



The Role of Forensic Science in Environmental Protection

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Description

Forensic science, traditionally associated with criminal investigations, has increasingly become an important tool in environmental protection. By applying scientific techniques to environmental issues, forensic science helps identify pollutants, track illegal activities, and ensure compliance with environmental regulations. This article explores how forensic science contributes to environmental protection, highlighting key techniques and applications.

Environmental forensic science: An overview

Environmental forensic science involves the application of forensic techniques to environmental issues, including pollution, contamination, and habitat destruction. The primary goal is to identify the sources of environmental harm, determine the extent of damage, and provide evidence for legal and regulatory actions. This field integrates principles from chemistry, biology, geology, and environmental science to address a wide range of environmental challenges.

Techniques in environmental forensic science

Several advanced techniques in forensic science are employed to address environmental issues. These methods are important for detecting, analyzing, and mitigating environmental contamination.

Chemical analysis

Chemical analysis is fundamental in environmental forensics. It involves the detection and quantification of pollutants in various environmental media, including air, water, soil, and sediments. Techniques such as Gas Chromatography-Mass Spectrometry (GC-MS), Liquid Chromatography-Mass Spectrometry (LC-MS), and Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) are commonly used. These methods provide detailed information about

the types and concentrations of pollutants, allowing forensic scientists to trace their sources and assess their impact.

Environmental DNA (eDNA) analysis

Environmental DNA (eDNA) analysis is a relatively new but increasingly important technique in environmental forensic science. eDNA refers to genetic material shed by organisms into their environment, which can be collected from water, soil, or air samples. By analyzing eDNA, scientists can identify the presence of specific species, track changes in biodiversity, and monitor the impacts of pollution on ecosystems. This technique is particularly useful for detecting rare or elusive species and assessing the effects of environmental changes.

Stable isotope analysis

Stable isotope analysis involves studying the ratios of isotopes of certain elements (such as carbon, nitrogen, and oxygen) in environmental samples. This technique helps trace the origin of pollutants and contaminants by providing information about their sources and pathways. For example, stable isotope analysis can differentiate between industrial and agricultural sources of nitrogen pollution in water bodies, aiding in identifying the responsible parties.

Applications of environmental forensic science

Environmental impact assessment: Environmental forensic science contributes to assessing the impact of pollution on ecosystems and human health. Forensic scientists evaluate the extent of contamination, its effects on wildlife and habitats, and potential risks to human populations. This information is used to develop strategies for remediation, rehabilitation, and prevention of future contamination.

Environmental crime investigation: Environmental crimes, such as illegal dumping of toxic waste or poaching of endangered species, are investigated using forensic techniques. Environmental forensic scientists gather evidence to identify perpetrators, assess the impact of their actions, and support prosecutions. This includes analyzing samples from crime scenes, tracking illegal trade routes, and documenting evidence of environmental damage.

Conclusion

Forensic science plays a vital role in environmental protection by providing tools and techniques for detecting, analyzing, and addressing environmental contamination. Through chemical analysis, eDNA analysis, remote sensing, stable isotope analysis, and other advanced methods, forensic scientists contribute to identifying pollution sources, assessing environmental impacts, and supporting legal and regulatory actions. As environmental challenges continue to evolve, forensic science will remain a different component of efforts to safeguard ecosystems and public health.

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