AI-BASED STRATEGIES TO COMBAT WILDLIFE TRAFFICKING AND WET MARKETS IN ASIA:

A CRITICAL REVIEW

Natasha Rusch
Payal Arora

KEY TAKEAWAYS

- The world faces an uphill battle against the illicit wildlife poaching industry given its estimated value of US$ 7–23 billion. It remains an attractive market as it is regarded as a high-profit, low-risk business. Artificial Intelligence (AI) based approaches promise to flip the script and make it a high-risk pursuit.

- To combat wildlife crime, the World Wildlife Fund's (WWF) programme identified four core pillars – stop the poaching, stop the trafficking, stop the buying, and international policy. For AI oriented strategies to be successful, it needs to intervene at all four levels.

- Given that half of the world's wildlife poaching takes place in Africa, and that this continent is plunging into recession due to the pandemic, the illicit wildlife trade is expected to gain strides. This has renewed the urgency for innovative AI based solutions and fostered partnerships between global technology companies and conservation organizations to rise to this challenge.

- This study maps the current AI-based challenges, initiatives, and voices from stakeholders and captures insights to important questions such as to what extent can/does AI mitigate illegal wildlife trafficking problems? What are the different beliefs among stakeholders about wildlife poaching and online trafficking and why? How is AI being embedded in these initiatives?

- There is a bias towards market-based solutions among the African stakeholders at a time when the international funding sectors in Europe are going against such measures. Cultural perspectives matter in AI-led enforcement, which demands local buy-in.

- Exorbitant costs to sustain AI interventions sit uncomfortably with major resource scarcities in pay for the rangers and their informant networks on the ground, still seen by conservationists as the most "intelligent" way to combat the trade.

- Anti-poaching tracking initiatives need to address ongoing dilemmas of data governance such as data cooperation vs data localization/ownership, and open science vs privacy/security to have real impact.

At US$ 60,000 a kilogram, a rhino horn costs more than a pound of gold or cocaine, and according to the UN Environment Programme and Interpol, this illicit wildlife poaching industry has an estimated value of US$ 7–23 billion.[1] The destination countries where this trade mainly takes place include China and Southeast Asia, which are considered a "biodiversity hotspot" at the centre of legal and illegal wildlife trade.[2] Asia's market demand is largely driven by the use of these animals and animal products as collectables, pets, traditional medicines, and food. The attraction to this illegal trade is due to the prevailing fact that it is regarded as a high-profit, low-risk business.[3]

Wildlife trafficking can be parsed into three phases: the poaching activity in the source countries, the transit and transportation to the destination countries and finally the trade in the destination countries.[4] The source wherein about half of the world's wildlife poaching takes place is African countries. The alarming rates of poaching have led to the endangering and/or possible extinction of many species, including elephants, rhinoceros, tigers, and pangolins. In Africa, an elephant is killed every fifteen minutes and in 2016, a rhino was killed every 8 hours.[5] To combat wildlife crime, the World Wildlife Fund's (WWF) programme identified four core pillars – "stop the poaching," "stop the trafficking," "stop the buying," and "international policy."[6] They highlighted the high level of organised international wildlife crime involved, and intelligence-led law enforcement was described as being vital in deterring the illicit trade chains from source to market.[7]

Wildlife poaching and trading have come under added scrutiny due to the COVID-19 pandemic. Asian countries, particularly China, are under serious international pressure to ban all further wildlife trade, as the virus is suspected to

1 *Poaching Facts. 2020. "Rhino Poaching Statistics." (http://www.poachingfacts.com/poaching-statistics/rhino-poaching-statistics/).*

2 *Krishnasamy, Kanitha and Monica Zavagali. 2020. "Southeast Asia at the heart of Wildlife Trade." TRAFFIC. (https://www.traffic.org/publications/reports/renewed-game-plan-needed-to-tackle-southeast-asias-massive-wildlife-trafficking-problem/).*

3 *Krishnasamy, Kanitha and Sarah Stoner. 2016. "Trading Faces: A rapid assessment on the use of Facebook to trade wildlife in Peninsular Malaysia". TRAFFIC. (https://www.traffic.org/site/assets/files/2434/trading-faces-facebook-malasia.pdf).*

4 *Cusack, John. 2020. "The Illegal Wildlife Trade, Dollars & Sense." Financial Crime News, 8 March. (https://thefinancialcrimenews.com/the-illegal-wildlife-trade-dollars-sense-by-john-cusack/).*

5 *Poaching Facts. 2020. "Rhino Poaching Statistics."*

6 *WWF. 2020. "Wildlife Crime Initiative." Panda.org. (https://wwf.panda.org/our_work/wildlife/wildlife_trade/wildlife_crime_initiative/).*

7 *Krishnasamy, Kanitha and Monica Zavagali. 2020. "Southeast Asia at the heart of Wildlife Trade."*

have emanated from the wildlife trade in a wet market in Wuhan, China.[8] As a result, in Asia, this trade has temporarily been banned, and further permanent laws are being drafted.[9] For instance, several law enforcement "milestones" have been achieved in response to the COVID-19 pandemic. As of June 2020, pangolins, the most trafficked mammals from Africa and Asia sold in the wet markets in Asia, have been removed from China's traditional medicine treatments.[10] There is renewed optimism towards an ultimate ban on using wildlife in traditional Asian medicine. Nevertheless, animal products such as rhino horns and elephant tusks are still on medicine lists and illegal trading still prevails.[7] Moreover, as Africa plunges into recession and tourism falls rapidly due to the pandemic, poaching may gain added economic incentives.

Furthermore, with the wet market venues closing, online illegal wildlife trafficking has expanded exponentially via social media and e-commerce platforms, further challenging the effective detection of illicit trading.[11] Along with supply chain routes, global access to technology and connectivity has enabled a fast-growing platform for buyers and sellers to trade illegal wildlife. Importantly, trans-continental trade has expanded due to Asia's wild populations being depleted. This has contributed to an increase in the demand for African wildlife in Asia.[12] Enforcement agencies are increasingly finding it difficult to detect illicit trading, especially due to the encrypted nature of the online transactions.[13] Thus, whilst the COVID-19 pandemic has resulted in the shutdown of wet markets and new laws in place to criminalise the sale of certain species, the fragmented and limited approach in tackling illegal wildlife trade is seen as a guarantee of the status quo, or even worse, of worsening the situation as global supply chains go online.

8 *Standaert, Michael. 2020. "Illegal wildlife trade goes online as China shuts down markets." Aljazeera, 24 March. (https://www.aljazeera.com/news/2020/03/illegal-wildlife-trade-online-china-shuts-markets-200324040543868.html).*

9 *Froehlich, Paula. 2020. "China and Vietnam finally ban wildlife trade due to coronavirus." New York Post, 28 March. (https://nypost.com/2020/03/28/china-and-vietnam-finally-ban-wildlife-trade-due-to-coronavirus/).*

10 *Briggs, Helen. 2020. "Coronavirus: Putting the spotlight on the global wildlife trade." BBC, 5 April. (https://www.bbc.com/news/science-environment-52125309).*

11 *Standaert, Michael. 2020. "Illegal wildlife trade goes online as China shuts down markets."*

12 *Krishnasamy, Kanitha and Monica Zavagali. 2020. "Southeast Asia at the heart of Wildlife Trade."*

13 *Briggs, Helen. 2020. "Coronavirus: Putting the spotlight on the global wildlife trade."*

To address these formidable challenges, AI is being developed to automatically monitor and investigate high volumes of online data to effectively prevent and disrupt this trade (see Table 1). In 2018, the WWF and the International Fund for Animal Welfare (IFAW) launched the "Coalition to End Wildlife Trafficking Online" (CEWTO), where currently thirty-four e-commerce, search and social media technology companies are collaborating with wildlife organisations to assist in combating this illegal trade.[14] Baidu, a Chinese multinational tech company and one of the largest AI and internet companies globally, is working with the CEWTO to develop AI solutions to detect listings of wildlife for sale.[15]

Table 1: Digital Platforms Used by the Crowdsourcing Initiatives

Company/ NGO/ Park/ Project	Type of Technology	Interviewees Involved in These Technologies	Country of Operations	Type of Park Management Utilising This Technology
Elephant Listening Project (ELP)	Acoustic Technology	Peter Wrege	▪ Democratic Republic of Congo ▪ Central African Republic	Government with NGO management support
Rainforest Connection	Acoustic Technology	Topher White	15 countries in Africa, Asia & South America	Government & Community management
Air Shephard	Aerial Technology	Fei Fang	Test pilots in various African & Asian countries	Government Management & Conservation areas utilising SMART technology

14 *WWF. 2020. "Coalition to End Wildlife Online." (https://www.worldwildlife.org/pages/coalition-to-end-wildlife-trafficking-online).*

15 *WWF. 2020. "Coalition to End Wildlife Online."*

Company/ NGO/ Park/ Project	Type of Technology	Interviewees Involved in These Technologies	Country of Operations	Type of Park Management Utilising This Technology
PAWS	Patrol Technology	Patrick Flickinger, Shahrzad Gholami, Remko De Lange, Fei Fang	Test pilots in various African & Asian countries Including: ■ China ■ Malaysia ■ Uganda	Conservation areas utilising SMART technology
Smart Parks B.V.	Sensor and Animal Tagging Technology	Timothy van Dam	"African Parks" Conservancies	Private management & APU
TrailGuard AI	Camera Technology	(Unable to reach for interview)	Tested in Tanzania	Grumeti Reserve Private management

While much research in this area of conservation focuses either on AI-led anti-poaching measures to check supply or policies to deter demand, few studies emphasise the global supply chains that intersect transnational actors, in this case Africa and Asia. The difficulties in creating AI applications for online trafficking are to a certain extent due to different stakeholder interests driving the nature conservation field and the technology industry.[16] Therefore, it is essential to explore the diverse aspects of these socio-technical systems to address the significant and global challenges in eliminating wildlife poaching and trade, particularly of endangered species.

The focus of this research is to create a critical and holistic approach in deploying AI-led strategies to combat the poaching and illegal trade that spans digital and physical geographies due to the inherent global supply chains that enable this practice. Through a qualitative approach of in-depth interviews with diverse experts involved in

16 *Maffey, Georgina, Hilary Homans, Ken Banks, and Koen Arts. 2015. "Digital technology and human development: A charter for nature conservation." Ambio 44, 4: 527–537.*

combating this trade, we asked the following: to what extent can/does AI mitigate illegal wildlife trafficking problems? What are the different beliefs about wildlife poaching and online trafficking and why? What are the biggest challenges and existing strategies in countering poaching and how is AI being embedded in these initiatives?

The study aims to provide cross-sectoral insights for stakeholders on the global value chains of wildlife markets and the use of AI anti-poaching applications to disrupt supply. Due to the increasing integration of AI and conservation, this work provides nuance to the relationship between the socio-technical systems of AI devices, the communicative and media ecologies of promoting such devices and responses from the various conservationist members of Asia and Africa. Given the economic pressures of the COVID-19 pandemic, the aim is to utilise these insights to further enable cost-efficient and proficient conservancy. ■

METHODOLOGY

This case study incorporates a mixed-method approach of in-depth interviews of 15 diverse stakeholders across the global supply chains (conservation experts, NGOs and technology companies) and the thematic analysis of their initiatives (see Table 2). The stakeholder analysis method is recognised as a vital process for environmental and natural resources management, making this method applicable to this study.[17] The aim is to intersect diverse strategies on conservation, AI design, and deployment processes geared towards mitigating the illegal wildlife trade.

The interviews were conducted over a span of two months (April-May 2020). Multiple stakeholders, including supervisors of the rangers (N=4), conservationists (N=2), NGOs (N=4), and AI technology experts (N=7), were interviewed over Zoom. Purposive sampling was applied to this study, whereby non-random, selected individuals were interviewed based on their expertise and our access to them. We used thematic analysis to analyse the interview data, guided by the key concepts/codes that have emerged from the state-of-the-art literature in the domains of the conservation sector, AI usage, and global supply chains in wildlife trafficking. Through the initial coding process, a total of 162 codes were created, and further filtered and cross-coded to arrive at six overarching themes, namely: "tools using AI", "anti-poaching strategy", "trade disruption techniques", "demand and crime", "COVID-19" and "economics".

Qualitative thematic analysis was also utilised to gain further insight into the media's narratives about AI as well as the persistence of illegal wildlife purchasing. We critically analyse the CEWTO NGO application report that addresses and presents their views about AI tools to combat wildlife trade online. Overall, this research reveals the global political economy of this industry by mapping and critically analysing

1/ ranger/poacher experiences and perspectives in Africa;
2/ AI-based anti-poaching software design initiatives; and
3/ consumer markets in Asia. ■

17 *Colvin, Rebecca M., G. Bradd Witt, and Justine Lacey. 2016. "Approaches to identifying stakeholders in environmental management: Insights from practitioners to go beyond the 'usual suspects'." Land Use Policy 52: 266–276.*

1. Market Paradigm and AI for Conservation

Global conservation practice stems from “sustainable utilisation”[18] where wildlife laws are enforced, and wildlife is utilised in such a way that it does not jeopardise the continued survival of the species, begging the question of whether it is proven to work. Currently, conservation governance widely follows the trend of neoliberalisation, which entails the promotion of market-based instruments for the management of the environment.[19] The neoliberal logic alludes to a “win-win” conservation approach for all affiliated parties through the strategic extraction of natural resources.

In the interviews, the topic of applying market principles in conservation resurfaced, specifically regarding the legalising of the sale of rhino horns and elephant tusks. Nico Jacobs, the Co-Founder of the NGO Rhino 911, argues that the proceeds could be reinvested into conservation:

> *“We owe it to the animals to at least try to lift the ban, try the trade. Can you imagine if we start selling horns in South Africa? People will come out of bankruptcy and start breeding the animals with a passion. Because at this stage it’s a liability. It’s not an asset anymore... That same rhino, the heart that’s beating is worth 10,000 US Dollars but the horn is worth 180,000 US Dollars.”*

Many of the Southern African countries are currently stuck with large ivory stockpiles due to global bans on exports to Asia and elsewhere. Olivia Mufute, Country Director for African Wildlife Foundation, explains that although there is concern that selling these remaining stockpiles could promote further poaching, given the scarcity of resources for conservation, the conservation areas would benefit greatly by selling them so they can reinvest that amount back into wildlife conservation.

The fact is that AI-led anti-poaching tools are designed primarily to detect poachers but not the poached products, such as rhino

18 *Duffy, Rosaleen. 1999. “The role and limitations of state coercion: Antipoaching policies in Zimbabwe.” Journal of Contemporary African Studies 17, 1: 97–121.*

19 *Fletcher, Robert, et al. 2019. “Natural capital must be defended: green growth as neoliberal biopolitics.” The Journal of Peasant Studies 46, 5: 1068–1095.*

horns. Using species identification tests to differentiate between the old stockpiles and newly poached products and standardised datafication of these processes[20] can serve as a valuable tool to allow for selective marketisation, nuanced policy-making and enforcement on tracking these products through the global supply chains. Strategic AI intervention can thereby resolve the long-standing conflict in the field of conservation regarding resource scarcity in conservation by capitalising on stockpiles though tracking their digital fingerprints. The ethical dilemma, however, remains in place.

The cultural dimension extends to the AI and ethics field as decisions are made about what these tools should do and why. A rethink of the universalisms of the ethical guidelines is needed on global wildlife conservation and animal cruelty in both Africa (the supply source) and Asia (the consumer source). Cultural conditions/perspectives matter in enforcement, which demands local buy-in. There appears to be a bias towards market-based solutions among the African stakeholders at a time when the international funding sectors in Europe are going against such measures.

2. Sustainability and Placement of AI in Conservation

TrailGuard AI has identified one hundred national parks that have the highest risks of poaching. AI cameras acting as an early warning system are due to be deployed at these parks by the end of 2020.[21] It is estimated that the equipment and infrastructure to protect these parks could be installed for about US$ 4 million, all of which are said to have been donated.[22] With these massive donor investments and profits for technology companies, AI-led interventions in conservation are, not surprisingly, being driven by the technology companies. These exorbitant costs sit uncomfortably with the major resource scarcity in pay for the rangers and their informant networks on the ground to prevent anti-poaching.

20 *Ewart, Kyle, et al. 2018. "An internationally standardized species identification test for use on suspected seized rhinoceros horn in the illegal wildlife trade." Forensic Science International: Genetics 32: 33–39.*

21 *Inmarsat. 2019. "Inmarsat joints forces with RESOLVE to revolutionise fight to protect African wildlife" Press Release, 25 July. (https://www.inmarsat.com/press-release/inmarsat-joins-forces-with-resolve-to-revolutionise-fight-to-protect-african-wildlife/).*

22 *FT.com. 2019. "Targeted action can stem illegal wildlife trade." Financial Times, 30 November. (https://www.ft.com/content/ef8e379e-12a3-11ea-a7e6-62bf4f9e548a).*

The reality is that national parks can barely afford to pay their rangers, let alone invest in new technologies. It is noteworthy that all stakeholders, both within the fields of conservation and technology, discussed the tensions involved with obtaining adequate funding; yet, the extent of deprivation differed. While initial subsidies and grants are allowing AI into these conservation areas, there is a limited period to this funding. Additional upkeep and upgrading of the equipment, training of the staff, data storage, repairs and ecologically responsible disposal of the e-waste are not often included in the budgets allocated. It is evident that some of the simplest tools are not being implemented in these African and Asian conservation areas due to basic problems of connectivity, lack of electricity and digital literacy. Without the basic foundations in place, AI cannot be integrated in a sustained manner.

Our stakeholders reveal that to manage and create networks on the ground, rewards are needed to incentivise the provision of such information, and this is costly. The accumulation of intelligence will only go as far as the funding allows. NGOs describe that they often lack funds for paying off informants and that this limited funding is getting diverted to AI technologies. They argue that these AI-led initiatives do not have a clear insider-knowledge base and a starting point for assessing these terrains. Donations given to conservationists and NGOs are often earmarked for AI-based projects or come in the form of partnerships with technology corporations and are facilitated by transnational agencies.

The fact is that public-private partnerships between donors and tech companies come with a long legacy of using Global South communities as "testbeds for new technologies." These "experiments" have led to the field suffering "chronic pilotitis," an inundation of technology-initiated pilot projects with no clear steps for integration into the community.[23] Hence, it is essential to have a sustainable and community growth-led model that accounts for institutional building and investment into human resources, alongside AI-led anti-poaching technologies. Otherwise, there is a danger of repeating past failures.

23 *Arora, Payal. 2019. The next billion users: Digital life beyond the West. Cambridge: Harvard University Press.*

3. Re-Examining What Counts as "Intelligence"

Preventing poaching in protected areas necessitates prompt collection, analysis and reporting of data deriving from the field.[24] In this field of preventing poaching, there are diverse anti-poaching information systems implemented to support, enhance and gather data to strengthen anti-poaching tactics, namely: Global Positioning Systems (GPS), microchipping wildlife, drones, infrared cameras, sensors, acoustics, cybertrackers, and Spatial Monitoring and Reporting Tool (SMART).[25] These technologies enable the derivation of data for AI processing and help with the breakthroughs for AI for conservation.[26] To date, information technologies that enable AI for such purposes are aerial-based, patrol-based, acoustic-based, camera-based, and sensor-based. Multiple technology companies, research institutes and non-profit organisations are utilising/testing machine learning, a subset of AI, and AI algorithms to revolutionise efforts in conservation, including the Elephant Listening Project, Rainforest Connection, Smart Parks, Air Shepherd, Protection Assistant for Wildlife Security (PAWS), and TrailGuard AI.

Undoubtedly, intelligence is noted to be a vital element in AI-led anti-poaching strategies. Wildlife poaching is increasingly paying attention to "high" level and "smart" intelligence anti-poaching operations in which processed information about poachers can assist in crime prevention, apprehension, and conviction.[27] Technology is a principal factor where automation and AI are deployed in conservation decisions as "conservation by algorithm."[28] For example, Gholami, a Data and Applied Scientist from Microsoft, explains how PAWS has been successfully pilot tested in the national parks of Uganda, Malaysia, Cambodia and China. PAWS utilises the data from SMART, which only gathers historical data, and provides insights based on its analyses of this data to the conservation area managers. Fang, an Assistant Professor at Carnegie Mellon, and an AI

24 *Stokes, Emma J. 2010. "Improving effectiveness of protection efforts in tiger source sites: developing a framework for law enforcement monitoring using MIST." Integrative Zoology 5, 4: 363–377.*

25 *Pimm, Stuart L. et al. 2015. "Emerging technologies to conserve biodiversity." Trends in ecology & evolution 30, 11: 685–696.*

26 *Wearn, Oliver R., Robin Freeman, and David Jacoby. 2019. "Responsible AI for conservation." Nature Machine Intelligence 1,2: 72–73.*

27 *Singh, Jaidev, and Henk Van Houtum. 2002. "Post-colonial nature conservation in Southern Africa: same emperors, new clothes?" GeoJournal 58, 4: 253–263.*

28 *Cowan, Devin, Christina Burton, and William Moreto. 2019. "Conservation-based intelligence-led policing." Policing: An International Journal.*

expert for the PAWS technology, explains that further data supplementation includes "geospatial features around [the] protected area", which is thereafter digitised and implemented into the PAWS technology. The implementation of machine learning and game theory is utilised for predictive analytics of poaching activities and movements in this vast terrain. Gholami from Microsoft explains that PAWS also provide "real time heat maps" that detect activities so that the rangers can see which locations have higher risks than others and guide them in optimising their time in the field.

While this is useful, historical data as the primary data feed can skew the system's analysis as it does not account for shifting ecological and human migratory patterns, dynamic poacher strategies, and counter-measures, which need to be captured for a complete and thereby more accurate prediction of poaching practices in the field. Moreover, the realities on the ground are that most rangers have rotary phones and limited access to connectivity and electricity and therefore engage with more paper-based record-keeping. Hence, for live streaming to work and for such data-intensive practices to be integrated, a larger investment into digital and data infrastructures would be required, which is beyond the scope of these projects.

Another example of AI deployment is the case of the Rainforest Connection project, an initiative that utilises acoustic technology. The AI technology monitors variables they see as being applicable to poaching, including animal noises, gun noises and chainsaws. The custom-designed acoustic technology is erected in trees and works in conservation areas that have cell phone networks, offering real-time data and alerts. Rainforest Connection CEO Topher White explains that AI technology is utilised to process the acoustics by "going through the massive data and filtering out the stuff that [they] don't need people to pay attention to" and to detect certain sounds acquired. The technology is operating in African, Asian and South American protected areas, and utilises bioacoustics, animal vocalisations and human-made sounds from the soundscapes, which can be detected through algorithms, deep learning, and experts.[29] Due to the fact that the acoustic technology uses cell phone

29 *Burivalova, Zuzana, Edward T. Game, and Rhett A. Butler. 2019. "The sound of a tropical forest." Science 363, 6422: 28–29.*

networks, the resultant effect is live streaming, thereby allowing for real-time responses from the rangers. Hence, it is important to build trust with technology at the start as it affects how people adopt and integrate new interventions.

The success of these strategies depends fundamentally on being sensitised to the socio-political and economic conditions of the target nation as well as its ecological uncertainties.[20] The efficacy of AI systems for conservation rests on quality and trustworthy intelligence. From our scholarship and findings, this fundamentally includes grassroots, on-the-ground "low intelligence", which constitutes local-level informant networks and humbler forms of knowledge-making and sharing. Mike Ball, the Security Manager from Malilangwe Trust, describes that "90% to 95% of poaching comes from within [the] property." Poachers, it seems, are often known and local. 98% of poachers are apprehended through information provided by informants in the community. Also, Ball states that his rangers have been approached by poachers to work for them, but instead they reported back to the organisation. He attributes this honesty to the fact that "they're well looked after" – with decent salaries and support to maintain their informant networks. This keeps rangers from being tempted to change sides. A well-managed local operation is one of the most important contributory factors in enabling effective anti-poaching programmes for the protection of wildlife populations.[30]

Nevertheless, working with neighbouring park communities to create intelligence networks also has its challenges. Kuvawoga, from Painted Dog Conservation, explains that the communities are made up of people who are related. Therefore, there is a need to shift from individual to household and even kinship informant networks to best optimise these "low intelligence" sources as credible data for AI-based technologies. Reward systems should be designed accordingly. Furthermore, humbler technologies can aid AI in fostering a more robust system of information networks. Stakeholders within conservation state that generally they share their own successes and challenges with the various technologies on the market via WhatsApp groups and general "word of mouth".

30 *Watson, James, Nigel Dudley, Daniel B. Segan, and Marc Hockings. 2014. "The performance and potential of protected areas." Nature 515, 7525: 67–73.*

Overall, whilst increasingly sophisticated technology is being utilised to fight against wildlife poaching, it is noted that success lies in continuing to invest in building and sustaining trusted ground-level networks at the source market alongside the ramping up of AI-based frameworks and applications for monitoring the moving of the products to the Asian markets.[31] Our findings show that we need both the "high" and the "low" forms of data collection to enhance the process of detecting illegal wildlife poaching and trade. Unfortunately, in an age of techno-solutionism where it is believed that the latest tools promise the best results, alongside the realities of budget cuts for local staff, there are pushes for the cost-cutting of the human networks of "low intelligence" in favour of "smart" technologies.

4. AI Technology Combating Online Trade: Double-Edged Sword?

In both Asia and Africa, the International Fund for Animal Welfare is operating online to detect illicit trade. Currently, machine learning and AI-driven technologies have not been thoroughly implemented in the conservation framework. Data mining on various social media platforms raises questions about the impact that data processing has on fundamental privacy rights and shared social and ethical values. With the stakes high in terms of extinction of entire species, the market is confronted with values that may conflict one another.

Research asserts that AI can drive a project to success for the "social good" of humanity.[32] However, whilst technologies can aid in conserving wildlife, "it is important that these tools themselves do not drive conservation efforts".[33] Metrics can be improved through collaborations between machine learning researchers and conservationists. Also, once algorithms are released and utilised "in the wild", this can improve the accuracy of the metrics. There is a need for a more holistic view of conservation practices; Sarah Savory, a conservation consultant from Africa Centre of Holistic Management, supports this approach,

31 *Ball, Mike, Colin Wenham, Bruce Clegg, and Sarah Clegg. 2019. "What does it take to curtail rhino poaching? Lessons learned from twenty years of experience at Malilangwe Wildlife Reserve, Zimbabwe." Pachyderm 60: 96–104.*

32 *Castro, Daniel, and Joshua New. 2016. "The promise of artificial intelligence." Center for Data Innovation: 1–48.*

33 *Pimm, Stuart L. et al. 2015. "Emerging technologies to conserve biodiversity."*

stating that technology must be "tested within the context" as this form of management style "ensures that [they] test that every decision or actionable policy is leading [them] towards that context; socially, culturally, and environmentally." Hence, technology should not drive conservation efforts, but rather supplement them.

Fang from Carnegie Mellon describes the setbacks encountered when conducting research for tracking wildlife trafficking and how AI should be situated strategically to be most effective. She explains that there are limitations to accessing social media and e-commerce images and textual data due to the data being on proprietary platforms and encrypted applications, thereby being very hard to retrieve. CEWTO, on the other hand, was able to utilise AI more effectively in this domain as the data was readily available due to the data platform owners themselves being partners of this organisation.[34] The CEWTO Coalition brings together e-commerce, search and social media companies across the world in partnership with three leading wildlife organisations, and aims to reduce wildlife trafficking online on company platforms by 80% by 2020.[35] This makes a case for technology companies to become more cooperative in conservation efforts.

Furthermore, Patrick Flickinger, the Senior Data Architect in the Microsoft AI for Good Research Lab, suggests that with the data from PAWS, their lab can make the APIs open to other conservation organisations and researchers around the world, so that they can reuse the same APIs inside their own pipelines. In this way the APIs provide an open system that can be used by conservationists to share poaching information with other stakeholders for further development of this AI technology. Open science data can, however, come with security and data ownership issues, especially today as nations, including those in the Global South, are entertaining the notion of data localisation, the mandatory storage of data in local servers.[36] Fang from Carnegie Mellon explains that in China, due to data localisation laws that restrict cross-border internet governance and data exchange, it can get complicated to operationalise such transnational collaborations for conservation:

34 *WWF. 2020. "Coalition to End Wildlife Online."*

35 *WWF. 2020. "Coalition to End Wildlife Online."*

36 *Chander, Anupam and Uyen P. Le. 2015. "Breaking the Web: data localization vs. the global internet." Emory Law Journal, UC Davis Legal Studies Research Paper 378. (https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2407858).*

“The only concern was that data transmission is a little bit hard because they need to make sure that the data stays in China, so we were able to find another additional collaborator who stays in China. This person would get the advice from us, the previous algorithms from us, and also get the data from them and then kind of integrate everything together to produce results.”

Hence, there are ways to navigate this terrain but it continues to be complicated as they demand far more stamina, persistence and commitment to the issue, which can deter some partnerships from happening.

Other various conservation areas which utilise a variety of wildlife trackers described issues with “closed systems.” Timothy van Dam, the CEO of Smart Parks, states that the problem of using VHF/UCF technology is that these “smart” animal collars are very expensive, closed-sourced and use old technology, which contributes to their vulnerability as one can even catch the collars’ signals with just a US$ 25 equipment. This is why his organisation started “Open Collar,” which is fully open source.

The call for an open and global collaborative effort goes against the current politics of data localisation and the nationalisation of data, and encrypted platforms and closed networks at play within the bigger trade wars between dominant players such as the United States and China. Yet, for conservation, while the talk continues about closed systems, there are more open collaborations between the technology and conservation communities, enabling them to utilise AI more effectively with the sharing of data across borders. ■

CONCLUSION

The wet markets and wildlife trade in Asia, particularly in China, have come under serious scrutiny due to the COVID-19 pandemic. As regulators, policy makers, tech innovators, conservationists and activists join forces to address this sector, there is a danger in implementing solutions that are piecemeal, fragmented and have the possibility of causing more confounding problems in the long run. This stems partly from looking at regions as contained units, where policy-making and technological governance disassociate from and even negate the intrinsic and complex matrix of relationships in the region vis-à-vis global, digital, and natural ecosystems.

In this study, we delve into Asian wet markets and wildlife trafficking by moving away from them; instead, we push the reader to look at the markets as part of global value chains and the political, digital and global economies, with a special focus on the source of the wildlife trade – Africa. Clearly, AI and institutional and policy interventions come with ethical dilemmas, of pushing for a marketised approach to sustainability due to the funding realities at the ground level against the morality of commodifying these endangered species. Further, high-end, "smart" technologies are humbled by the more mundane low-end but critical informant networks, and existing limited data/digital infrastructures. This demands a long-term investment into community-based networks, support for rangers, and pressure on governments to improve digital and data infrastructures for these AI-led technologies to be embedded within. Limited financial resources compel leapfrogging over the human to the technology, dooming AI centred conservation initiatives to possible failure. Sustainability considerations also push us to scrutinise collaborations between technology companies and development and government actors in terms of data governance, security and access. Global alliances are essential to tackling the problems humanity faces today, as they are intrinsically global and complex in nature – climate change, extinction of species, and pandemics. Therefore, this chapter argues that we need to go beyond the "human in the loop" trope in designing responsible platforms by recognising the specific motivations, rationales and networks that sustain the illicit in the global wildlife trade. By humanising the actors in the global supply chains, we may have a chance to boost conservation towards more sustainable ends. ■

Table 2: Overview of Stakeholder Analysis

Company/NGO/ Park/ Project & Country	Interviewee	Stakeholder Category	Job Position	Date & Programme
Africa Centre of Holistic Management & Zimbabwe	Sarah Savory	Conserva-tionist	Conservation Consultant & Author	28/04/2020 Zoom
AndBeyond & South Africa	Les Carlisle	Conserva-tionist (operating in field)	Group Conservation Manager	30/04/2020 Zoom
Big Life Foundation & Kenya	Richard Bonham	Ranger	Co-Founder	04/05/2020 Zoom
Painted Dog Conservation & Zimbabwe	David Kuvawoga	Ranger	Operations Manager	05/05/2020 Zoom
Panda Masuie Project & Zimbabwe	Jos Danckwerts	Ranger	Project Manager	06/05/2020 Zoom
The Malilangwe Trust & Zimbabwe	Mike Ball	Ranger	Security Manager	06/05/2020 Zoom
Zambezi Society & Zimbabwe	Gary Layard	NGO	Volunteer Logistics Coordinator	28/04/2020 Zoom
International Fund for Animal Welfare & Zimbabwe	Philip Kuvawoga	NGO	Director: Landscape Conservation Programs	05/05/2020 Zoom
African Wildlife Foundation & Zimbabwe	Olivia Mufute	NGO	Country Director	08/05/2020 Zoom

Company/NGO/ Park/ Project & Country	Interviewee	Stakeholder Category	Job Position	Date & Programme
Rhino 911 & South Africa	Nico Jacobs	NGO	Co-Founder and Pilot	30/04/2020 Zoom
Elephant Listening Project & America	Peter Wrege	AI expert and Ecolo-gist	Senior Research Associate: Cornell University	30/04/2020 Zoom
Rainforest Connection & America	Topher White	AI expert	CEO	09/05/2020 Zoom
PAWS & Air Shephard & America	Fei Fang	AI expert	Assistant Professor: Carnegie Mellon University	29/04/2020 Zoom
Microsoft & America	Patrick Flickinger	AI expert	Senior Data Architect: AI for Good Research Lab	4/05/2020 Zoom
Microsoft & America	Shahrzad Gholami	AI expert	Data and Applied Scientist	14/05/2020 Zoom
Microsoft & Netherlands	Remko De Lange	AI expert	Cloud Solution Architect: Data & AI	14/05/2020 Zoom
Smart Parks & Netherlands	Timothy van Dam	AI expert	Co-Founder/ Director	14/05/2020 Zoom

The Authors

Natasha Rusch has a MA in Media and Business from Erasmus University Rotterdam in the area of ethical design of AI for global conservation. She served as a journalist for the Die Matie Stellenbosch University newspaper and works as a Marketing Manager for a company in Zimbabwe named Cutting Edge. Natasha was born and brought up in Zimbabwe and her passion for conservation stems from her many trips throughout the years to National Parks and Reserves.

Payal Arora is a digital anthropologist and Professor and Chair in Technology, Values and Global Media Cultures at Erasmus University Rotterdam. She is the author of award-winning books including "The Next Billion Users" with Harvard University Press. Her expertise lies in digital experience among low-income communities worldwide and comes with more than a decade of fieldwork experience in such contexts. Forbes named her the "next billion champion" and the "right kind of person to reform tech". Several international media outlets have covered her work including the BBC, The Economist, Quartz, Tech Crunch, The Boston Globe, F.A.Z, The Nation and CBC. She is also the founder of Catalyst Lab, a digital storytelling organisation and co-founder of FemLab.Co, an IDRC-funded initiative on women worker collectives in the global platform economy.

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