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Short Communication

Remarkable records of jaguars and Andean bears in northwestern Ecuador: Implications for human-wildlife conflicts

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Abstract

Jaguar populations (*Panthera onca*) on the Ecuadorian coast are critically endangered, with only a few dozen individuals remaining in the region. In some areas, no records have been documented for decades. Between November 2023 and January 2024, independent camera trap monitoring in northwestern Ecuador yielded evidence of the presence of a jaguar, marking a significant recovery after seven years of absence in Manduriacu and at least 15 years in Junín. The jaguar was observed moving through an area of approximately 25 km, traversing forested and human-altered zones. Furthermore, additional evidence from the Ecominga Foundation and the Cielo Verde community indicated the occurrence of livestock attacks, which aligns with the typical predatory patterns observed in jaguar behavior. The attack site was located approximately 8 km from where the jaguar was initially recorded, suggesting that both events refer to the same individual. In response, local authorities inspected the area and organized community workshops. Furthermore, an Andean bear was recorded in Manduriacu during the same sampling period, confirming the co-occurrence of both species in the area. The documented movement of this jaguar, along with the presence of other species, underscores the imperative need to continue research and conservation initiatives in the region. These initiatives will ensure the protection and coexistence of wildlife and human populations in this highly biodiverse region.

Resumen

Las poblaciones de jaguar (*Panthera onca*) en la costa ecuatoriana están en peligro crítico, con solo unas pocas docenas de individuos en la región. En algunas áreas, no se han registrado en décadas. Entre noviembre de 2023 y enero de 2024, monitoreos independientes con cámaras trampa confirmaron la presencia de un jaguar tras siete

años de ausencia en Manduriacu y al menos 15 años en Junín. El jaguar recorrió 25 km de una zona a la otra, atravesando zonas boscosas y áreas intervenidas. La Fundación Ecominga y la comunidad de Cielo Verde reportaron un ataque a ganado que coincidió con los patrones de depredación del jaguar. El sitio del ataque está a 8 km del primer registro del jaguar, sugiriendo que ambos eventos involucran al mismo individuo. Las autoridades locales inspeccionaron la zona y organizaron talleres comunitarios. Además, durante el mismo periodo de muestreo se registró un oso andino en Manduriacu, lo que confirma la co-ocurrencia de ambas especies en la zona. El movimiento documentado de este jaguar, junto con la presencia de otras especies, resalta la necesidad urgente de continuar con las iniciativas de investigación y conservación en la región. Estas acciones serán fundamentales para garantizar la protección y la coexistencia de la vida silvestre y las poblaciones humanas en esta región de gran biodiversidad.

Key words: Endangered, human disturbances, livestock killed, mining exploration, *Panthera onca*, retaliation, *Tremarctos ornatus*, Tropical Andes bioregion

Jaguars in northwestern Ecuador (*Panthera onca*) are among the most critically endangered species in the country, primarily due to the extensive habitat fragmentation of these ecosystems (Ministerio del Ambiente 2022; Barros-Diaz 2024). Deforestation resulting from timber extraction, agricultural expansion, illegal hunting, and mining activities over recent decades pose significant threats to biodiversity in the region. The severity of this issue is reflected in estimates suggesting that only a few dozen jaguar individuals remain along the Ecuadorian coast (Espinosa et al. 2016; Ministerio del Ambiente 2022). In certain areas, such as the northern coast of Ecuador, jaguar populations have not been recorded for decades, leading to their declaration as extirpated in some locations (Ministerio del Ambiente 2022).

Another significant issue is human-wildlife conflict, where jaguars rank among the most targeted species killed in retaliation in the Americas (Gittleman 2001; Nyhus 2016). Particularly in Ecuador, four to five jaguars are killed annually due to conflict in certain areas of the Ecuadorian Amazon (Torres 2014). Economic losses incurred by farmers, local perceptions and beliefs regarding the jaguar´s presence, and potential conflicts arising from predation on livestock pose challenges that require immediate action, such as environmental education for local communities to promote coexistence between humans and jaguars (Dickman 2010; König et al. 2020; Hill 2021; Pooley et al. 2021).

In a collaborative effort involving Universidad Central del Ecuador, Fundación Cóndor Andino, and Fundación Ecominga, wildlife monitoring has been carried out since October 2023 in a forested area of northwestern Ecuador within the Tropical Andes Bioregion. This area lies approximately three hours away from Ecuador's capital, Quito. The site has an elevational range of 1200 to 1800 masl. Between October and December 2023, we deployed 20 camera traps for three months in Río Manduriacu Reserve, managed by Fundación Ecominga. During this survey, a jaguar was captured by one of the cameras on November 30, 2023 (0°18'27.4"N, 78°51'49.0"W), around 17:00 h (Fig. 1a).

As mentioned, jaguar populations in western Ecuador face significant threats, leading to drastic declines in recent decades, where they have been considered nearly extirpated in certain areas. Specifically, no jaguars had been

recorded in Manduriacu for over seven years, with the last sighting captured by a camera trap on August 5, 2016, and a jaguar killed in a nearby area in 2017. This recent record offers both hope and concern for jaguar conservation in Ecuador. Despite regular monitoring, which included deploying five camera traps for two to three months each year and patrols conducted by reserve rangers, the absence of jaguar records could be caused by an insufficient or inconsistent monitoring system. Expanding and enhancing monitoring efforts may be necessary to better track the presence of this elusive species.

A parallel camera trap survey supported by DECOIN, Ecoforensics, and the local paraecologist monitoring group was conducted in the Junín Community Forest, in the Llurimagua mining concession, at 1200–1500 masl. Two camera traps were deployed from 4 January to 24 February 2024. Although smaller in scale compared to the Manduriacu survey, one camera captured a jaguar on 24 January (0°18'43.5"N, 78°38'43.3"W) around 14:50 h, and again on 11 February at 21:30 h, marking the first recorded sightings in this area after at least 15 years (Fig. 1b). Camera trap data is limited in scope in the Junín area, thus neither the presence nor absence of jaguars and other large mammals can be determined before February 2023. Although locals have reported semi-frequent sightings of bears, pumas, and other large mammals, no reports of jaguar sightings have been made by locals or other sources in many years.

Through collaborative efforts, new records were shared between institutions, and a detailed fur pattern analysis confirmed that these sightings were of the same individual (Fig. 1c, d). Accordingly, based on our observations, it can be inferred that this individual is traversing the surveyed area, although the specific behavior or purpose remains uncertain. The first report made in Manduriacu is about 25 km from the second report in Junín. Thus, this individual seems to have taken a circuitous route through forested and human-altered zones for almost two months (Fig. 2).

Further analysis is required for creating biological corridors, as the area is one of the most fragmented ecosystems in coastal Ecuador. Vegetation cover within a 5-km radius around the jaguar record in Manduriacu is approximately 90%. Forest cover around the camera traps in Junín is nearly 100% within a kilometer of the camera where the individual was recorded, with an increase in forest cover loss to the southeast and southwest at lower altitudes around the 3–5 km range. North of the cameras where the recent reports were made, the forest is continuous and encompasses higher altitudes, forming a potential connection with the protected areas in the region, such as Manduriacu and Cotacachi-Cayapas National Park areas (Fig. 2).

Several conservation efforts are underway in the region, such as a network of registered protected forests recognized by the Ministry of Environment, Water, and Ecological Transition, including Los Cedros and El Cebú in Imbabura. Other initiatives include the Socio Bosque program, private reserves, and community water reserves. Additionally, the local government of Santa Ana de Cotacachi has established the Intag-Toisán Municipal Conservation and Sustainable Use Area (ACUSMIT), covering 1269,68 km^2, 55% of which consists of four forest types (Lowland Evergreen Forest of the Chocó, Lower Montane Evergreen Forest of the Western Andes, Montane Evergreen Forest of the Western Andes, and Piedmont Evergreen Forest of the Andes), along with shrubland and paramo grassland at higher altitudes. These ecosystems are directly connected to the

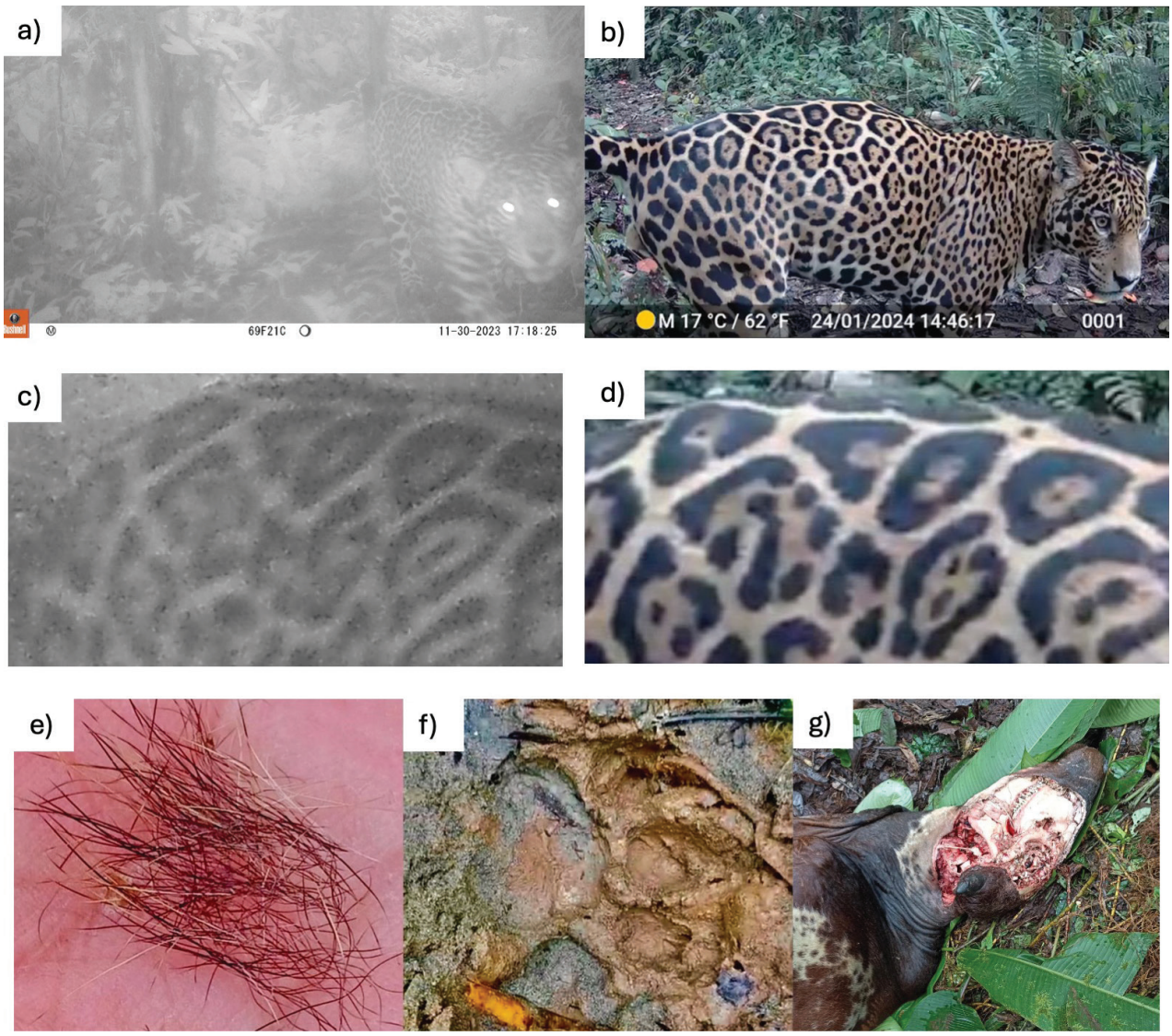

Figure 1. Camera trap records of a jaguar in Manduriacu in November 2023 (**a**), then recorded in January and February 2024 in the community of Junín (**b**). Fur patterns captured in the images from Manduriacu (**c**) and Junín (**d**) indicate that it is the same individual. In December 2023, livestock was killed by a jaguar, potentially the individual recorded, a hypothesis supported by evidence found at the site, i.e., fur (**e**), pawprint (**f**), and typical patterns present in jaguar livestock prey (**g**).

Cotacachi-Cayapas National Park, which spans 2436,38 km^2, making it the largest conservation area in northwestern Ecuador. Despite these efforts, mining projects driven by the government pose significant threats to ecosystems and species in this region. Deforestation and land-use changes also present important challenges in the area (Fig. 2).

A court-mandated withdrawal of mining activity in Llurimagua, part of Junin area, occurred in March 2023, months before the camera recorded the jaguar. This may suggest that jaguars may have avoided the area previously due to disturbances from mining and other human activities. The reduced mining-related pressure may have improved the chances of jaguars returning to the region. However, this jaguar's movement, with uncertainties about its origin and destination, raises concerns about potential human-wildlife conflicts and the inherent risk of retaliatory killings, resulting in challenges that require multi-institutional cooperation to establish effective conservation actions.

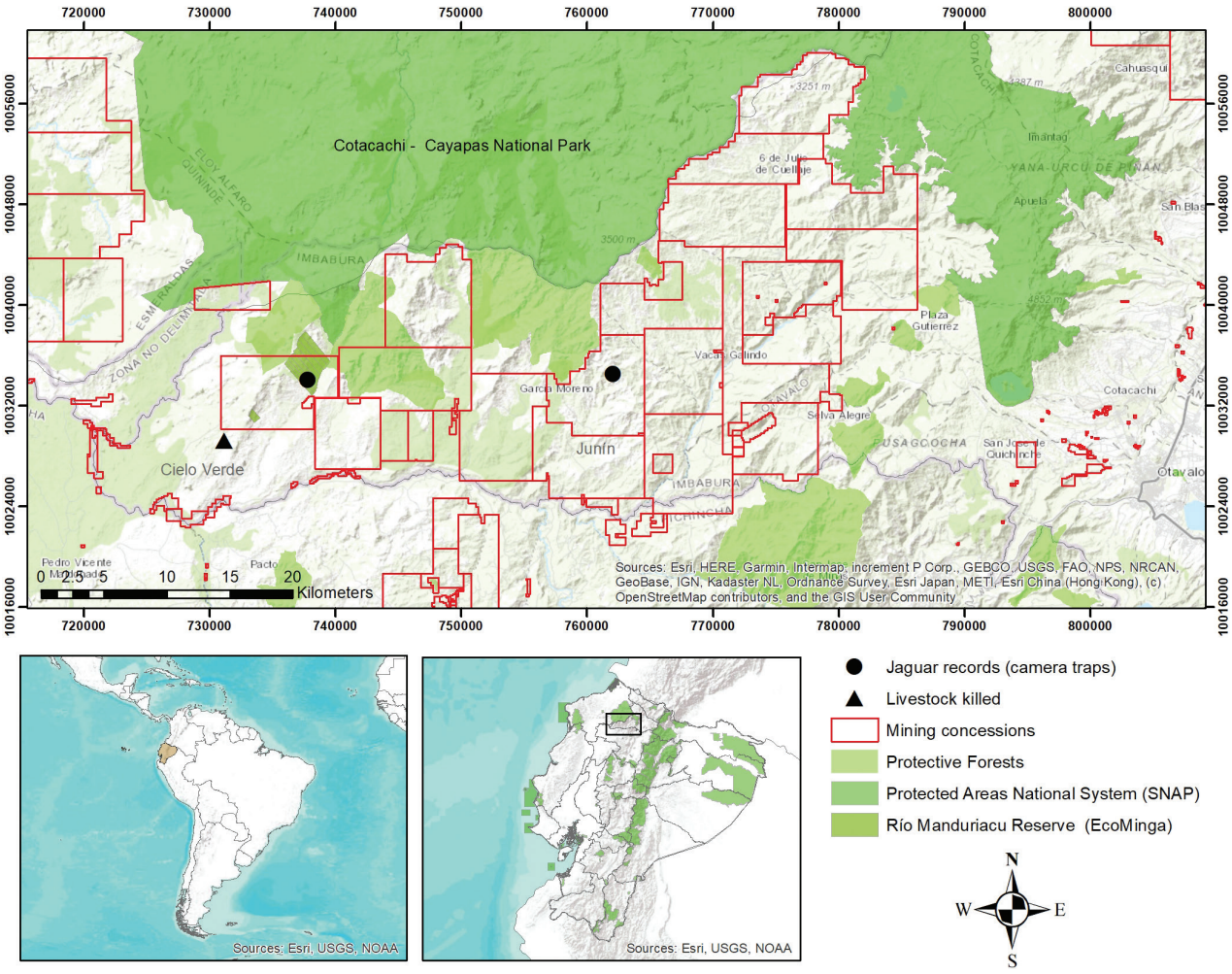

Figure 2. Map of western Imbabura Province. The Río Manduriacu Reserve and Junín Community Forest are located in the Cordillera del Toisán within the Tropical Andes bioregion.

Further evidence provided by Fundación Ecominga and members of the Cielo Verde community, situated southwest of the first record, indicates a jaguar attacked livestock the week before 01 January 2024. Evidence (Fig. 1e, f, g) is consistent with patterns of jaguar predation (Marchini 2010; Márquez and Goldstein 2014). The distance between the attack and the jaguar recorded in Manduriacu 2.5 weeks later was 8 km, which suggests that the same individual could be responsible for the attack. Another less likely possibility, due to the extensive territories involved, is that there may be another undocumented jaguar in the area.

In the site close to Junín, livestock also occurs near the forest where the jaguar was recorded. However, there have been no reports of cattle attacks in this period. On the other hand, pumas and Andean bears have been documented attacking livestock in the Intag Valley, where conservation groups are working with local farmers on methodologies to alleviate risks, educate residents, and reduce carnivore-livestock predation.

Local authorities responded to the reported attack by inspecting the site, collecting primary information, and holding two workshops in the Cielo Verde community. Led by the Imbabura Prefecture's Research Component for Conservation, with support from Cotacachi-Cayapas National Park, workshops introduced deterrent measures based on olfactory signals to be tested for

effectiveness. The project "Expansion and Strengthening of Sustainable Practices to Reduce Pressure on Wildlife Habitat" was also presented to the community. This project aims to develop field training schools, design farm models, and implement solar-powered electric fencing to keep livestock out of forests. It includes installing livestock water troughs to ensure water access and prevent livestock jaguar encounters. Community members showed interest in applying these measures and participating in the sustainable practices project.

Another important observation, in addition to the jaguar, is an Andean bear (*Tremarctos ornatus*), recorded in Manduriacu on 23 October with a camera 1.5 km apart from the one that captured the jaguar in November, at an elevation of 1791 m (0°19' 5.1234"N, 78°52'17.436"W). Similarly, cameras in Junín also captured Andean bears, with two different individuals photographed on 24 June 2023 and a third recorded on 3 July and 2 August 2024 at 1200–1500 masl. Signs of Andean bears are relatively common in these areas.

According to the literature, Andean bears typically avoid jaguars (Peyton et al. 1998; Peyton 1999). However, in this zone of the Cordillera Occidental, where jaguars can be found at elevations up to 1300 masl and Andean bears descend to elevations lower than 1200 masl, their co-occurrence is not rare. This event has been observed in other areas of their distribution, albeit infrequently (Peyton 1999; Huarcaya et al. 2020). The presence of this young male jaguar, seemingly in search of territory, sharing habitat with another large mammal, underscores the critical importance of preserving these remnant natural areas. Furthermore, the presence of these two species, alongside others such as pumas, margays, oncillas, and ocelots, highlights the importance of this area for conservation. However, it also highlights the imminent threat posed by illegal hunting, human-wildlife conflicts, and mining towards not just critically endangered species such as jaguars and Andean bears but the entire ecosystem. The Junín Community Forest is home to over 100 endangered species, while at Río Manduriacu Reserve, over 21 endangered species (amphibians and reptiles) have been documented over the years (Guayasamin et al. 2019; Guayasamin et al. 2022; Monteros et al. 2022; Monteros et al. 2023). The region is characterized by high levels of endemism coupled with strong human pressures (Roy et al. 2018; Bax and Francesconi 2019).

To conclude, the reappearance of the critically endangered jaguar in northwestern Ecuador, alongside the presence of Andean bears and other threatened species, emphasizes the urgent need for enhanced conservation strategies in the region. The rediscovery of jaguars in the area raises concerns about potential conflicts between inhabitants and these large carnivores, as evidenced by recent incidents. Therefore, coordinated efforts among local communities, NGOs, government agencies, and academic institutions are essential to address these issues.

The Tropical Andes ecoregion is recognized for its remarkable biodiversity (Myers et al. 2000; Bax and Francesconi 2019), including new species of amphibians and orchids and, potentially, the resurgence of large mammals. These records underscore the critical need to preserve these areas to maintain their biodiversity and the environmental services they provide. The documented movement steps of the jaguar and the likely positive impact of reduced mining activities emphasize the need for continued research and monitoring of these populations with the implementation of sustainable practices. These coordinated conservation efforts are vital in ensuring the protection and coexistence of wildlife and human populations in this highly biodiverse region.

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Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

This research was conducted in compliance with relevant ethical guidelines for wildlife conservation. Necessary permits were obtained, and efforts were made to minimize disturbance to species and habitats. Data collection adhered to principles of integrity and transparency, with all findings reported honestly and responsibly.

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Data availability

All of the data that support the findings of this study are available in the main text.

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