Economic Drivers of the International Rhino Horn Trade

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Abstract: *The international rhino horn trade persists through the interaction of consumer demand, illicit profits, criminal networks and uneven conservation capacity. This critical narrative review examines how these forces shape incentives across source, transit and consumer markets. Drawing on published research and institutional reports, it brings together evidence on medicinal beliefs, status consumption and investment demand; the role of trust and security coordination in illegal transactions; corruption; dehorning; and proposals for regulated legal supply. The literature indicates that price alone cannot explain the trade's resilience. Trafficking networks manage enforcement risk through relationships and access, while differences in protection create opportunities for displacement. Dehorning can reduce the immediate reward from poaching, but residual horn, regrowth and continuing demand limit its effectiveness as a stand-alone response. Proposals to legalise trade remain contested because their effects depend on consumer preferences, substitution between legal and illegal horn, supply capacity and the ability to prevent laundering. The review develops an integrated risk-reward framework linking market incentives to governance and conservation outcomes. It argues for coordinated responses that combine demand reduction, targeted enforcement, anti-corruption safeguards, sustained conservation finance and locally appropriate protection measures. It also identifies priorities for evaluating intervention costs, unintended displacement and long-term population outcomes. The analysis is a qualitative synthesis, not a new empirical test or meta-analysis.*

Keywords: Rhino Horn Trade; Wildlife Trafficking; Conservation Economics; Consumer Demand; Dehorning; Corruption; Legal Trade; Enforcement.

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Introduction

Rhino horn trafficking is both a conservation problem and an illicit political economy. Policies must protect animals while confronting a chain of transactions that connect local extraction, intermediaries, transport, processing and consumption. The United Nations Office on Drugs and Crime (UNODC) describes wildlife trafficking as an adaptive activity shaped by demand, organised crime, corruption and differences in regulation. Its 2024 assessment identifies signs of progress for rhinoceros and elephant products but cautions against interpreting arrests and seizures alone as evidence of lasting reductions in criminal incentives [1]. Persistence should therefore not be confusing with an absence of all policy success, nor should local success be assumed to establish regional recovery. The international regulatory setting also requires precision. CITES guidance distinguishes restrictions on international commercial transactions from exceptional non-commercial movements and domestic rules. Its explanation of rhino horn permits states that horn treated as Appendix I material from wild animals cannot be traded internationally for primarily commercial purposes, while exceptional movements require specified permitting conditions [2]. This review does not treat every movement of horn, every population listing or every domestic transaction as legally identical. Proposals for a future regulated international supply are analysed as policy scenarios, not as permission to trade under existing law.

A simple demand-and-supply account is useful but incomplete. A high final-market price may create an incentive, yet participants must also arrange transport, manage confiscation risk and secure cooperation in transactions that cannot rely on ordinary legal contracts. Hübschle's analysis places security coordination at the centre of the transnational rhino horn market and stresses relationships across the legal-illegal divide [3]. This perspective complements, rather than replaces, economic analysis: trust, concealment and corrupt access affect the costs and feasibility of exchange.

This review asks how consumer motivations, network organisation, protection costs and governance interact to sustain trade. It also examines what dehorning and the legal-trade debate reveal about changing incentives. Its contribution is an integrated analytical account, not a claim to have estimated global demand or statistically ranked the importance of enforcement against price. It separates published findings from the interpretive framework developed here and identifies conditions under which apparently beneficial interventions could have unintended effects.

Review approach and scope

2.1. Design and source identification

The paper is a critical narrative review with an economic and governance focus. The supplied draft and reference list were used as starting material, followed by targeted public-web searches and checks of journal pages, university publication records and institutional reports. Search topics covered rhino horn demand, legalisation, security coordination, corruption, dehorning and intervention effectiveness. Sources were checked during manuscript preparation in November 2026. This was a purposive exercise aimed at evaluating mechanisms and

contrasting arguments, not an exhaustive search of all available literature. Priority was given to directly relevant research with identifiable bibliographic records and to institutional sources that explain market patterns or regulatory context. Where complete article text was not available, interpretation was limited to accessible abstracts or publication summaries. University records were used to cross-check bibliographic details and reported findings, not counted as additional independent studies. Historical sources were retained when they directly informed a mechanism; older price or population statements were not carried forward as current conditions.

2.2. Analytical procedure

The selected material was organised around five linked themes: consumer valuation; transaction costs and criminal coordination; governance and conservation finance; dehorning and expected reward; and regulated supply. For each theme, the synthesis distinguishes an observed or reported result, the inference it supports, and the uncertainty that limits transfer to other contexts. Qualitative network research, stated-preference studies, observational conservation studies and policy arguments are not treated as interchangeable evidence. No new interviews, surveys, wildlife interventions or original trafficking dataset were conducted for this manuscript. No pooled effect size, database coverage claims or PRISMA flow diagram is reported. The review is not preregistered and does not offer a formal risk-of-bias score. These limits reduce reproducibility and rule out claims about the proportion of the entire literature devoted to any theme.

2.3. Geographic and inferential boundaries

The international question is examined principally through evidence from southern African source settings and Vietnamese and Chinese consumer contexts. Those settings should not be treated as a representative sample of every rhino species, trafficking route or consumer population. Evidence about African rhino protection cannot automatically be transferred to Asian species, and consumer findings from one country do not identify global demand. The paper uses this bounded evidence to develop testable propositions rather than universal causal claims.

Consumer demand, valuation and scarcity

3.1. Demand is segmented

Rhino horn cannot be understood as a uniform commodity with a single use. Gao and colleagues examined Chinese media and auction records and identified investment, collection and artistic motivations alongside medicinal associations [4]. Their analysis concerned art and antiques market and historical media coverage. It does not measure the current share of all Chinese horn purchases attributable to each motive. Nor does a correlation between auction activity and poaching establish a causal pathway from individual antique transactions to specific killings. In Vietnam, Dang Vu and Nielsen describe utilitarian and hedonic motivations, including reported hangover treatment, the projection of business success and ritualised responses to serious illness [5]. These are accounts of consumer beliefs and practices, not evidence that rhino horn has the claimed medicinal effects. Their importance for economics is that buyers may value social meaning, perceived provenance and the relationship in which a gift is offered as

well as the material itself.The International Trade Centre (ITC) reported a survey of 1,000 traditional Asian medicine consumers, including 239 rhino horn users. Its summary describes preferences for wild-sourced and non-lethally harvested horn and heterogeneous responses to hypothetical legalisation and demand-reduction measures [6]. These findings illustrate why a campaign based only on information about endangered animals may fail to address all motives. They do not show that every user has the same preference or that hypothetical responses will translate directly into actual purchases.

3.2. Legal and illegal products may not be perfect substitutes

A choice experiment involving 345 Vietnamese rhino horn consumers found preferences for legality, but also for wild over semi-wild and farmed origin. Higher-income consumers were less concerned about legality, and peer experience affected preferences [7]. This combination complicates a standard substitution argument. If buyers see wild origin as a valuable attribute, adding a legal farmed product may leave a distinct illicit segment rather than eliminate illegal purchasing. The studies do not produce one uncontested forecast. The 2018 study raised the possibility that legal availability could sustain or increase demand for poached horn [5]. The later choice experiment identified a strong preference for legal horn while still anticipating competition from a parallel black market [7]. Differences in design, sample and attributes mean these results should not be reduced to a single demand of elasticity. They support scenario analysis and further behavioural work rather than certainty about either market collapse or a demand surge.

3.3. Price signals require context

Prices differ by chain position, product form, quality, provenance, location and time. An auction price for a carved historical object is not equivalent to a raw-horn transaction, and a retail quote is not the amount a poacher receives. UNODC's discussion of illicit markets and Gao and colleagues' auction analysis reinforce the need to identify the observation being valued [1,4]. This review therefore does not use a single sensational per-kilogram figure as a current global price. Scarcity may increase desirability in some collection or status markets, but that relationship is a mechanism to investigate, not an automatic law. Reduced availability may instead lower access or shift consumption. The conservation consequence depends on how buyers respond and whether expected gains induce additional extraction. Reliable analysis requires time-matched price and quantity observations with clear market-level definitions, rather than comparing unrelated quotations.

Networks, corruption and uneven protection

4.1. Security coordination as an economic input

Illegal exchange exposes participants to confiscation, arrest, unreliable partners and loss without ordinary legal recourse. Hübschle's account shows why relationships and security precautions can make transnational flows resilient [3]. Coordination is consequently an input into production and exchange: it may reduce transaction failure and uncertainty even when it has a financial cost. Policies that address only final demand or physical supply may leave these organizational capabilities intact. The relevant network can include people operating within formally lawful institutions as well as individuals already involved in illicit activity. This is an

analytical warning against assuming that legal and illegal markets are separate, not an allegation against any profession or community. Oversight must focus on verifiable conduct and institutional vulnerabilities. UNODC similarly identifies corruption, specialised public-sector roles and organised criminal activity as matters requiring targeted responses [1].

4.2. Corruption and the limits of a wage-only explanation

Corruption can reduce the perceived likelihood of interception or punishment and improve the predictability of access. It can also divert stockpiles or undermine permit controls. UNODC identifies vulnerabilities along regulatory and enforcement chains and argues for financial investigation and the use of anti-corruption measures alongside wildlife offences [1]. Such mechanisms connect governance failures directly to expected returns. A wage-bribe explanation is plausible but insufficient as a general account of corruption. The reviewed material does not establish a universal threshold at which ranger pay determines corrupt behaviour. Coercion, accountability, organisational norms, protection of informants and the probability of detection may also matter. Low pay should not be treated as evidence that an individual ranger is corrupt. Improving employment conditions is a policy consideration, while its independent effect on corruption requires evaluation.

4.3. Conservation finance and spatial displacement

Protection creates recurrent costs rather than a one-time infrastructure requirement. The 2025 multi-reserve analysis reports approximately US$74 million in anti-poaching expenditure during its study period, illustrating the scale of financial effort in one southern African setting [8]. That amount is not a current annual global requirement and does not imply that every reserve should be spent at the same rate. Budget continuity, institutional capacity and the mix of interventions matter as much as aggregate expenditure. Differences in risk and reward across locations may encourage displacement. A reserve-level reduction can represent a genuine local benefit while remaining incomplete evidence of regional impact. UNODC stresses geographical and commodity displacement and the need for coherent responses across the trade chain [1]. It follows that funders should examine neighbouring outcomes and changes in reporting effort, rather than treating a protected site's count as a self-contained test of success. Donor dependence can create vulnerability when support is temporary, but the available material does not estimate a general causal effect of funding withdrawal on poaching. The practical inference is narrower: multi-year planning and contingency arrangements are worth assessing where recurrent protection depends on uncertain funding. That is an analytical recommendation, not a measured result of this review.

An integrated risk-reward framework

The following framework is an interpretive synthesis of the market and network mechanisms discussed above, not an estimated model [1,3,7,8]. For an actor at stage j, expected net return can be represented as: Here, s_j is the probability of completing a transaction and receiving its associated revenue, R_j is gross revenue conditional on success, C_j represents direct participation and coordination costs, p_j is the probability of a sanction, F_j is the associated loss, and O_j is the value of the best lawful alternative. The expression is a simplified decision aid. It does not assume that all actors know probabilities, value risk identically or act

voluntarily, and it is not calibrated to observed trafficking data. Consumer demand affects revenue, dehorning reduces recoverable horn at the animal, and enforcement may change success and sanction probabilities. Corruption may lower effective risk while increasing payments to collaborators. Trusted relationships can lower transaction uncertainty. These influences can interact: a lower price does not guarantee exit if costs also fall, and a larger statutory penalty may have little deterrent effect if participants believe punishment is unlikely. At the community level, participation and reporting cannot be reduced to cash alone. Safety, trust in authorities and the distribution of conservation benefits may affect choices. UNODC emphasises community interests and differentiated motivations along the chain [1]. Accordingly, the framework should be used to identify questions and intervention pathways, not to imply that communities are homogeneous suppliers of crime.

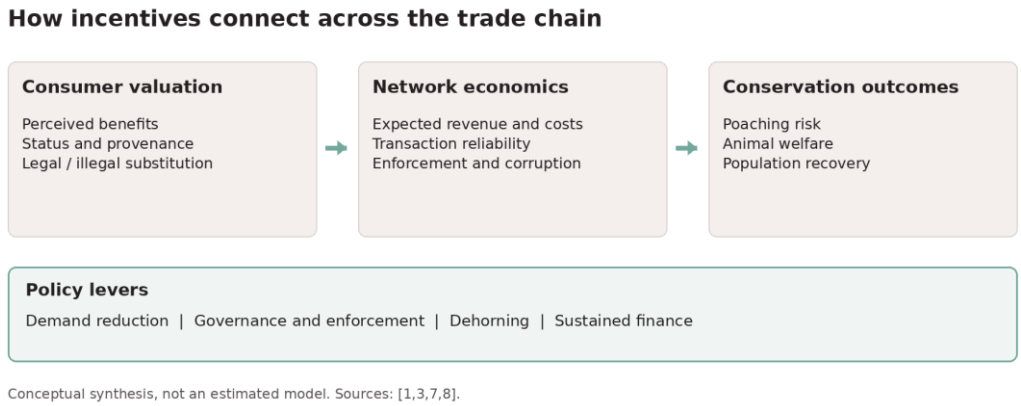


Figure 1. Conceptual risk-reward pathways in rhino horn trafficking. Author-developed synthesis of [1,3,7,8]. Arrows denote proposed mechanisms, not measured coefficients or proven causal effects. Governance and conservation finance can influence every stage.

Dehorning: published evidence and economic interpretation

6.1. The Greater Kruger multi-reserve evidence

Kuiper and colleagues analysed poaching and interventions across 11 southern African reserves during 2017-2023. They documented 1,985 rhinos poached despite approximately US$74 million spent on anti-poaching measures. Dehorning involved 2,284 rhinos across eight of those reserves and was associated with large, abrupt reductions in poaching of approximately 78%, using 1.2% of the reported budget [8]. The number of reserves in the wider analysis must not be confused with the number implementing dehorning. The same study found no statistical evidence that the evaluated reactive enforcement investments reduced poaching, although they contributed to more than 700 arrests [8]. This is not proof that law enforcement is useless. It is a finding about the interventions, outcome measures and setting studied. Arrests can be operationally important without demonstrating an independent reduction in animal losses, and an observational comparison cannot automatically establish what would happen if all background protection were removed. The economic interpretation is that reducing recoverable

reward can change incentives even where risk-taking continues under substantial enforcement. However, the reported percentage is not guaranteed for another reserve, and the budget share is not a complete global cost-effectiveness ratio. Repeat procedures, veterinary capacity, monitoring, security storage and any displacement must be considered when evaluating a new programme.

6.2. Residual risk and animal outcomes

Dehorning does not remove all horn, and regrowth can restore value to a target. Kuiper and colleagues report continued poaching of dehorned animals and call for regular dehorning alongside judicious law enforcement [8]. Programmes should therefore be assessed as recurrent management strategies, not permanent protection. Decisions also need to account for animal welfare and ecological outcomes rather than judging success solely by short-term losses. Chimes and colleagues examined historical data from four Namibian black rhino sub-populations and found no significant differences between horned and dehorned individuals in the productivity and survival measures assessed [9]. Importantly, their abstract also reports no significant difference in the proportion poached between the two categories in that dataset. This does not simply cancel the later multi-reserve result: designs, populations and outcome comparisons differ. It does show why one study should not be turned into a universal claim. A failure to detect differences in selected reproductive or survival measures is not evidence that all behavioural or long-term effects are absent. Conservation managers should monitor relevant animal outcomes, report adverse events and evaluate whether local conditions differ from those in published studies. The review supports contextual use and evaluation of dehorning, not an unconditional prescription for every species or site.

Regulated legal supply: competing mechanisms

7.1. The economic case for legal trade

Biggs and colleagues advanced the case that legal trade could provide a non-lethal source of horn and alter the incentives sustaining illegal supply [10]. In a simplified market, legal supply could lower prices, attract consumers away from poached products and create revenue for protection. These are coherent mechanisms, but the direction and scale of conservation benefit depend on assumptions about consumer substitution, production costs, supply capacity and governance. Legalization is not equivalent to a fall in illegal revenue in every segment. If new consumers enter, if preferences favour wild horn, or if legal supply is costly to authenticate, the outcome can differ from the simplest competitive model. The demand evidence already discussed establishes that provenance and legality are separate valued attributes [6,7]. Revenue accruing to a producer also does not automatically finance public conservation or improve wild population outcomes. Allocation and accountability would have to be demonstrated.

7.2. Caution

Eikelboom and colleagues reviewed arguments about legal international trade and concluded that likely demand growth, laundering and corruption could outweigh potential benefits for remaining wild populations [11]. This is a published review conclusion, not an experimental observation of a newly legalised global market. It provides a counterweight to the pro-trade case without resolving every uncertainty about an unimplemented policy scenario. The

empirical consumer evidence supports caution about parallel markets, although it does not settle their eventual size [5-7]. A legal preference can support substitution, while a preference for wild horn can sustain residual illegal demand. Traceability would also have to operate credibly under institutions already exposed to corruption risks [1,3,11]. A label or register is therefore not, by itself, proof that laundering has been prevented.

7.3. Conditions for policy appraisal

A serious appraisal should specify the legal source of supply, the quantity and cost of repeated harvest, expected consumer responses, the division of revenues and independent auditing arrangements. It should also include the possibility of demand expansion, illegal undercutting, stockpile diversion and misleading declarations of origin. These are evaluation requirements derived from the debate, not a claim that this review has quantified them [1,7,10,11]. Any proposed change must be evaluated within applicable international and domestic law [2]. The review does not recommend that stockpiled horn be sold under existing arrangements or imply that a policy hypothesis supplies legal authority. The immediate common ground is stronger evidence on demand and enforcement, transparent governance and protection of wild populations, regardless of the preferred long-term trade regime.

Evidence synthesis and policy implications

Table 1. Selected evidence, contribution and limits.

Source	Evidence type	Contribution	Limit
UNODC [1]	Global institutional synthesis	Adaptive networks; corruption and displacement; multiple intervention needs.	Seizures and arrests do not directly identify market size or causal impact.
Gao et al. [4]	Chinese media and auction analysis	Investment, collection and artistic value extend beyond medicinal demand.	Historical art-market observations are not a current population survey.
Dang Vu & Nielsen [5]; ITC [6]	Vietnamese consumer research	Multiple motives and preferences for provenance; heterogeneous policy responses.	Self-reported / hypothetical responses do not establish observed behavioural change.
Dang Vu et al. [7]	Choice experiment, 345 consumers	Legality is valued, but wild origin also attracts preference; parallel trade remains plausible.	Stated preferences in Vietnam do not forecast total international demand.

Source	Evidence type	Contribution	Limit
Kuiper et al. [8]	11-reserve observational analysis, 2017-2023	2,284 rhinos dehorned in eight reserves; about 78% reduction reported; 1.2% budget share.	Not a universal effect or full cost-effectiveness ratio; background enforcement remains relevant.
Chimes et al. [9]	Four Namibian black rhino sub-populations	No significant differences in assessed productivity / survival measures.	No significant poaching difference in this dataset; not proof of no effects in all settings.
Biggs et al. [10]; Eikelboom et al. [11]	Policy argument and literature review	Competing mechanisms: supply substitution and revenue versus demand growth and laundering.	Neither is an experiment observing a legalised global horn market.

The evidence supports an intervention portfolio rather than a binary choice between markets and enforcement. First, demand reduction should be segmented by use and buyer context. Status, gift exchange, perceived medicinal value and collecting require different messages and evaluation designs [4-7]. Stated willingness to consume less should not be treated as a verified fall in purchases, and campaign reach should not be substituted for behavioural outcomes.

Second, enforcement should target the organisation and financial benefits of trafficking as well as physical movement. Hübschle's emphasis on relationships and UNODC's focus on major beneficiaries suggest investigating enabling structures and corruption [1,3]. This does not justify abandoning frontline protection. It argues that local protection to credible prosecution, financial investigation and inter-agency cooperation, while safeguarding lawful rights and avoiding unsupported accusations.

Third, dehorning should be evaluated as part of a sustained protection programme where biologically and operationally appropriate [8,9]. Budget appraisal needs to compare complete programme costs and animal outcomes over time. A low share of one historical budget should not be copied as a funding rule. Effective implementation also requires continuity and monitoring rather than a one-off intervention.

Fourth, protection should be assessed across space and time. Regional coordination, comparable reporting and continued observation after funding changes would help distinguish harm reduction from displacement [1]. Conservation finance should make recurrent obligations visible, and funding success should be judged by animal and governance outcomes rather than expenditure alone.

Finally, policy appraisal should explicitly separate ecological, financial and social objectives. Protecting a captive asset, preserving a wild population, reducing criminal revenue and improving community welfare are related but not identical goals [1,11]. A programme may perform well on one dimension while failing on another. Reporting those trade-offs is preferable to presenting one metric as a complete measure of success.

Limitations and Future Research

The review is selective, qualitative and dependent on accessible published material. It does not establish comprehensive coverage, rank study quality with a formal instrument or estimate an average intervention effect. Abstract-level access for some sources constrains assessment of sampling, model specification and sensitivity analyses. Publication and institutional-reporting biases may also favour visible interventions or regions. The paper should therefore be read as a structured interpretation of selected evidence, not a definitive map of the entire literature.Illicit-market data have additional weaknesses. Seizures reflect both trafficking and enforcement effort; arrests are not a direct estimate of market size; reported prices may refer to different chain positions; and self-reported or hypothetical preferences may differ from actual behaviour [1,6,7]. Many relevant mechanisms are hard to observe, and evidence from legal antique transactions, illegal medicinal purchasing and reserve-level protection answers different questions.

Future studies should evaluate whether reward-reduction measures retain effects under different prices and protection conditions, and whether neighbouring sites experience displacement. Designs with credible comparison groups, pre-intervention trends and longer follow-up could improve causal inference. Repeated observation of horn regrowth, animal welfare, survival and reproduction would allow a fuller assessment of dehorning than short-term poaching counts alone.

Consumer research should test real-world behavioural change where lawful and ethical, distinguish market segments and publish uncertainty around substitution. Governance research should investigate how accountability, working conditions and safe reporting affect corruption risks rather than assuming salary increases are sufficient. Financial analysis should measure who captures revenues and bears conservation costs. These are proposed research priorities, not hypotheses tested in this manuscript.

Conclusion

The international rhino horn trade is sustained by interacting incentives rather than price alone. Consumer valuations create potential revenue, networks make illegal transactions possible, and governance influences the risks and costs of participation. Dehorning provides evidence that reducing the immediate reward can lower poaching in settings, but residual horn, regrowth and differences between study contexts limit stand-alone claims. Legal supply could change substitution and conservation finance, yet it may also coexist with illicit demand and laundering. A defensible policy response combines locally appropriate animal protection with segmented demand reduction, coordinated enforcement, anti-corruption safeguards and

sustained financing. Its success should be evaluated through population outcomes, criminal incentives, animal welfare, community effects and displacement. The central analytical lesson is to examine how interventions change the full chain of rewards and risks, while remaining explicit about what existing evidence can and cannot establish.

References

United Nations Office on Drugs and Crime. World Wildlife Crime Report 2024: Trafficking in Protected Species. Vienna: United Nations; 2024. https://www.unodc.org/documents/data-and-analysis/wildlife/2024/Wildlife2024_Final.pdf

CITES Secretariat. Background on the issuance of CITES permits in respect of the export of rhinoceros horn. Updated 28 October 2022. https://cites.org/eng/news/Background_issuance_CITES_permits_export_of_rhinoceros_horn_15032017

Hübschle A. Security coordination in an illegal market: the transnational trade in rhinoceros horn. Politikon. 2016;43(2):193-214. https://doi.org/10.1080/02589346.2016.1201377

Gao Y, Stoner KJ, Lee ATL, Clark SG. Rhino horn trade in China: An analysis of the art and antiques market. Biological Conservation. 2016;201:343-347. https://doi.org/10.1016/j.biocon.2016.08.001

Dang Vu HN, Nielsen MR. Understanding utilitarian and hedonic values determining the demand for rhino horn in Vietnam. Human Dimensions of Wildlife. 2018;23(5):417-432. https://doi.org/10.1080/10871209.2018.1449038

International Trade Centre. Demand in Viet Nam for rhinoceros horn used in traditional medicine. Geneva: ITC; 2017. https://www.intracen.org/resources/publications/demand-in-viet-nam-for-rhinoceros-horn-used-in-traditional-medicine

Dang Vu HN, Nielsen MR, Jacobsen JB. Conserving rhinos by legal trade: Insights from a choice experiment with rhino horn consumers. Ecological Economics. 2022;193:107287. https://doi.org/10.1016/j.ecolecon.2021.107287

Kuiper T, Haussmann S, Whitfield S, et al. Dehorning reduces rhino poaching. Science. 2025;388(6751):1075-1081. https://doi.org/10.1126/science.ado7490

Chimes LC, Beytell P, Muntifering JR, Kötting B, Neville V. Effects of dehorning on population productivity in four Namibia sub-populations of black rhinoceros (Diceros bicornis bicornis). European Journal of Wildlife Research. 2022;68:58. https://doi.org/10.1007/s10344-022-01607-5

Biggs D, Courchamp F, Martin R, Possingham HP. Legal trade of Africa's rhino horns. Science. 2013;339(6123):1038-1039. https://doi.org/10.1126/science.1229998

Eikelboom JAJ, Nuijten RJM, Wang YXG, Schroder B, Heitkönig IMA, Mooij WM, van Langevelde F, Prins HHT. Will legal international rhino horn trade save wild rhino populations? Global Ecology and Conservation. 2020;23:e01145. https://doi.org/10.1016/j.gecco.2020.e01145