

Mapping the ‘hidden highways’ of Mexico’s illegal wildlife trade

New interactive tool allows law enforcement to proactively identify trafficking hot spots

By Sandy Keaton Leander, ASU News
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For decades, wildlife traffickers have illegally captured and sold hundreds of thousands of wild parrots native to Mexico. Despite changes to international wildlife laws, the conservation status of these birds has continued to deteriorate over the past 30 years.

One of the primary drivers of their risk of extinction is poaching.

Now, law enforcement officials have a new tool to help stop poachers in their tracks. Researchers have developed an interactive platform that allows credentialed law enforcement officers to identify future trafficking hot spots.

Arizona State University scientists, along with their colleagues from The Australian National University, have mapped the hidden routes used to traffic wild parrots across Mexico, revealing where criminal networks are most likely to strike next.

In new research led by ANU and co-authored by ASU, the study combines landscape ecology with criminology to reveal how illegal wildlife trafficking has evolved over the past three decades. By doing so, the researchers were able to transform decades of confiscation data into an interactive tool.

[Greg Asner](#), co-author and director of the [Center for Global Discovery and Conservation Science](#) in the [Julie Ann Wrigley Global Futures Laboratory](#), said the tool could help law enforcement officials intervene before trafficked animals are sent to a final destination.

“This tool allows authorities to shift from a reactive posture to proactive intervention,” Asner said. “By anticipating criminal behavior and pinpointing transit bottlenecks, law enforcement can

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strategically deploy resources to intercept traffickers before the animals reach urban markets.”

The researchers examined more than 6,000 parrot confiscation records between 1997 and 2024. Their analysis allowed them to determine how trafficking networks have changed after major policy shifts, including following a 2008 ban in Mexico on capturing and trading native parrots, and after the disruptions caused by the COVID-19 pandemic.

The team found that half of Mexico's 20 native parrot species analyzed are directly threatened by trapping for the illegal wildlife trade, and since 1993, no Mexican parrot species has improved its conservation status. With the country's parrots now facing substantially higher extinction risk than birds globally, illegal trapping has emerged as one of the most widespread and highest-impact threats, challenging even habitat loss from agriculture and logging.

Finding hidden trafficking routes

To visualize how parrots are moved from forests into city markets, the research team adapted a modeling tool typically used to study wildlife movement across landscapes.

They modeled the entire country as an electrical grid, where wild parrot populations acted as electricity sources and confiscation locations served as endpoints. By treating Mexico's road network as conductive wiring, the researchers calculated where the greatest "current" of illegal trafficking would flow, revealing the hidden transportation corridors most likely used by traffickers.

Lead author [George Olah](#), a DECRA fellow at the Fenner School of Environment and Society at ANU, said wildlife trafficking networks were not static, but constantly adapting in response to changing social and economic conditions.

“For decades, efforts to combat wildlife trafficking have largely been reactive, responding to seizures after they occur,” Olah said.

“By analyzing almost 30 years of data, we found these criminal networks adapt in predictable ways as socioeconomic conditions change. We’ve seen the trade shift from opportunistic trapping in rural areas to increasingly sophisticated supply chains driven by urban demand,” Olah said.

(Video: https://youtu.be/mmRNNQMUy_E)

The researchers also discovered that rather than being randomly distributed, trafficking activity is clearly concentrated along a network of high-risk corridors, particularly across southeastern Mexico and the Yucatán Peninsula.

The findings have been translated into an interactive online platform that allows verified law enforcement authorities to identify trafficking hot spots by species and jurisdiction. The secure tool allows verified law enforcement officers to zoom into their jurisdictions, identify high-risk routes, and filter trafficking corridors by individual parrot species, enabling more targeted enforcement operations.

Olah said the application extends well beyond parrot conservation.

“Many organized crime groups use the same transport corridors to move multiple forms of contraband,” he said.

The researchers say the framework could be expanded and adapted to investigate trafficking of timber, marine wildlife and other forms of organized crime. Olah’s current research is incorporating forensic DNA data to pinpoint where trafficked animals originated to further strengthen criminal prosecutions.

The team found that confiscations increasingly occurred hundreds of kilometers from the parrots’ native habitats, often in major cities such as Mexico City, indicating a highly organized, long-distance trafficking network rather than isolated, local poaching. They also found traffickers consistently targeted large, charismatic species such as macaws and Amazon parrots at rates considered unsustainable in the wild.

“By integrating criminological theory with landscape science, we are providing a new arsenal of data-driven tools that can strengthen biodiversity conservation while also supporting transnational efforts to combat organized crime,” Olah said.

“Our highly applied geospatial tracking approach supports both policy at the strategic level and law enforcement at the tactical level. The science and technologies we are pioneering now will make wildlife poaching more difficult for the perpetrators in the future,” Asner said.

The [study is published](#) in Proceedings of the National Academy of Sciences.

This story originally appeared on [ASU News](#).

Main image



These birds are a prime target of the illegal wildlife trade. This is a wild nesting pair of scarlet macaws in Chiapas, Mexico, whose offspring are highly sought after by transnational smuggling networks. Photo courtesy of Rodrigo León Pérez

Gallery



Recovered contraband: A poached scarlet macaw confiscated by authorities in a village in Chiapas, Mexico, before it could be funneled into the broader illicit supply chain.



A scarlet macaw roosting site in Chiapas, Mexico. Birds aggregate in these communal roosts as a behavioral defense against predators, including human poachers.



Highly vulnerable scarlet macaw nestlings are saved from a sprawling transnational wildlife trafficking network in Chiapas, Mexico.



A bird's-eye view of a scarlet macaw nest in Chiapas, Mexico, deep within the biodiverse source regions mapped in researchers' trafficking models.



Red-lored Amazon chicks, poached from the wild, are kept in a rural village, representing the initial, local extraction phase before birds enter transnational trafficking networks.



The Lacandon Rainforest in Chiapas, Mexico, serves as a critical biodiversity hot spot and a primary target area for the illicit parrot trade.