Evaluating the Effectiveness of Artificial Intelligence in the Conservation of Pangolins: A Literature Review

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**Introduction**

The integration of artificial intelligence (AI) in wildlife conservation has gained significant attention, particularly in addressing challenges related to illegal wildlife trade, species and habitat monitoring, and analysing wildlife behaviour. This literature review examines existing research on AI-driven conservation methods, with a particular focus on pangolin conservation.

**Pangolin conservation**

Pangolins (Pholidota: Manidae) are medium sized, nocturnal, and elusive mammals that are covered in scales(Heinrich et al., 2016). Pangolins are the most trafficked mammal globally (Khwaja et al., 2019; Sarma et al., 2023; Zhong et al., 2025), with all eight species classified as globally threatened according to the IUCN Red List of Threatened Species(2019). These animals face many threats including poaching and habitat loss (Wang et al., 2022).Additionally, Heinrich, Wittmann and Prowse(2016) state that pangolins are poached and trafficked because various parts of their bodies such as their scales, foetuses, blood and bones are used in traditional medicines, their meat is considered a delicacy. Despite this, they have been subject to limited research, which results in a lack of reliable population estimates and standardised survey methods for all the species(Khwaja et al., 2019). Additionally, pangolins are difficult to study due to their elusive behaviours, nocturnal activity patterns, low population densities and increasing rarity(Morin et al., 2019). Traditional pangolin research and conservation methods include, camera trapping, burrow counts, nocturnal surveys, telemetry, community interviews and molecular techniques (Willcox et al., 2019). These traditional methods are time-consuming, labour-intensive, and susceptible to human error (Wang et al., 2024).

**Artificial Intelligence in conservation**

Ongsulee (2018) defines Artificial Intelligence (AI) as machines that exhibit intelligence by perceiving their environment, making decisions to achieve goals, and mimicking human cognitive functions such as learning and problem-solving. AI technologies, including machine learning, deep learning, and computer vision, have proven to be effective tools for wildlife conservation (Tuia et al., 2022). According to Sisodia, Dhyani and Kathuria (2023) AI models analyse historical data to predict future trends including deforestation and illegal wildlife trade. Furthermore, computer vision and deep learning models like Convolutional Neural Networks (CNNs) improve image recognition which enables AI to identify wildlife and detect poachers effectively (Chalmers et al., 2019; Fergus et al., 2024). Chalmers, Fergus and Wich (2019) found that AI-integrated drones, equipped with thermal and visual spectrum cameras, can monitor remote areas to detect endangered species and human threats. Additionally, AI models use remote sensing to track environmental changes affecting wildlife habitats, integrating multi-sensor data from drones, satellites, and bio-loggers​ (Tuia et al., 2022). Di Minin, Fink and Hiippala (2019) proposed a machine-learning framework to track illegal wildlife trade on social media, demonstrating AI’s potential in analysing vast datasets to detect trafficking activities.

**Artificial Intelligence in Pangolin Conservation**

Zhong, Wei and Chen (2025) highlight that deep learning models, when integrated with drones and infrared cameras, can effectively track and identify pangolins from extensive video footage. However, there are few detection models specifically tailored for pangolins, prompting Zhong et al. (2025) to propose an improved real-time object detection algorithm based on YOLOv8 (You Only Look Once). Their research demonstrated that the enhanced model provides reliable pangolin detection capabilities. In addition to species detection, AI is being used to monitor and study pangolin behaviour. According to Wang, Hou and Xu (2024) found that AI-assisted monitoring can improve understanding of pangolin breeding behaviours. Their models achieved high recognition accuracy (86% or more) for activity, resting, and other behavioural states, which is crucial for improving captive breeding programs. Similarly, Cardoso, Bryukhova and Renna(2023) investigated the potential of deep learning models to identify pangolins in their natural habitat and in illegal online wildlife trade. Their models exhibited high accuracy, with performance values ranging from 78,11% to 99,53%. Additionally, Samara, Krishna and Boro(2023) found that machine learning models can be used to efficiently predict suitable habitats for pangolins by analysing variables such as altitude, seasonality and temperature.

**Limitations of AI in wildlife and pangolin conservation**

Despite its advantages, the implementation of Artificial Intelligence in wildlife conservation faces several challenges. Sisodia et al.(2023) note that AI models often require extensive training data, substantial computational resources, and robust data security measures. Additionally, AI models require vast, high-quality datasets which are difficult to obtain for rare, endangered(Fergus et al., 2024) and elusive species like pangolins. Moreover, AI-powered monitoring raises ethical concerns, including potential privacy violations when drones or cameras inadvertently capture human activity and when social media platforms are used (Di Minin et al., 2019; Tuia et al., 2022). Another limitation is the risk of AI conservation tools being misused, as poachers could potentially exploit AI tracking methods for illicit purposes.

**Conclusion**

The integration of AI into pangolin conservation presents a transformative opportunity to enhance monitoring, protection, and understanding of this endangered species. While AI offers powerful tools to combat illegal trade, monitor and study pangolin behaviour, addressing challenges related to data quality, ethical considerations, and resource use is imperative. There is a lot of research regarding the use of AI in wildlife conservation but not much on AI and pangolin conservation. Thus, more research needs to be done on how effective the use of AI is in pangolin conservation.

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