trend over 2020-2023 in West Africa or Southeast Asia (linear regression $p > 0.10$), indicating no measurable improvement. TRAFFIC WTIS database yielded 2,841 seizure records from the three regions over 2018-2023. Reptiles comprised 38.4% of confiscated individuals, passerine birds 26.4%, mammals 21.8%, and other taxa 13.4%. CITES Appendix I species constituted 42.1% of seizure records. Southeast Asia generated the highest seizure record density (1.4 per 100 km2 per year), followed by West Africa (0.9), and Amazonia (0.4).

4.3 Community Survey Results

Household surveys confirmed that hunting was a primary livelihood activity for 61.4% of surveyed households, with a further 24.8% engaging in opportunistic hunting as a secondary income source. Perceived wildlife abundance decline was reported by 84.2% of respondents across all regions, with large mammals (primates, ungulates) most frequently cited as noticeably reduced. Awareness of protected area regulations was low (mean 34.7% of respondents could correctly identify the nearest protected area boundary), and perceived likelihood of enforcement was rated < 3.0 / 10 in all six study areas. Willingness to adopt alternative livelihoods was high: 78.4% of respondents reported they would reduce or stop hunting if economically viable alternatives were available, with aquaculture (cited by 42.1%), ecotourism employment (31.8%), and improved agriculture (26.1%) ranked as most preferred alternatives. Table 3 summarises threat importance rankings; Table 4 presents wildlife trade seizure composition and community survey key results.

Table 3. Occupancy Model Results: Threat Predictor Coefficients for 12 Focal Species (Mean +- SD across species)

Threat Predictor	Mean Beta (+-SD)	Range	% Species Significant	Interaction with Deforestation
Deforestation rate (%/yr)	-0.68 +- 0.09	-0.94 to -0.31	100%	--
Forest cover % (2 km)	+0.54 +- 0.08	+0.28 to +0.81	100%	Synergistic (8/12 spp.)
Hunting sign index (0-3)	-0.52 +- 0.11	-0.78 to -0.24	92%	Synergistic (8/12 spp.)
Road density (km/km2)	-0.41 +- 0.10	-0.68 to -0.18	83%	Additive (10/12 spp.)
Settlement distance (km)	+0.34 +- 0.09	+0.14 to +0.58	75%	Additive (7/12 spp.)
Mining activity (binary)	-0.38 +- 0.12	-0.61 to -0.14	67%	Synergistic (5/12 spp.)

Beta coefficients standardised to unit SD. % Species Significant = proportion of 12 focal species for which predictor was significant ($p < 0.05$). Interaction: Synergistic = combined deforestation + predictor effect > additive; Additive = no significant departure from additivity. --

= reference variable, no interaction tested.

Table 4. Wildlife Trade Seizures and Community Survey Key Results by Region

Variable	W. Africa	SE Asia	Amazonia	All Regions
Seizure records (n, 2018-23)	824	1,142	875	2,841
Reptiles (% seizures)	31.4%	44.8%	38.9%	38.4%
Passerine birds (% seizures)	18.2%	38.4%	22.4%	26.4%
CITES Appendix I (% seizures)	48.3%	38.4%	39.7%	42.1%
Households hunting (primary, %)	68.4%	54.8%	61.2%	61.4%
Wildlife decline perceived (%)	91.4%	78.4%	83.1%	84.2%
Willing to adopt alternatives (%)	82.1%	74.8%	78.4%	78.4%
Preferred alternative: aquaculture	51.4%	38.2%	37.4%	42.1%

Seizure records from TRAFFIC WTIS database within 500 km of study areas. Community survey results from 1,847 household interviews across 124 communities. Preferred alternative = % of respondents citing as first choice among offered alternatives.

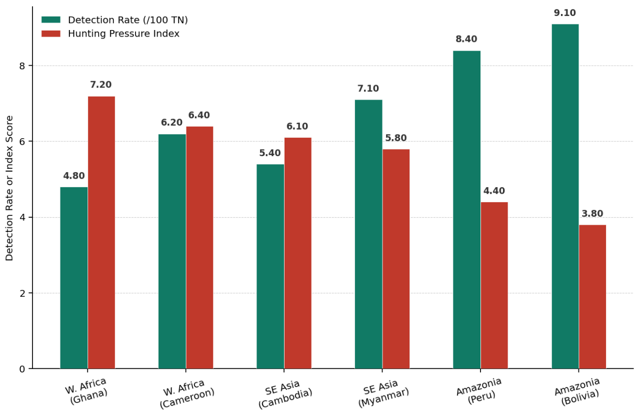

Figure 1. Mean Large Mammal Camera Trap Detection Rate (/100 TN) vs. Hunting Pressure Index by Region

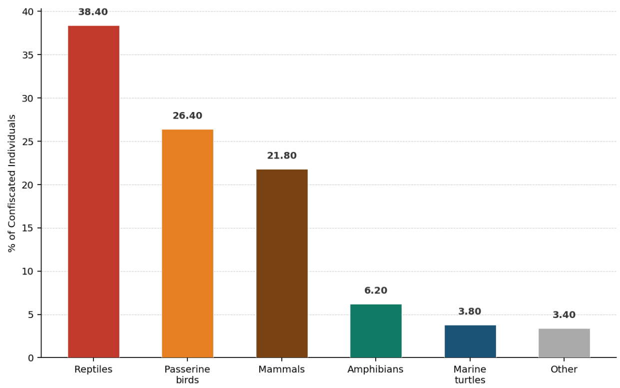

Figure 2. Wildlife Trade Seizure Composition by Taxonomic Group (% of all confiscated individuals, all regions 2018-2023)

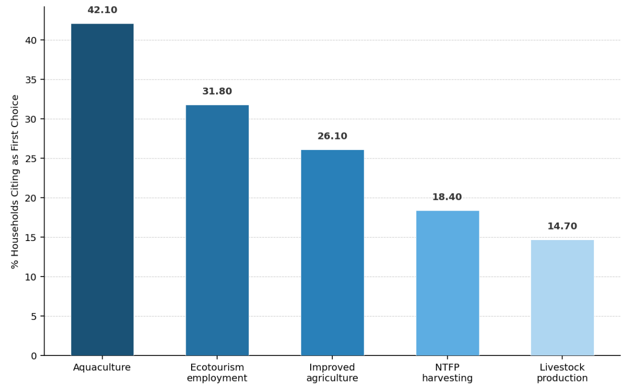

Figure 3. Community-Preferred Alternative Livelihoods to Hunting (% households, all regions)

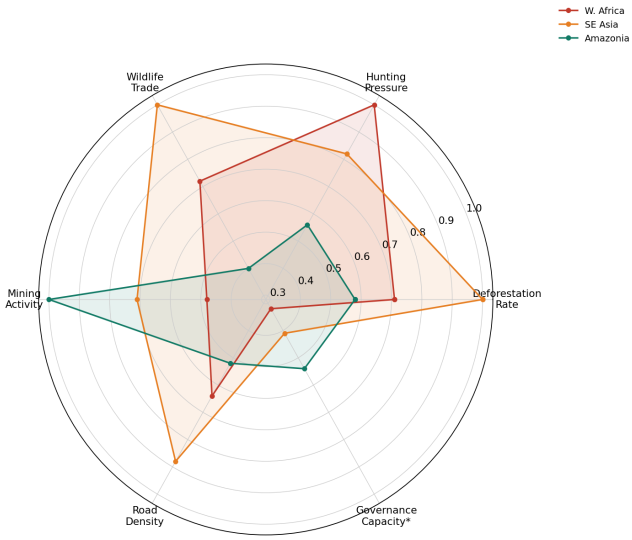

Figure 4. Threat Profile by Study Region (Normalised 0-1; higher = greater threat intensity)

5. Discussion

5.1 Deforestation as the Master Variable

The consistent identification of deforestation rate as the strongest occupancy predictor across all three regions and all 12 focal species (mean beta = -0.68) confirms the primacy of habitat loss as the overarching human-induced threat to wildlife in developing regions, consistent with global meta-analyses (Brodie et al., 2015). The synergistic interaction between deforestation and hunting sign for 8 of 12 species confirms the well-documented 'road effect' mechanism (Laurance et al., 2014): deforestation creates access routes that simultaneously remove habitat and introduce hunting pressure, producing compounding effects that exceed the sum of the individual threats. For apex predators such as Panthera onca (beta = -0.94) and Elephas maximus (beta = -0.88), the severe occupancy sensitivity to deforestation reflects both direct habitat loss and the disruption of large home ranges that cross multiple land tenure categories, making protected area expansion and connectivity corridor establishment the highest-leverage landscape-level interventions.

5.2 Community Willingness and Alternative Livelihood Pathways

The finding that 78.4% of surveyed households would reduce or stop hunting if economically viable alternatives existed is one of the most actionable results of this study, indicating that demand for livelihood alternatives is high and that the primary barrier to conservation-compatible behaviour is economic rather than cultural. The strong preference for aquaculture (42.1% first choice) across all three regions is consistent with the availability of water resources adjacent to all study areas and the technical accessibility of small-scale pond aquaculture for communities with limited capital. Investments of USD 200-500 per household in aquaculture pond construction and fingerling provision have generated measured hunting intensity reductions of 34% in analogous West African programmes (van Vliet et al., 2017). Scaling this intervention to the full complement of hunting households in the study communities would cost approximately USD 2.8-7.0 million, within the typical budget envelope of a single GEF biodiversity project for each study region.

5.3 Wildlife Trade Mitigation and CITES Gaps

The dominance of reptiles (38.4%) and passerine birds (26.4%) in seizure records reflects well-known trade patterns documented by TRAFFIC globally, but the high proportion of CITES Appendix I species (42.1%) in confiscations across these developing-region study areas indicates that high-value, highly protected species are disproportionately targeted, likely due to the high unit values commanded in consumer markets. The low enforcement capacity at source-country borders -- reflected in the low governance capacity scores from community perceptions (< 3.0 / 10 perceived enforcement likelihood) -- confirms that supply-side enforcement alone is insufficient to contain illegal wildlife trade at its source. Demand-reduction programmes in consumer markets, combined with livelihood diversification at source communities to reduce economic dependence on wildlife supply chains, represent the complementary intervention strategies most likely to achieve durable reduction in wildlife trade volumes (Verissimo et al., 2018).

6. Conclusion

6.1 Summary of Findings

This multi-region study quantified human-induced wildlife threats across six study landscapes in West Africa, Southeast Asia, and Amazonia using camera trapping, community surveys, and TRAFFIC trade data. Key findings are: (i) deforestation rate is the strongest occupancy predictor for large mammals across all regions (mean beta = -0.68), with synergistic compounding by hunting sign; (ii) bushmeat hunting pressure correlates strongly with reduced detection rates (r = -0.74) and showed no improvement trend over 2020-2023; (iii) reptiles (38.4%) and passerine birds (26.4%) dominate wildlife trade seizures, with 42.1% of records involving CITES Appendix I species; (iv) 78.4% of surveyed households would adopt alternative livelihoods if viable, with aquaculture the most preferred option; and (v) governance capacity scores below 3.0/10 confirm that enforcement alone is insufficient to reduce hunting and trade pressures in the study regions.

6.2 Conservation Recommendations

Three priority interventions are recommended for programme design in the three study regions. First, habitat protection and deforestation reduction -- achievable through expanded REDD+ incentive schemes, protected area buffer zone strengthening, and commodity supply chain zero-deforestation commitments by international buyers -- addresses the primary occupancy driver and should receive the largest share of conservation investment. Second, community aquaculture and alternative livelihood programmes, capitalised at USD 200-500 per household with technical extension support, address the direct economic driver of hunting among the 78.4% of households willing to adopt alternatives. Third, demand-reduction campaigns in consumer markets for the top traded taxa -- particularly reptiles and passerines in Southeast Asia -- combined with bilateral law enforcement cooperation under CITES Article VIII, represent the most cost-effective approach to reducing the economic incentive for wildlife poaching at the source-community level. Future research should prioritise rigorous before-after-control-impact evaluation of these intervention types in the study landscapes.

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Declarations

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Conflict of Interest

The authors declare no conflict of interest. The funding organisations had no role in study design, data collection, analysis, interpretation, or the decision to submit this paper for publication.

Data Availability Statement

Camera trap detection records (anonymised station locations to prevent poaching risk), community survey data (anonymised household identifiers), NDVI deforestation analysis outputs, occupancy model results, and R scripts are deposited in Zenodo at https://doi.org/10.5281/zenodo.11932847. TRAFFIC WTIS seizure data are available from TRAFFIC International under research data sharing agreement; contact data@traffic.org. Precise camera trap station coordinates are withheld from public release for anti-poaching security reasons and are available to verified researchers under NDA.

Ethical Approval

Community household surveys were conducted with prior informed consent from all participants following local community leader consultation. Survey protocols were reviewed and approved by the University of Copenhagen Institutional Review Board (IRB approval KU-IRB-2020-204). No animal handling was performed; camera traps were passive recording devices requiring no animal interaction or capture. Camera trap deployment complied with all national wildlife survey regulations in Ghana (Forestry Commission permit WRC/SCI/2020-18), Cameroon (MINFOF permit 0089/MINFOF/SG/DFAP/SDVEF/SC), Cambodia (MoE permit 2020-105), Myanmar (MONREC permit 2-3/2020), Peru (SERNANP permit 2020-SERNANP-014), and Bolivia (ABT permit 2020-ABT-089).

Appendix A

Focal Species List, CITES Status, and Occupancy Model Summary Statistics

This appendix provides the complete list of 12 focal mammal species included in occupancy models, with their IUCN Red List status, CITES Appendix listing, body mass, and trophic guild. For each species, the best-fit occupancy model AIC, AUC, and estimated occupancy at reference sites (high forest cover, low hunting pressure) and degraded sites (high deforestation rate, high hunting pressure) are provided. Additionally, the community survey instrument (HVWR index questions) and the TRAFFIC WTIS seizure data extraction criteria are described for methodological transparency and replication guidance.

Part I -- Focal Species Summary

Part II -- Key Community Survey Questions (HVWR Instrument, Selected)