How forensic science can stop slaughter of endangered wildlife

High-tech ways to tackle wildlife crime are hampered by multiple challenges on the ground
Jeff Hutchens/Getty

By **Aisling Irwin**

With wildlife crime escalating, maybe it's time to revamp the international treaty aimed at combatting it. Forensic scientists are proposing a series of changes to the Convention on the International Trade in Endangered Species (CITES) to allow new technologies to be unleashed on the problem.

Later this month, the CITES meeting in Johannesburg, South Africa, will hear of growing desperation over the rise in poaching and the illicit wildlife trade, which is said to be the fourth largest illegal trade in the world.

For example, rhino killings in Africa have risen for the last six years, with over 1300 killed in 2015. Some CITES-listed plant species have become more valuable than ever. A 1-kilogram piece of resinous agarwood, used in pricey perfumes and traditional Chinese medicine, sold for $3 million earlier this year, says Ed Espinoza, deputy director of the US Fish and Wildlife Services Forensics Laboratory in Ashland, Oregon.

Find out more at our New Scientist Live discussion: Stopping the ivory trade

And yet cutting–edge forensic tools that could help fight such crime have been hampered by different national protocols and legal or financial obstacles (see box, below). There is increasing evidence that the various parties involved in tackling it don't cooperate enough, for example: they don't work to the same standards when taking samples and they speak different technical languages.

Potential game changers

"A lot of the techniques we're working on right now could be quite game-changing provided these things are standardised," says Nick Ahlers at the wildlife trade monitoring network TRAFFIC. "We're hoping that some real, practical things will come out of [this month's meeting]."

One problem is that researchers trying to get reference samples of horn, pangolin scales, wood and other CITES-listed materials can face delays of months or even years. This has hampered the uptake of a pioneering technique that can identify timber species and point to their geographical origin without the need for tricky DNA analysis.

"Just getting the permits is horrendous and you can't develop tests if you can't get samples," says Eleanor Dormontt, a timber DNA specialist at the University of Adelaide in Australia. As a result her team has "virtually stopped testing for illegal wood" and mostly doesn't work on CITES-listed species.

At the meeting, her group will propose putting more responsibility on countries to supply researchers and law-enforcers with samples of tree species being illegally harvested within their borders. They also want a global map of reference samples and a push to expand existing collections.

"At the moment a party puts a species on the [CITES] appendix and then it's the responsibility of every other country to identify it," she says. "Without the cooperation of the country where it exists it's very difficult."

Sample transfer is also a problem with tracing rhino material. Cindy Harper of the University of Pretoria, South Africa, frequently receives bags of rhino parts to be DNA-matched to their owners, as recorded on her lab's RhODIS database.

Since demonstrating in 2009 that they could link DNA signatures with individual rhinos, her lab has logged 20,000 of them. A poacher caught with rhino horn, or even dust from a horn he has already sold, can now be linked with the corpse of a specific rhino, contributing to successful prosecutions in South Africa.

The sad truth is, however, that most poached rhino horn finds its way out of the continent to places, often in South-East Asia, where RhODIS cannot help. If horn is confiscated in Malaysia, for example, officials are unlikely to send it to her lab. Even if they do, it can

take two years to get there.

Networking and standards

The RhODIS team would like to internationalise its database, enabling scientists across South-East Asia to do online matching of seized horn with DNA profiles. To achieve this requires not new technology but networking, educating and standardisation.

Rhino conservationists are proposing to CITES that any country where rhino horn is seized should automatically collect samples for forensic scientists and follow a new, standard procedure that means researchers worldwide can use the data.

Another obstacle is that some of the countries that most need forensic techniques are lacking in resources and woefully ill equipped to take them on.

“Often… the whole system has no exposure to forensic science, or the laws don’t exist to prosecute wildlife crime,” says Ogden. It’s ethically questionable, he adds, to equip a country with wildlife forensics when it cannot even do fingerprinting in day-to-day crime investigations.

On the legal front, one proposal to CITES is to demand that all countries with inadequate laws to shake them up within two years or face sanctions – and for countries with watertight laws to help those who are struggling. Another proposal calls for a directory of the top forensics labs around the world, which could form hubs to which neighbouring countries can send seized material.

“We’re starting from scratch,” says Kathryn Jeffery, scientific adviser to Gabon’s National Parks Agency, who is part of a project to establish an elephant DNA testing lab. The Gabon government realises that this cannot be done in isolation, so at the same time, the Gabon police are developing a basic human forensics capacity and the country’s laws are being revised to admit scientific evidence in court. Gabon is also imposing stricter wildlife crime penalties, which currently carry a maximum of six months in prison.

“The big challenge is that you need to make progress at all levels,” says Jeffery. “We need to be careful not to go too fast along the technological route.”

Lots of promise, shame about the resources

Forensic technology is coming of age, even as its implementation lags (see main story). For example, Ed Espinoza at the US Fish and Wildlife Services Forensics Laboratory has developed a technique that can determine the origins of wooden products in a matter of seconds. Known as DART-TOFMS, it involves bombarding a sample with helium ions at 450 °C, vaporising chemicals at and near the surface. Mass spectrometry can then quickly reveal its detailed chemical signature.

The approach is far faster than the conventional method of boiling a sample for four days, then attempting to extract DNA – which may not work, says Espinoza. But although it has been used on seized timber in the US, the new technique has so far failed to be a game-changer. While this is partly down to resources – the equipment costs around $200,000 – the technique depends on having reference samples from around the globe, which are just not available.

MinION, a portable DNA sequencer that could identify trafficked species in the field, also faces an uphill battle. The device has already been used to test for Ebola. But "it'll be a long time coming" with regard to using it against wildlife crime, says Jon Wetton, co-director of the Alec Jefferies Forensic Genomics Unit at the University of Leicester, UK.

Wetton has funding to explore how to deploy MinION, developed in the UK by Oxford Nanopore Technologies, in Africa. There are sizeable technological obstacles, he says, but what he's really worried about is the lack of local forensics expertise.
"It has absolutely humongous promise. But you put a powerful technology into the hand of someone who has not even had the technology for fingerprinting – it's like giving them a *Star Trek* tricorder."

Wetton is starting in Kenya, which is making a big push against wildlife crime – including tough new poaching penalties and a new wildlife forensics lab. If MinION proves successful there, Wetton hopes it might then be extended to neighbouring countries, all working to the same standards.
"We're going to approach this in baby steps," he says.

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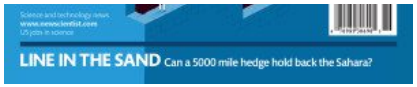
A shorter version of this article was published in *New Scientist* magazine on



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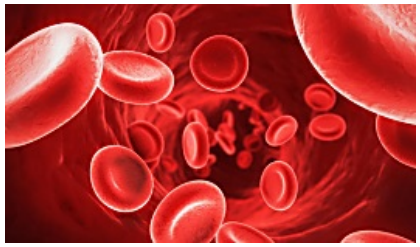

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