

Wildlife Forensics and Law Enforcement: A Review of Current Practices

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ABSTRACT

Global biodiversity, ecological stability, and socioeconomic growth are all seriously threatened by wildlife crime, which includes illegal trading in protected species, poaching, and the trafficking of animal products. By using biological, chemical, and technical techniques in judicial settings, wildlife forensics has become a specialized scientific field that aids in the identification, examination, and prosecution of these crimes. This review looks at current animal forensic science practices, such as morphological and microscopic investigations, trace evidence methodologies, DNA and genetic studies for species and individual identification, and the use of conventional human forensic techniques. Additionally, it evaluates how forensic evidence aids law enforcement, influences court decisions, and informs policy frameworks. The main issues are emphasized, including the scarcity of laboratory resources, the absence of established procedures, and the unequal legal recognition of forensic evidence. In order to improve investigative capacities, the piece also examines new developments including portable genomic instruments, artificial intelligence for pattern detection, and improved inter-agency cooperation. This paper highlights the critical role that wildlife forensics plays in preventing wildlife crime and developing successful enforcement tactics around the world by combining recent advancements with real-world applications.

Introduction:

Poaching, the illicit trade in animal parts, and the illegal trade in endangered species are all examples of wildlife crime, which has emerged as one of the most significant dangers to the world biodiversity, ecosystem health, and sustainable development. Not only do these illegal activities directly contribute to the extinction of species and the damage of habitats, but they also undermine local economies, erode the rule of law, and have the potential to feed organized criminal networks that run over international borders. Crimes committed against wildlife provide a significant threat to the biodiversity of the nation. In spite of the existence of stringent rules such as the Wildlife Protection Act of 1972, the implementation of the law continues to be a challenging endeavor. Because of the limited resources available, the presence of corruption, and the intricate structure of the networks that are involved in the trafficking of animals, this is the case. The outcomes of this research indicate that India continues to confront the most severe challenges and implement the most effective solutions for combating wildlife crimes. At the same time that it intends to evaluate the necessity of improved technical assistance for wildlife crimes in India, the study has also included an analytical approach to research. Both the primary and secondary data about wildlife crime have been taken from the Crime in India Statistics-2021 report. In order to gain an understanding of the current state of law enforcement in dealing with wildlife crimes in accordance with the Wildlife Protection Act of 1972, these data have been analyzed through government reports and various other sources. Additionally, the necessity of advanced technology has been emphasized in order to maintain equality with the global call for the reduction of such crimes. Both the percentage of cases involving wildlife crimes that are still pending and the percentage of convictions in 2021 can be explained by

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this specific factor. The conviction rate is relatively low, coming in at 72.63%, when compared to the number of cases that are still pending trial, which is 93% of the total.

The field of wildlife forensics has arisen as an important scientific area at the intersection of conservation biology, molecular science, and criminal justice. It provides law enforcement with tools that can assist them in identifying, investigating, and prosecuting criminals who have committed crimes against wildlife.

What Is Wildlife Forensics?

Investigating wildlife crimes using both traditional and new forensic science methods is known as wildlife forensics. It connects criminal investigations and conventional wildlife biology to:

- ❖ Determine which species are involved.
- ❖ Identify the material's geographic origin
- ❖ Connect suspects to evidence from animals
- ❖ Encourage prosecutions in court cases

These procedures go beyond merely determining the type of animal product that has been confiscated; they also involve determining who may be responsible for the crime and explaining how it was carried out.

The Most Vital Forensic Methods Adopted Currently

The phrase "Core Forensic Techniques Used" refers to the primary scientific methods and procedures that are utilized in forensic investigations for the purpose of gathering, analyzing, and interpreting evidence that is associated with a criminal offense. Specifically, it refers to the primary scientific tools that are utilized in the field of wildlife forensics for the purpose of investigating wildlife crimes like as illegal trading and poaching. In a nutshell, the fundamental and most significant scientific approaches that are utilized in the process of examining evidence in criminal investigations. The following techniques are using recently in Forensic.

1. **DNA and Genetic Analysis:** The use of DNA analysis is among the most common methods employed in the field of animal forensics. In order to identify species, individual animals, and population origins with a high degree of accuracy, many techniques are utilized. These techniques include mitochondrial DNA (mtDNA) sequencing, nuclear DNA profiling, and short tandem repeat (STR) markers. These genetic instruments are very efficacious in applications such as:
 - ❖ A demonstration of the species composition of bone or ivory
 - ❖ Separating wild animals from those that have been reared in captivity
 - ❖ Presenting evidence to indicate that the possession or trade in question is prohibited

In many parts of the world, where judicial decisions are based on clear and unquestionable identification of species, DNA evidence is of the utmost importance. As an illustration, national laboratories in South Africa conducted DNA testing on thousands of incidents involving wildlife in order to provide support for convictions of wildlife crimes.

2. **Morphological and Microscopic Techniques:** Morphological analysis, which includes the examination of hair structure, feathers, and bones, can yield forensic information in situations when genetic material has been disintegrated or is not present. The differentiation of closely related species has been made possible by the development of specialized taxonomic techniques, such as tricho-taxonomic hair analysis, in situations when DNA analysis is not feasible.
3. **Trace Evidence and Forensic Techniques in Human Analysis:** In order to establish a connection between persons and the animal goods that have been seized, traditional forensic evidence, such as fingerprints, latent marks, and human contact DNA, is currently being investigated at crime scenes involving wildlife. Fingermarks and human DNA can be retrieved from items that have been traded from animals, according to studies. This suggests that there is a possible path for associating individuals with evidence of wildlife crimes, despite the fact that this method is underutilized.
4. **Emerging Technologies:** Automated detection of illicit wildlife products and artificial intelligence-assisted picture analysis of confiscated commodities are two examples of the technical advancements being explored

to assist frontline enforcement, in addition to laboratory examination. Using these tools, even the most complicated datasets may be quickly analyzed for patterns and identified.

The Function of Wildlife Forensics in Law Enforcement

Wildlife Forensics is the utilization of scientific methodologies and procedures to examine and resolve crimes associated with wildlife, including poaching, habitat degradation, and wildlife trafficking. Law enforcement is fortified in numerous critical ways by wildlife forensics.

- ❖ **Evidence In Criminal Cases:** It is possible for forensic evidence to conclusively reveal whether or not a crime has been committed and to assist in establishing connections between persons of interest and illicit wildlife goods. The legal cases are strengthened as a result, and successful prosecutions are supported.
- ❖ **Geographic and Trade Pattern Analysis:** Through the identification of trade channels and origin places of wildlife that has been trafficked, forensic data also contributes to the collecting of intelligence. This enables law enforcement agencies to concentrate their efforts more efficiently.
- ❖ **Crime Scene Training and Standardisation:** It is becoming increasingly common for frontline cops and rangers to obtain specialized training in order to appropriately collect and maintain biological evidence while operational in the field. Recent initiatives in regions such as East Africa have provided law enforcement agents with the ability to provide forensic evidence that is admissible in court.
- ❖ **Identification of the Species:** Using DNA and morphological analysis, it assists in the identification of the species from the animal parts that have been confiscated (skin, bones, ivory, flesh, and feathers). In order to ensure compliance with the laws that are outlined in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), this is absolutely necessary.
- ❖ **The Presentation of Scientific Evidence in Court:** Scientific evidence that is dependable and admissible in court is provided by wildlife forensic reports. This evidence helps enhance prosecutions and raises the likelihood of convictions.
- ❖ **Facilitating Intelligence and Inquiry:** The findings of forensic investigations provide law enforcement agencies with the ability to evaluate patterns of unlawful commerce and destroy organized networks of wildlife trafficking.
- ❖ **Supporting Conservation and Policy Planning:** Forensic investigations provide governments with valuable information that can be used to strengthen wildlife conservation legislation and enforcement techniques.

Legal and Policy Implications

It is essential for there to be a robust legal framework that acknowledges scientific evidence in court for wildlife forensics to be effective. Many countries are currently working to update their wildlife protection legislation in order to reflect this phenomenon. With regard to the enforcement of trade restrictions, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is one of the most important international agreements that places a focus on the utilization of forensic science. Despite this, difficulties still exist. As a result of the absence of specialized wildlife crime courts, well-trained prosecutors, and established evidentiary standards for forensic science in many criminal justice systems, the effectiveness of forensic evidence in gaining convictions might be hindered.

Existing Obstacles in the Current Wildlife Forensics and Law Enforcement

The phrase "Existing Obstacles in Current Wildlife Forensics and Law Enforcement" refers to the constraints that are imposed by the system, the technical aspects, and the resources that are available. These limitations prohibit effective investigation, prosecution, and conviction of wildlife criminals. Due to these problems, an atmosphere is created in which the illegal trafficking of wildlife, which is a multi-billion-dollar sector that frequently works on a multinational scale, can function with huge profits and relatively low danger of being punished. Because of these barriers, a sizeable fraction of wildlife crimes is not brought to justice, despite the fact that more sophisticated scientific procedures, such as DNA analysis, have been developed. A breakdown of the most significant extant hurdles is as follows:

1. Forensic and Scientific Hurdles:

- **Absence of Reference Samples/Databases:** Identifying items (such as bones or powders) might be challenging due to the significant lack of curated genetic data (DNA sequences) for numerous wildlife species.
- **Sample Degradation:** It can be challenging to extract high-quality DNA for identification purposes from samples that have been taken from remote, tropical, or wet regions since these samples are frequently damaged.
- **Limited Specialized Labs:** A deficiency of forensic laboratories specialized in animal testing compels agencies to transport samples over considerable distances, leading to delays and potential degradation of evidence integrity.
- **Difficulty in Identifying Derivatives:** Once animals have been turned into items (such as shahtoosh, medicine, or jewelry), it is difficult to identify them morphologically. This requires specialized chemical or DNA analysis, which is frequently unavailable.

2. Challenges in Law Enforcement and Investigation:

- **Lack of Training and Expertise:** When it comes to wildlife regulations, species identification, and crime scene management, general law enforcement frequently lacks specialist understanding, which can result in inadequate evidence collecting.
- **Insufficient Resources/Funding:** They are frequently understaffed and underfunded, which limits their ability to perform patrols, investigations, or laboratory tests. Specialized agencies are frequently understaffed and underfunded.
- **Weak Evidence Handling:** Inadequate management of evidence at the scene frequently results in the evidence being deemed inadmissible or failing to establish a connection between the suspects and the crime.
- **Poor Inter-agency Coordination:** Ineffective prosecutions and data shortages are the results of a lack of coordination between local forest staff, law enforcement, and specialized central institutions.
- **Technological Gap:** When it comes to the sophisticated and ever-evolving strategies employed by organized crime syndicates (for example, online, covert, or cyber-based trade), law enforcement agencies frequently fall behind.

3. Legal and Judicial Limitations:

- **Low Conviction Rates:** In many parts of the world, including as India, the conviction rates for wildlife-related offenses are shockingly low, often falling below 5%. This situation fosters repeat offenses.
- **Weak Sentences:** The severity of the crimes that are committed is not always reflected in the sanctions that are imposed, with the criminals frequently receiving punitive penalties.
- **Lack of Transnational Cooperation:** Despite the fact that wildlife crime knows no boundaries, cross-border investigations including reciprocal legal aid are either sluggish or non-existent.

4. Systemic and Social Factors:

- **Corruption:** Traffickers may be able to operate without fear of repercussions if there is a lack of integrity within the agencies.
- **Socio-economic Drivers:** The presence of poverty and a dearth of other means of subsistence in rural locations can render local communities more receptive to engaging in poaching-related activities.
- **High Demand and Profit:** In addition to the lucrative nature of the trade, organized crime is constantly creating new innovations, which makes it more difficult for law enforcement to keep up with them.

5. Resource and Infrastructure Gaps:

There are some localities that do not have access to sophisticated laboratories, qualified forensic scientists, or the requisite equipment for molecular studies. This is especially true in those isolated areas where a significant number of wildlife crimes are committed.

6. Underuse of Human Forensic Evidence:

With relatively little integration of human-focused evidence like as fingerprints or touch DNA, the majority of wildlife forensic work focuses on animal DNA and product identification. This gap in integration may limit the ability to link offenders to crimes.

7. Standardisation and Validation:

In order to validate many techniques, thorough testing under real-world settings is required. As an illustration, fingermark studies have been impeded up to this point due to the fact that they have had insufficient sample numbers and inconsistent field settings, which indicates the requirement for more robust experimental foundations.

The combination of these challenges results in a "vicious cycle" in which the absence of enough proof leads to inadequate prosecution, which in turn leads to the belief that wildlife crime is not a severe criminal, which in turn contributes to the perpetuation of other crimes that go unpunished.

Emerging Trends and Future Directions

The methods and resources used to investigate and forestall wildlife crimes are developing in tandem with the complexity and prevalence of these crimes. The capacity of forensic science and law enforcement to better safeguard wildlife is being enhanced by recent and future advancements. This field is undergoing rapid change, and there are numerous developing themes that are expected to have an impact on future practice:

- ❖ **Expanded Utilization of Genomic and Bioinformatics Instruments:** An increase in the capacity to identify species, trace geographical origins, and even date samples for the sake of establishing investigative timelines is being brought about by developments in population genetics and portable sequencing technology.
- ❖ **Artificial Intelligence and Machine Learning:** Using artificial intelligence to analyze handwriting on ivory, detecting wildlife products with the use of smartphones, and doing automated pattern recognition on massive datasets are all examples of techniques that show significant promise for enhancing traditional forensic approaches.
- ❖ **Enhanced Inter-Agency Collaboration:** Forensic investigations into animals that are successful frequently require collaboration across international borders, the exchange of data, and the provision of cooperative training among scientific laboratories, law enforcement agencies, environmental agencies, and international organizations.

Wildlife crimes are spurred by the immense demand for animal parts in the markets for traditional medicine, fashion, and exotic pets, which are prevalent both locally and globally. These markets are present in both countries or regions. Inadequate execution of conservation legislation, corruption, and a lack of awareness among local populations are all elements that contribute to the development in wildlife crime. Conservation policies are being executed in an insufficient manner. The intricacy and scale of wildlife crime continue to be a barrier to conservation efforts, despite the fact that both governmental and non-governmental organizations have made efforts to limit these activities through the implementation of stringent rules, increased community participation, and international collaboration. The results of this study shed insight on the key challenges and approaches that are necessary to counteract wildlife-related criminal activity in India. In order to evaluate the necessity of enhanced technical support for wildlife crimes in India, the study has incorporated an analytical research strategy into its methodology. This is part of the study's efforts to better understand the situation. Both the primary and secondary data about wildlife crime have been taken from the Crime in India Statistics-2021 report. In order to gain an understanding of the current state of law enforcement in dealing with wildlife crimes in accordance with the Wildlife Protection Act of 1972, these data have been analyzed through government reports and various other sources. Additionally, the necessity of advanced technology to maintain them at par with the global call for the reduction of such crimes has also been taken into consideration. It provides an explanation of the percentage of cases involving wildlife crimes that are currently pending, as well as the percentage of convictions that occurred in the year 2021. In comparison, the percentage of cases that are still awaiting trial is 93%, which is significantly higher than the conviction rate, which is now at 72.63%. Poaching, illegal trading, and the deterioration of habitat are the key challenges. These issues are exacerbated by the strong demand for animal parts such as tiger bones, rhino horns, and elephant ivory. The ineffective enforcement of laws protecting animals, corruption, and a lack of resources all contribute to making the situation even worse. Additionally, local communities frequently rely on wildlife for their means of subsistence, which can result in tensions between efforts to conserve

wildlife and the fulfilment of economic requirements. The preventative measures that are taken need to take a holistic approach in order to address these multiple problems. Improving law enforcement by providing them with more resources and training is of the utmost importance. Technologies that are designed to prevent poaching, like as drones and video traps, have the potential to improve monitoring and protection activities. It is essential to involve the community in the process of promoting alternative livelihoods in order to lessen reliance on the exploitation of animals. Targeting transnational wildlife trafficking networks requires international collaboration, which is also something that is vital.

Conclusion:

Forensics in the field of wildlife has developed into an essential component of contemporary wildlife law enforcement. The authorities are given the ability to detect illicit wildlife operations, support convictions, and destroy organised trafficking networks through the utilization of a combination of genetic, morphological, and new digital technology. Despite this, the industry continues to struggle with issues pertaining to the distribution of resources, the implementation of new technologies, and the incorporation of legislative frameworks. In order to tackle these challenges, which include bolstering conservation efforts and providing justice for wildlife all around the world, it will be essential to continue research, make investments in forensic infrastructure, and work more closely together with law enforcement agencies and lawmakers. Despite various laws and efforts to combat wildlife crime, new wildlife conservation laws are needed. Wildlife crime has decreased in recent years, but the numbers are worrying and must be handled. These offenses are easier to perpetrate due to enforcement and jurisdictional deficiencies. These crimes are now coordinated and sophisticated and usually committed internationally. Regional collaboration, especially between neighboring nations, is needed to combat transboundary wildlife crimes and maintain biodiversity. Wildlife crime investigations must incorporate scientific methods. Modern technology like AI-operated monitoring systems or drones can help discover wildlife criminals. Since these crimes have become more coordinated and harder to track, forensic procedures can reduce them. Destroying India's biodiversity can be dangerous. These crimes can harm humans and animals. Critical attention to these crimes is needed to save endangered wildlife species. These crimes can be reduced through scientific and other means, resulting in a healthy ecosystem and long human life.

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