Title: Illegal cattle trade drives New World Screwworm emergence in wildlife and erodes Mesoamerica's protected areas

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The New World Screwworm (*Cochliomyia hominivorax*; hereafter “screwworm”) is a parasitic fly originally found in the Americas (World Organization for Animal Health 2019). Females lay eggs in open wounds of warm-blooded animals and humans (World Organization for Animal Health [WOAH] 2019). The hatched larvae feed on living tissue, causing damage, severe pain, and facilitating secondary infections, potentially resulting in death of the host (WOAH 2019).

The screwworm was a major pest in the early to mid-20th century, causing significant losses in livestock and wild animals, as well as substantial economic damage (Novy 1991; Alexander 2006). Given the impact on agricultural producers, a full-scale eradication program was initiated in the 1950s in the southeastern United States (US) through the release of sterile male flies (Sterile Insect Technique [SIT]; Krafsur et al. 1987; Novy 1991; Wyss 2000; Vargas-Terán et al. 2021). After successful eradication of the parasite from the US, the strategy was repeated southward through Mexico to Panama, rendering Central America screwworm-free by the 2000s (Wyss 2000; WOAH 2019; Vargas-Terán et al. 2021). The Darién Gap jungle that straddles the Panama-Colombia border was designated a barrier zone to prevent reinfestation from South America (WOAH 2019; Vargas-Terán et al. 2021). Here, millions of sterile flies were released weekly for decades (Comisión Panamá - Estados Unidos para la Erradicación y Prevención del Gusano Barrenador del Ganado [COPEG] 2024).

Between 2001-2022, Panama experienced sporadic screwworm cases, averaging 25 cases per year (Maxwell et al. 2017; US Department of Agriculture Animal and Plant Health Inspection Service [USDA–APHIS] 2025; Zaldivar-Gomez et al. 2025). However, the country saw an explosion of more than 6,500 cases in 2023 alone, a 260-fold increase (De Escobar 2023; WOAH 2023; USDA–APHIS 2025). Potential factors facilitating this reemergence include SIT failure (Maxwell et al. 2017), operational challenges to produce and release sterile male flies (WOAH 2019; WOAH 2024), climate change (Gutierrez & Ponti 2014), and migration of half a million people in 2023 alone (and potentially domestic animals) from South to Central America across the Darien Gap, (Maxwell et al. 2017; United Nations High Commissioner for Refugees & International Organization for Migration 2023; COPEG 2024).

From Panama, the screwworm rapidly spread northwards, reemerging throughout Central America (Zaldivar-Gomez et al. 2025) and reaching Mexico by late 2024 (WOAH 2024b). Movement of domestic livestock, historically a primary driver of screwworm propagation (Novy 1991; Lindquist et al. 1992; Reichard 1999; Alexander 2006; Vargas-Terán et al. 2021), is considered a main facilitator of the current reemergence (Zaldivar-Gomez et al. 2025). Particularly relevant are the well-documented routes for large-scale illegal cattle transport running from Nicaragua through Honduras and Guatemala into Mexico. Here, animals are integrated into the legal trade and even transported onward to the US (Asmann & Dittmar 2022; InSight Crime 2022; Montoya 2022). Key cross-border points, including Benemérito de las Américas and protected areas, are also well-documented (Soberanes 2018; Dittmar et al. 2022; InSight Crime 2022). Cattle trafficking favors the spread of parasites and pathogens, as sanitary controls are bypassed (Asmann & Dittmar 2022).

The epidemiological consequences of illegal cattle movements were foreseeable. Currently, almost one hundred thousand screwworm infestation cases in domestic animals and hundreds of

human cases have been reported from Panama to Mexico, and case numbers continue to rise (Supplementary Tables S1 and S2). Legal livestock trade among countries has been repeatedly or permanently halted since re-emergence, resulting in significant economic losses (Venegas-Montero et al. 2024; U.S. Department of Agriculture 2025).

Historically, screwworm surveillance has focused primarily on livestock and humans, with wildlife largely overlooked despite their susceptibility to infestation through wounds from fights, tick bites, parturition, umbilical openings, gunshots, abrasive lesions, or other trauma; and the potential consequences for biodiversity and ecosystem health. Confirmed cases in Mesoamerica reported in official sources are detailed in Table 1, excluding species exotic to the region (unofficial sources are provided in Supplementary Table S3). Infestation has been previously described in some of these species (Lindquist 1937; Cepeda-Duque et al. 2025).

We report four Baird's tapirs (*Tapirus bairdii*) with confirmed screwworm infestation in a fragmented landscape in northwestern Costa Rica between August 2024 and April 2025 (Figure 1). The initial detection occurred around one year after the first case in domestic animals in this country. These individuals with low to moderate body condition presented deep, suppurative wounds with active myiasis in living tissue and received successful veterinary intervention through the TapirVet Project. Two of these tapirs were subsequently reinfested. These are the first screwworm infestation cases identified during five years of monitoring. Another tapir case was detected in the Osa Peninsula, southwestern Costa Rica, which died despite veterinary intervention. Each affected animal required field response, chemical immobilization, wound treatment, and post-release monitoring for 15-21 days, costing between 3,000-5,000 USD. Screwworm myiasis cases in a related endangered tapir species were recently reported in Colombia, where the parasite remains endemic (Cepeda-Duque et al. 2025; Mantilla-Meluk et al., 2025).

Table 1. Cases of screwworm infestation in native wild species in Central America, as reported in official sources.

Country	Affected wild animal (identified to taxonomic level reported in the source)	Number of cases	Captivity status	Source	Report by Official Government Source	Case confirmation
Panama	New World porcupine (*Coendou sp*)	1^	Unknown	https://mida.gob.pa/wp-content/uploads/2025/07/BoletinMensual_Mayo-2025.pdf?csrt=4956185204491234556	Yes	Confirmed: Case reported by an official source
	Folivora (species of sloth)	1*		https://mida.gob.pa/wp-content/uploads/2025/06/BoletinMensual_Abril-2025.pdf?csrt=4956185204491234556.	Yes	Confirmed: Case reported by an official source
	Kinkaju (*Potus flavus*)	2		https://www.copeg.org/situacion-actual/situacion-panama/	Yes	Confirmed: Cases reported by an official source
	Deer	1				
	Sloth	1*				
	Porcupine	1^				
Costa Rica	Unknown[$]	20	Probably free-ranging	https://www.senasa.go.cr/informacion/centro-de-informacion/informacion/estado-sanitario/boletines-epidemiologicos/10349-2025-04-boletin-epidemiologico/file https://www.senasa.go.cr/informacion/centro-de-informacion/informacion/estado-sanitario/boletines-epidemiologicos/10301-2025-03-boletin-epidemiologico/file https://www.senasa.go.cr/informacion/centro-de-informacion/informacion/estado-sanitario/boletines-epidemiologicos/10302-boletines-epidemiologicos-2024/file	Yes	Confirmed: Cases reported by an official source

	Brown-throated sloth (*Bradypus variegatus*)	1	Probably free-ranging	https://www.senasa.go.cr/informacion/centro-de-informacion/informacion/estado-sanitario/boletines-epidemiologicos/10302-boletines-epidemiologicos-2024/file	Yes	Confirmed: Case reported by an official source
Guatemala	Common opossum (*Didelphis marsupialis*)	1	Free-ranging	https://wahis.woah.org/#/in-review/5986?reportId=175268&fromPage=event-dashboard-url	Yes	Confirmed: Case reported by an official source
Mexico	Roadside hawk (*Rupornis magnirostris*)	2	Free-ranging	Reported as an Eurasian sparrowhawk (*Accipiter nisus*) in Event 6269 (https://wahis.woah.org/#/in-review/6269?reportId=175092&fromPage=event-dashboard-url) which is not native to Mexico. A red-shouldered hawk was also reported later in https://www.excelsior.com.mx/nacional/gusano-barrenador-confirman-primer-caso-animal-silvestre/171993. However, Servicio Nacional de Sanidad, Inocuidad y Calidad Alimentaria (SENASICA) México confirmed both birds were in fact Roadside hawk.	Yes	Confirmed: Cases confirmed by an official source

* ^: They could be the same individual

$: A press release by Sistema Nacional de Áreas de Conservación in September 2024 mentions 6 infestation cases of two-toed sloth (*Choloepus hoffmani)*, two of the infestation cases in Baird's tapirs (*Tapirus bairdii*) reported in this document, and a case in Mexican hairy dwarf porcupine (*Sphiggurus mexicanus*; see http://www.sinac.go.cr/ES/noticias/ComPrensa/ComunicadosPrensaSetiembre22102024.zip).

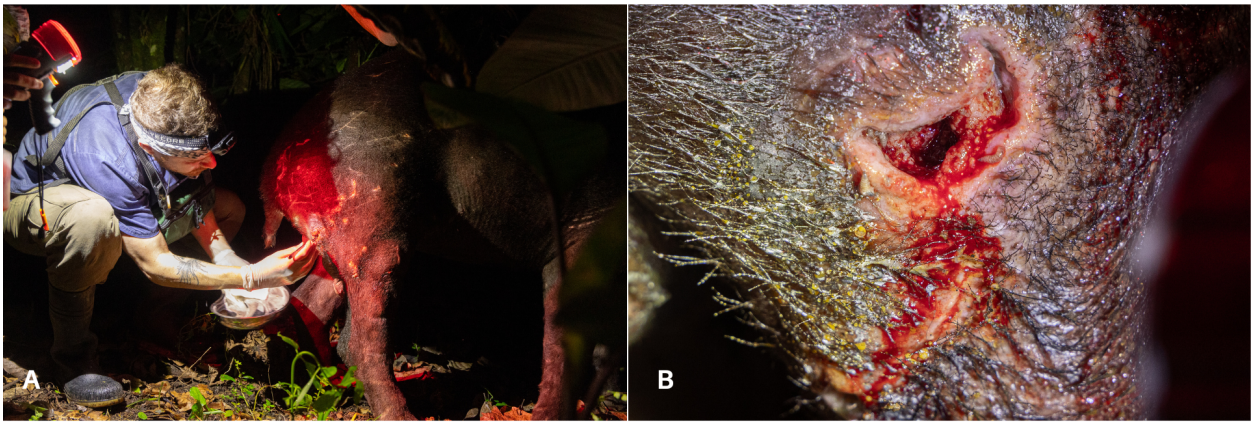


Figure 1. A) Treatment of a wound in a sedated Central American tapir (*Tapirus bairdii*) likely resulting from intraspecific conflict and infested by New World Screwworm (*Cochliomyia hominivorax*). Treatment administered by co-author Dr. Jorge Rojas-Jiménez (TapirVet Project). B) Close-up of the infested wound with fly larva on the low edge. The tapir was successfully treated and fully recovered. Photographs: Michiel van Noppen.

In April 2025, camera-trap monitoring in Guatemala's Mirador-Rio Azul National Park, Naachtun-Dos Lagunas Biotope, and Laguna del Tigre National Park, captured two pumas (*Puma concolor*) and a Baird's tapir with distinctive open wounds exposing live tissue, suspected screwworm myiasis (Figure 2A-C). The first puma was detected (Figure 2A) seven months after Guatemala's first domestic animal case (Zaldivar-Gomez et al. 2025) and within two weeks of domestic cases in Mexico only ~35 km away (Figure 2D). The second puma and tapir were photographed (Figure 2B and 2C) one month and ~2km apart, with domestic animal cases within ~12-18 km in the prior 2-3 months. (Figure 2D). Across >20,000 camera-trap nights in these parks since 2019, these are the first lesions observed with these characteristics.

Infested wildlife and screwworm dispersal may contribute more significantly to spread if the movement of infested livestock is controlled, but their role appears minor compared to current trade-driven infested livestock transport. Supporting evidence includes the predominance of cases in domestic animals, initial detections in illegally imported horses and cattle (WOAH 2024a, 2024b), earlier-than-expected arrival to Mexico (Zaldivar-Gomez et al. 2025), and new detections skipping neighboring administrative units over distances consistent with informal livestock movement (https://dmontecino-latorre.shinyapps.io/screwworm_reemergence_polygon/) (Zaldivar-Gomez et al. 2025).

Figure 2. Camera trap images of two pumas (*Puma concolor*; panel A and B) and a Baird's tapir (panel C) with open wounds, potentially caused by screwworm infestation, documented in the Naachtún-Dos Lagunas Biotope, Maya Biosphere Reserve, and Laguna del Tigre National Park, Guatemala (WCS 2025). D) Locations of screwworm confirmed infestations in domestic animals (points) in northern Guatemala and southern Mexico between October 2024 and June 2025 according to data in the World Animal Health Information System (WAHIS) database and Ministerio de Agricultura, Ganadería y Alimentación, Guatemala; and locations of the pumas and Baird's tapir described in panels A-C (asterisks). The color scale of points and asterisks shows the date of the report with grading from dark blue (for cases detected in October 2024) to yellow (for cases detected in June 2025); points and asterisks with similar colors indicate cases closer in time.

Documented screwworm-associated morbidity and mortality in wildlife in pre-eradication endemic North America suggest a historical role in regulating wild mammal populations (Marburger & Thomas 1965; Alexander 2006). Reports describe frequent seasonal infestation of opossums (*Didelphis virginiana*) and white-tailed deer (*Odocoileus virginianus*), and large outbreaks in wild mammals (Lindquist 1937; Allen 1950; Strode 1954). Texas censuses linked screwworm to an up to 60% deer fawn reduction (Teer et al. 1965) with increased survival after control (Marburger & Thomas 1965).

Potential impacts in a region similarly suitable for year-round parasite reproduction were illustrated by the 2016 Florida Keys screwworm reintroduction: wildlife experienced high mortality and morbidity (Skoda et al. 2018; Parker et al. 2020), with 15-20% of endangered Florida Key deer (*Odocoileus virginianus clavium*) dying or euthanized. Mortality in September 2016 was ~2x normal (Delgado et al. 2016; Parker et al. 2020). A rapid, multipronged response—SIT, treatment of deer, preventative interventions, population assessments and recovery strategies—contained the outbreak before fawning season, likely averting significant population impacts from infestation of more susceptible parturient females and fawns (Lopez et al. 2016; Parker et al. 2020).

Directly assessing medium- to long-term impacts on Mesoamerican wildlife—should reintroduction progress to endemicity—is difficult due to lack of comparable data (e.g., from South America or Central America pre-eradication) (Snow et al. 1985; Costa-Júnior et al. 2019; Fresia et al. 2021). Cattle data from countries with broadly comparable environmental conditions offer a proxy: Costa Rica had 52–65 screwworm cases per 10,000 cattle in 2024 (Supplementary Table S4), versus 453 cases per 10,000 annually in endemic Ecuador in the 2010s (Rodríguez-Hidalgo et al. 2019). Assuming similar surveillance and production systems, these rates suggest that current Mesoamerican cases could intensify if control falters. Recent modeling in endemic Colombia suggests that screwworm could drive the local extinction of a mountain tapir (*Tapirus pinchaque*) population in a national park, even in the absence of hunting or further habitat reduction (Mantilla-Meluk et al. 2025).

Key socio-ecological conditions that shape parasite–wildlife dynamics have changed dramatically in Mesoamerica since pre-eradication. Wildlife populations have sharply declined (World Wildlife Fund for Nature International 2024); Gutierrez et al. (2019) noted that SIT succeeded partly because oviposition sites were sparse, but the larger regional cattle population than pre-eradication (Food and Agriculture Organization of the United Nations [FAO] 2025) (Supplementary Information Figure S1), provides abundant sites. Screwworm, a multi-host parasite, can be maintained by this livestock and continuously expose wildlife potentially above historical levels. Moreover, veterinary care is limited near biodiversity hotspots (Pérez-Flores et al. 2025) and transport of infested livestock can repeatedly reintroduce parasites into cleared zones. Together with confirmed infestations near and within protected areas (Figure 2 and 3; Supplementary Information Figure S2), the fly's broad host range and dispersal capacity (Mayer & Atzeni 1993; Alexander 2006; WOAH 2019; Venegas-Montero et al. 2024); detection of suspect wildlife cases shortly after nearby domestic cases (Fig 2D); reinfestation of treated wild animals; high wildlife morbidity/ mortality in historical endemic zones and past outbreaks; and range expansion as result of warmer temperatures, screwworm poses a plausible biodiversity threat that

necessitates monitoring of conservation impacts. As noted by Kuiken and Cromie (2022), it is critical that humans take stronger preventive action to protect wildlife from livestock diseases.

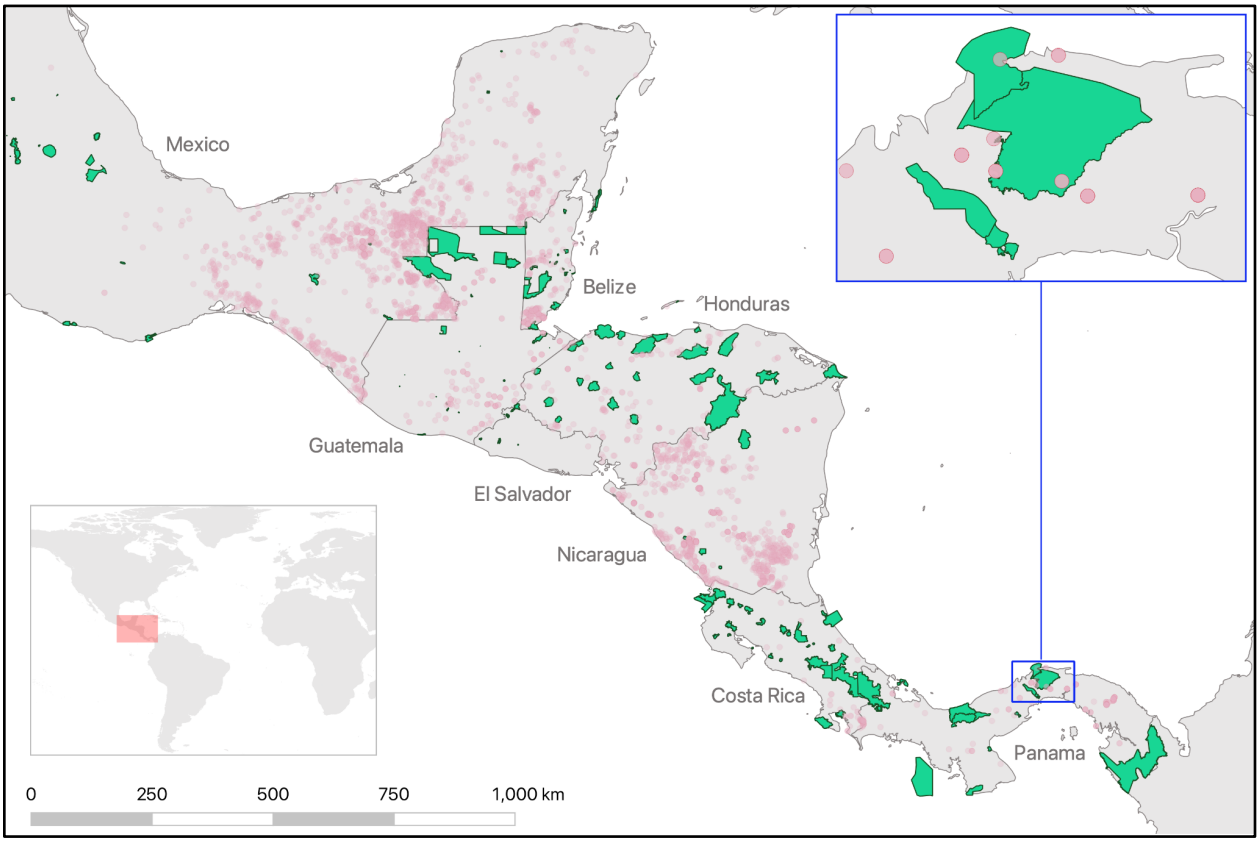


Figure. 3. The spatial distribution of confirmed screwworm infestation in animals between January 1st, 2023, and July 26th, 2025 (red circles) according to data in the WAHIS database; and national parks with terrestrial components (green polygons) according to the World Database on Protected Areas in Central America and Southern Mexico. Other protected area types, such as RAMSAR sites, are not shown. The blue-framed inset shows reported cattle infestation cases in Chagres and Portobelo National Parks, Panama.

Governments are reacting by strengthening law enforcement, controlling livestock movement, conducting surveillance, treating cases, raising awareness, and trapping flies (Instituto de Protección y Sanidad Agropecuaria 2024; Servicio Nacional de Salud Animal 2024; Ministerio de Agricultura y Ganadería 2025; Servicio Nacional de Sanidad e Inocuidad Agroalimentaria 2025; Servicio Nacional de Sanidad, Inocuidad y Calidad Agroalimentaria 2025a, 2025b; Ministerio de Agricultura, Ganadería y Alimentación 2025). Mexico is releasing sterile flies; expanded releases are planned but not expected before late 2026 (COPEG 2025, USDA 2025).

However, wildlife health surveillance has been mostly neglected, including in conservation planning and management. We encourage sustained monitoring of Mesoamerican wildlife populations and health to understand screwworm impacts (and other threats), enable timely mitigation, and adapt conservation plans. Biologists, rehabilitation centers, and rangers, (e.g., Reserva Maya trained to document health events; Montecino-Latorre et al. 2024) can contribute.

Fly populations should be monitored to evaluate control effectiveness and compare current dynamics with Mesoamerican pre-eradication (Matlock et al. 1996) and endemic areas of South America. Collaboration among global/regional organizations, national authorities, conservation and private organizations, legal ranchers, researchers, and the public is key to strengthening detection and mitigation efforts.

Mitigation should avoid procedures or devices that cause wounds in wildlife, (e.g., invasive sampling, radio-collars; Cepeda-Duque et al. 2025); prevent environmental contamination with larvae from carcasses or wound washings; and reduce tick- related (or other) wounds in livestock around biodiverse landscapes. Adult fly trapping guidelines exist (Foreign Animal Disease Preparedness and Response Plan - USDA 2025), with identification references to differentiate *C. hominivorax* from “secondary screwworm”, such as *C. macellaria* (WOAH 2019). Trapping should avoid non-target capture or providing oviposition sites. We strongly oppose lethal trapping and poisoning of vampire bats to prevent infestible cattle wounds (Sanchez 2025; Pool 2025): evidence does not support vampire bites as a main cause, and culling can increase rabies spread, fail to reduce livestock incidence (Viana et al. 2023; Ávila-Vargas et al. 2025), and disrupt ecosystems.

Screwworm control will likely fail without curtailing illegal livestock corridors. Despite sterile-male releases during the northward advance, the parasite reached Mexico (COPEG 2025). By contrast, spread appeared to slow following stricter enforcement of “healthy-only” livestock transport in Mexico (Servicio Nacional de Sanidad, Inocuidad y Calidad Agroalimentaria 2025a). Unregulated livestock movement also risks introducing other transboundary pathogens e.g., Foot and Mouth Disease (FMD), African Swine Fever (ASF); threatening trade, economies, livestock and wildlife health, and potentially causing trophic cascades (WOAH 2025a; Humphreys et al. 2025; Kuiken and Cromie 2022). Central America and Mexico are recognised FMD-free without vaccination, whereas parts of South America lack or only partially have that status (WOAH 2025b). ASF emerged in 2021 in the Dominican Republic and Haiti (WOAH 2025a).

Screwworm re-emergence is the latest social-ecological consequence of cattle trafficking, an illegal activity that has, until recently, operated openly for years in Mesoamerica (Asmann & Dittmar 2022; InSight Crime 2022; Montoya 2022). By 2022, at least 1 million cattle occupied Mesoamerican protected areas (Dittmar et al. 2022), intensifying wildlife-livestock interfaces and spillover risk. Cattle smuggling routes cross protected areas and are tied to organized narcotrafficking, money laundering, violence, land usurpation, and illegal ranching (McSweeney et al. 2014; Tellman et al. 2020; Asmann & Dittmar 2022; InSight Crime 2022; Montoya 2022). “Narco-ranches” clear forest for grazing along borders (Wrathall et al. 2020; Dittmar et al. 2022), including Laguna del Tigre National Park in Guatemala (Consejo Nacional de Areas Protegidas & Wildlife Conservation Society 2018; Devine et al. 2020) and the Honduran Mosquitia (McSweeney et al. 2018; Asmann & Dittmar 2022; Montoya 2022). Cattle trafficking represents a major driver of environmental degradation: Honduras, Guatemala, and Nicaragua experienced some of the world's highest deforestation rates since 2000, coinciding with increased drug trafficking (FAO 2006; McSweeney et al. 2014; Tellman et al. 2020).

The convergence of criminal enterprises, illegal cattle movement and ranching, disease emergence, environmental degradation, and habitat loss, poses a fundamental threat to Mesoamerican biodiversity. Without decisive, coordinated, cross-sectoral action, decades of conservation gains are rapidly undone. Combining current screwworm controls with a comprehensive, multi-pronged strategy can address drivers, reduce disease, and advance conservation and sustainability goals. Win-win actions require greater investment and sustained political commitment and include: reclaiming protected areas from illegal ranchers; integrating livestock and wildlife health monitoring into conservation management (Montecino-Latorre, Pruvot, and Olson 2025); enforcing buffer zones; implementing rapid response protocols for screwworm and other health threats in and around protected areas; supporting alternative livelihoods for rural farmers; mobilizing legal ranchers to oppose enabling conditions (Hidalgo & Natalia 2025); and rigorously enforcing laws against livestock trafficking, unauthorized grazing, and habitat encroachment.

Given cross-cutting social-ecological-health impacts, screwworm reemergence and its drivers constitute a One Health crisis requiring a paradigm shift towards integrated intervention across livestock management, law enforcement, human healthcare, biodiversity conservation, community engagement, and environmental monitoring.

References

Alexander JL. 2006. Screwworms. Journal of the American Veterinary Medical Association **228**:357–367. American Veterinary Medical Association (AVMA).

Allen RH. 1950. Effects of screw-worm on deer in the southeast. Pages 143–147 Proceedings of the Annual Conference Southeast Association of Game & Fish Commissions.

Asmann P, Dittmar V. 2022, May 18. How black market ear tags help flow of contraband cattle. Available from https://insightcrime.org/investigations/black-market-ear-tags-contraband-cattle-central-america-mexico/ (accessed April 29, 2025).

Ávila-Vargas L, Soler-Tovar D, Dong Q, Escobar LE. 2025. Anticoagulants for the Control of the Common Vampire Bat (Desmodus rotundus). Zoonoses and Public Health **72**:101–116.

Cepeda-Duque JC et al. 2025. New World screwworm infestation in wild mountain tapirs, Central Andes mountains, Colombia. Emerging Infectious Diseases **31**:1871–1874. pmc.ncbi.nlm.nih.gov.

Comisión Panamá - Estados Unidos para la Erradicación y Prevención del Gusano Barrenador del Ganado (COPEG). 2024. Current situation – Strategic actions for the control and eradication of GBG. Available from https://www.copeg.org/en/situacion-actual/ (accessed July 11, 2025).

Comisión Panamá–Estados Unidos para la Erradicación y Prevención del Gusano Barrenador del Ganado (COPEG). 2024. Newsletter Campo – Enero 2024 (Edición A). Available from https://www.copeg.org/wp-content/uploads/2025/02/Newsletter-campo-Enero-2024-A.pdf.

Consejo Nacional de Areas Protegidas, Wildlife Conservation Society. 2018. Monitoreo de la gobernabilidad en la Reserva de la Biosfera Maya, actualización al año 2017. Page 56. Petén, Guatemala.

Costa-Júnior LM, Chaves DP, B. BDR, Santos V A F, Costa-Júnior HN, M. BAT. 2019. A review on the occurrence of Cochliomyia hominivorax (Diptera: Calliphoridae) in Brazil. Revista Brasileira de Parasitologia Veterinária **28**:548–562.

De Escobar C. 2023, February 23. La Dirección Nacional de Salud Animal ante el aumento

inusual de casos de Gusano Barrenador del Ganado en la Provincia de Darién comunica. Available from https://mida.gob.pa/2023/02/23/la-direccion-nacional-de-salud-animal-ante-el-aumento-inusual-de-casos-de-gusano-barrenador-del-ganado-en-la-provincia-de-darien-comunica/ (accessed July 16, 2025).
Delgado A, Hennessey M, Hsi D. 2016. Investigation into introduction of New World Screwworm into Florida Keys. United States Department of Agriculture, Animal and Plant Health Inspection Service.
Devine JA, Wrathall D, Currit N, Tellman B, Langarica YR. 2020. Narco-cattle ranching in political forests. Antipode **52**:1018–1038. Wiley.
Dittmar V, Asmann P, Soberanes R, Montoya H, Papadovassilakis A, Previde S. 2022. Cash cows: the inner workings of cattle trafficking from Central America to Mexico. InSight Crime. Available from https://insightcrime.org/wp-content/uploads/2022/05/Cash-Cows-The-Inner-Workings-of-Cattle-Trafficking-from-Central-America-to-Mexico-InSight-Crime-May-2022.pdf.
Food and Agriculture Organization of the United Nations. 2006. Cattle ranching and deforestation. Livestock Information, Sector Analysis and Policy Branch, Animal Production and Health Division, Rome. Available from https://openknowledge.fao.org/server/api/core/bitstreams/0b4d2952-b42c-4725-8aad-24deb2bb1de1/content (accessed July 30, 2025).
Food and Agriculture Organization of the United Nations. 2025. Compare Data. Available from https://www.fao.org/faostat/en/#compare (accessed July 20, 2025).
Foreign Animal Disease Preparedness and Response Plan - United States Department of Agriculture. 2025. Disease response strategy: New World Screwworm myiasis (2025). United States Department of Agriculture. Available from https://www.aphis.usda.gov/sites/default/files/nws-myiasis-disease-strategy.pdf.
Fresia P et al. 2021. Historical perspective and new avenues to control the myiasis-causing fly *Cochliomyia hominivorax* in Uruguay. Agrociencia Uruguay **25**. Universidad de la República, Facultad de Agronomía. Available from http://dx.doi.org/10.31285/agro.25.974.
Gutierrez AP, Ponti L. 2014. The new world screwworm: prospective distribution and role of weather in eradication: Screwworm distribution and eradication. Agricultural and Forest Entomology **16**:158–173. Wiley.
Gutierrez AP, Ponti L, Arias PA. 2019. Deconstructing the eradication of new world screwworm in North America: retrospective analysis and climate warming effects. Medical and Veterinary Entomology **33**:282–295. Wiley.
Hidalgo, Natalia. 2025, July 29. Screwworm scare highlights ongoing cattle trafficking loopholes in southern Mexico. Available from https://insightcrime.org/news/screwworm-scare-cattle-trafficking-mexico/ (accessed July 29, 2025).
Humphreys JM et al. 2025. Epidemiology and economics of Foot-and-Mouth disease: current understanding and knowledge gaps. Veterinary Research **56**:141. Springer Science and Business Media LLC.
InSight Crime. 2022, May 18. The secrets of cattle smuggling from Guatemala to Veracruz. Available from https://insightcrime.org/investigations/secrets-cattle-smuggling-guatemala-veracruz/ (accessed April 29, 2025).
Instituto de Protección y Sanidad Agropecuaria. 2024. Gusano Barrenador - Información y Prevención. Available from https://www.ipsa.gob.ni/Gusano-Barrenador (accessed July 18, 2025).
Krafsur ES, Whitten CJ, Novy JE. 1987. Screwworm eradication in North and Central America. Parasitology Today **3**:131–137. Elsevier BV.
Kuiken T, Cromie R. 2022. Protect wildlife from livestock diseases. Science **378**,5-5. American Association for the Advancement of Science (AAAS).
Lindquist AW. 1937. Myiasis in wild animals in Southwestern Texas. Journal of Economic

Entomology **30**:735–740. Oxford University Press (OUP).
Lindquist DA, Abusowa M, Hall MJ. 1992. The New World screwworm fly in Libya: a review of its introduction and eradication. Medical and Veterinary Entomology **6**:2–8. Wiley.
Lopez RR, Parker ID, Silvy NJ, Pierce BL, Beaver JT. 2016. Florida Key Deer Screwworm final report (Phase I). Available from https://scholar.google.com/citations?user=mzx28vQAAAAJ&hl=en&oi=sra.
Mantilla-Meluk, H et al. 2025. One Health against the extinction of the Mountain Tapir (*Tapirus pinchaque*) in the Central Andes of Colombia. CABI One Health, doi:10.1079/cabionehealth.2025.0031, CABI.
Marburger RG, Thomas JW. 1965. A die-off in white-tailed deer of the central mineral region of Texas. The Journal of Wildlife Management **29**:706. JSTOR.
Matlock RB Jr, Welch JB, Parker FD. 1996. Estimating population density per unit area from Mark, release, recapture data. Ecological Applications **6**:1241–1253. Wiley.
Maxwell MJ, Subia J, Abrego J, Garabed R, Xiao N, Toribio RE. 2017. Temporal and spatial analysis of the New World Screwworm (*Cochliomyia hominivorax*) in Darien and Embera, Panama (2001-2011). Transboundary and Emerging Diseases **64**:899–905. Wiley.
Mayer DG, Atzeni MG. 1993. Estimation of dispersal distances for *Cochliomyia hominivorax* (Diptera: Calliphoridae). Environmental Entomology **22**:368–374. Oxford University Press (OUP).
McSweeney K, Nielsen EA, Taylor MJ, Wrathall DJ, Pearson Z, Wang O, Plumb ST. 2014. Drug policy as conservation policy: narco-deforestation. Science (New York, N.Y.) **343**:489–490. American Association for the Advancement of Science (AAAS).
McSweeney K, Wrathall DJ, Nielsen EA, Pearson Z. 2018. Grounding traffic: the cocaine commodity chain and land grabbing in eastern Honduras. Geoforum; Journal of Physical, Human, and Regional Geosciences **95**:122–132. Elsevier BV.
Ministerio de Agricultura, Ganadería y Alimentación. 2025, June 16. Crean programa para la contención, control y erradicación del Gusano Barrenador del Ganado. Available from https://www.maga.gob.gt/crean-programa-para-la-contencion-control-y-erradicacion-del-gusano-barrenador-del-ganado/ (accessed July 18, 2025).
Ministerio de Agricultura y Ganadería. 2025. Sistema nacional de trazabilidad bovina y bufalina en Costa Rica. Available from https://www.mag.go.cr/trazabilidad-bovina-y-bufalina/ (accessed July 18, 2025).
Montecino-Latorre D et al. 2024. Rangers as an essential One Health workforce: strengthening the preservation of biodiversity and One Health in practice. papers.ssrn.com. Available from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4997409.
Montoya H. 2022, May 18. Narco-cattle ranching in La Mosquitia, Honduras. Available from https://insightcrime.org/investigations/narco-cattle-ranching-honduras/ (accessed April 29, 2025).
Novy JE. 1991. Screwworm control and eradication in the southern United States of America. World animal review **10**:18–27. Food & Agriculture Organization of the United Nations, Rome, Italy.
Panama–United States Commission for the Eradication and Prevention of Screwworm. 2025. About COPEG. Available from https://www.copeg.org/en/historia/ (accessed July 21, 2025).
Parker ID, Lopez RR, Silvy NJ, Pierce BL, Watts KG, Myers EP, Gibbs SEJ, Davis DS, Beaver JT, Lund AA. 2020. Florida key deer abundance and recovery following new world screwworm infestation. Southeastern Naturalist **19**:179. Humboldt Field Research Institute.
Pérez-Flores J, Calmé S, Schmook B, Oliva M, Lecuyer L, Cervantes A, Giordano AJ. 2025. A land without veterinarians: animal health practices among smallholders in the Selva Maya. Tropical Animal Health and Production **57**:217. Springer Science and Business Media LLC.
Pool M. 2025, September 4. Capturan murciélagos para combatir gusano barrenador. Available from https://puntomedio.mx/capturan-murcielagos-para-combatir-gusano-barrenador/

(accessed October 8, 2025).
Reichard R. 1999. Case studies of emergency management of screwworm. Revue Scientifique et Technique **18**:145–163. World Organisation for Animal Health.
Rodríguez-Hidalgo R, Tapia-Chiriboga A, Arciniegas S, Vanwambeke SO, Benítez-Ortiz W. 2019. Epidemiological analysis of the New World screwworm (*Cochliomyia hominivorax*) in Ecuador. Transboundary and Emerging Diseases **66**:968–977. Wiley.
Sanchez M. 2025, February. OIRSA donó 12 redes para la captura de murciélagos vampiros y vampiricida para el control de estos animales. Available from https://estereoamor.com/oirsa-dono-12-redes-para-la-captura-de-murcielagos-vampiros-y-vampiricida-para-el-control-de-estos-animales/ (accessed October 8, 2025).
Servicio Nacional de Salud Animal. 2024, July 2. Protocolo de vigilancia epidemiológica: Gusano Barrenador.
Servicio Nacional de Sanidad e Inocuidad Agroalimentaria. 2025. Gusano Barrenador del Ganado. Available from https://senasa.gob.hn/alertazoo/ (accessed July 18, 2025).
Servicio Nacional de Sanidad, Inocuidad y Calidad Agroalimentaria. 2025a, May 13. The Ministry of Agriculture intensifies measures for the control and eradication of New World Screwworm in national territory. Available from https://www.gob.mx/senasica/documentos/the-ministry-of-agriculture-intensifies-measures-for-the-control-and-eradication-of-new-world-screwworm-in-national-territory?state=published (accessed July 18, 2025).
Servicio Nacional de Sanidad, Inocuidad y Calidad Agroalimentaria. 2025b, May 14. Cronología de las acciones de prevención, control y erradicación del Gusano Barrenador del Ganado. Available from https://www.gob.mx/agricultura/articulos/cronologia-de-las-acciones-de-prevencion-control-y-erradicacion-del-gusano-barrenador-del-ganado-implementadas-por-el-gobierno-de-mexico.
Skoda SR, Phillips PL, Welch JB. 2018. Screwworm (Diptera: Calliphoridae) in the United States: Response to and elimination of the 2016-2017 outbreak in Florida. Journal of Medical Entomology **55**:777–786. Oxford Academic.
Snow JW, Whitten CJ, Salinas A, Ferrer J, Sudlow WH. 1985. The screwworm, *Cochliomyia hominivorax* (Diptera: Calliphoridae), in Central America and proposed plans for its eradication south to the Darien Gap in Panama. Journal of Medical Entomology **22**:353–360. Oxford University Press (OUP).
Soberanes R. 2018. Illegal cattle ranching deforests Mexico's massive Lacandon jungle. Mongabay. Available from https://news.mongabay.com/2018/03/illegal-cattle-ranching-deforests-mexicos-massive-lacandon-jungle/.
Strode DD. 1954. The screw-worm problem in the Ocala National Forest deer herd. Pages 176–185 Proceedings Annual Conference of the Southeast Association of Game & Fish Commissions. 8:176-185.
Teer JG, Thomas JW, Walker EA. 1965. Ecology and management of the white-tailed deer herd in the Llano Basin of Texas. Wildlife Monographs:3–62. University of Wisconsin--Madison.
Tellman B et al. 2020. Illicit drivers of land use change: Narcotrafficking and forest loss in central America. Global Environmental Change: Human and Policy Dimensions **63**:102092. Elsevier BV.
United Nations High Commissioner for Refugees, International Organization for Migration. 2023, December 7. IOM, UNHCR call for stronger response in the Americas as half a million people cross the Darien. United Nations High Commissioner for Refugees. Available from https://www.unhcr.org/news/press-releases/iom-unhcr-call-stronger-response-americas-half-million-people-cross-darien (accessed July 20, 2025).
United States Department of Agriculture Animal and Plant Health Inspection Service. 2025. New World Screwworm outbreak in Central America and Mexico. Available from https://www.aphis.usda.gov/livestock-poultry-disease/cattle/ticks/screwworm/outbreak-

central-america (accessed October 14, 2025).
United States Department of Agriculture. 2025, May 11. Secretary Rollins suspends live animal imports through ports of entry along southern border, effective immediately. Available from https://www.usda.gov/about-usda/news/press-releases/2025/05/11/secretary-rollins-suspends-live-animal-imports-through-ports-entry-along-southern-border-effective (accessed July 17, 2025).
Vargas-Terán M, Spradbery JP, Hofmann HC, Tweddle NE. 2021. Impact of screwworm eradication programmes using the sterile insect technique. Pages 949–978 Sterile Insect Technique. CRC Press, Boca Raton.
Venegas-Montero DP, Alfaro-Vellanero MJ, Rojas-Araya D, Calderón-Arguedas Ó, Vargas-Castro CM, Baldioceda-Villarreal A, Chaves-González LE, Camacho-Leandro J, Troyo A. 2024. Case report: Re-emergence of *Cochliomyia hominivorax* in Costa Rica: Report of a human myiasis case 23 years after elimination. The American Journal of Tropical Medicine and Hygiene **111**:1020–1023. American Society of Tropical Medicine and Hygiene.
Viana M et al. 2023. Effects of culling vampire bats on the spatial spread and spillover of rabies virus. Science Advances **9**:eadd7437.
World Organization for Animal Health. 2019. Chapter 3.1.14. New World screwworm (*Cochliomyia hominivorax*) and Old World screwworm (*Chrysomya bezziana*). Terrestrial Manual. World Organization for Animal Health, Paris.
World Organisation for Animal Health. 2024, July. Interview: Everything you need to know about New World Screwworm in cattle. Available from https://rr-americas.woah.org/en/news/interview-everything-you-need-to-know-about-new-world-screwworm-in-cattle/ (accessed July 13, 2025).
World Organisation for Animal Health. 2023, July 6. WAHIS Report No. 5106: Screwworm outbreak event (Report ID 161636). Available from https://wahis.woah.org/#/in-review/5106?reportId=161636&fromPage=event-dashboard-url (accessed July 16, 2025).
World Organisation for Animal Health. 2024a, September 16. WAHiS Event #5864: New World Screwworm outbreak report - Honduras. Available from https://wahis.woah.org/#/in-event/5864/dashboard (accessed July 1, 2025).
World Organisation for Animal Health. 2024b, November 21. WAHiS Event #6059: New World Screwworm Outbreak Report - Mexico. Available from https://wahis.woah.org/#/in-event/6059/dashboard (accessed July 1, 2025).
World Organisation for Animal Health. 2025a, June. African Swine Fever. Available from https://www.woah.org/en/disease/african-swine-fever/ (accessed July 18, 2025).
World Organisation for Animal Health. 2025b, June. Official recognition of animal health status. Available from https://www.woah.org/en/what-we-do/animal-health-and-welfare/official-disease-status/ (accessed July 18, 2025).
World Wildlife Fund for Nature International. 2024. Living Planet Report. WWF International, Gland, Switzerland.
Wrathall DJ et al. 2020. The impacts of cocaine-trafficking on conservation governance in Central America. Global Environmental Change: Human and Policy Dimensions **63**:102098. Elsevier BV.
Wyss JH. 2000. Screwworm Eradication in the Americas. Annals of the New York Academy of Sciences **916**:186–193. Wiley.
Zaldivar-Gomez A, Gomez-Vazquez JP, Iniesta-Valencia AJ, Figueroa-Martínez LG, Rico-Chávez O. 2025. Estimation the reinvasion of New World Screwworm (*Cochliomyia hominivorax*) in Central America: The role of animal movement in disease dispersal and control measures. Veterinary Parasitology (Amsterdam: Online) **59**:101220. Elsevier BV.

Supplementary Information

Supplementary Table S1. Number of cases of New World Screwworm in non-human animal species in Central America and Mexico between January 2023 and July 2025 as reported in the World Animal Health Information System database (WAHIS) of the World Animal Health Organisation and reported by the Organismo Internacional Regional de Sanidad Agropecuaria (OIRSA) in March 2025 and June 2025.

Country	**WAHIS July 27th, 2025**	**OIRSA, March 2nd - 8th, 2025[1]**	**OIRSA, June 22nd - 28th, 2025[2]**
Belize	218	25	198
Costa Rica	14878	16325	22122
El Salvador	1	356	2973
Guatemala	815	282	1353
Honduras	960	863	1984
Mexico	2500	164	2791
Nicaragua	8569	13945	19430
Panama	29776	37697	48133
Total	**57717**	**68257**	**98986**

[1]https://rr-americas.woah.org/en/events/19th-meeting-of-the-regional-steering-committee-of-the-gf-tads-for-the-americas/ and https://rr-americas.woah.org/app/uploads/2025/04/Situacion-actual-GBG-OIRSA_GFTAD%C2%B4s-17.03.2025_ENG.pdf)

[2]https://www.sica.int/noticias/se-comisca-realizo-webinario-sobre-el-gusano-barrenador-con-enfoque-regional_1_135415.html

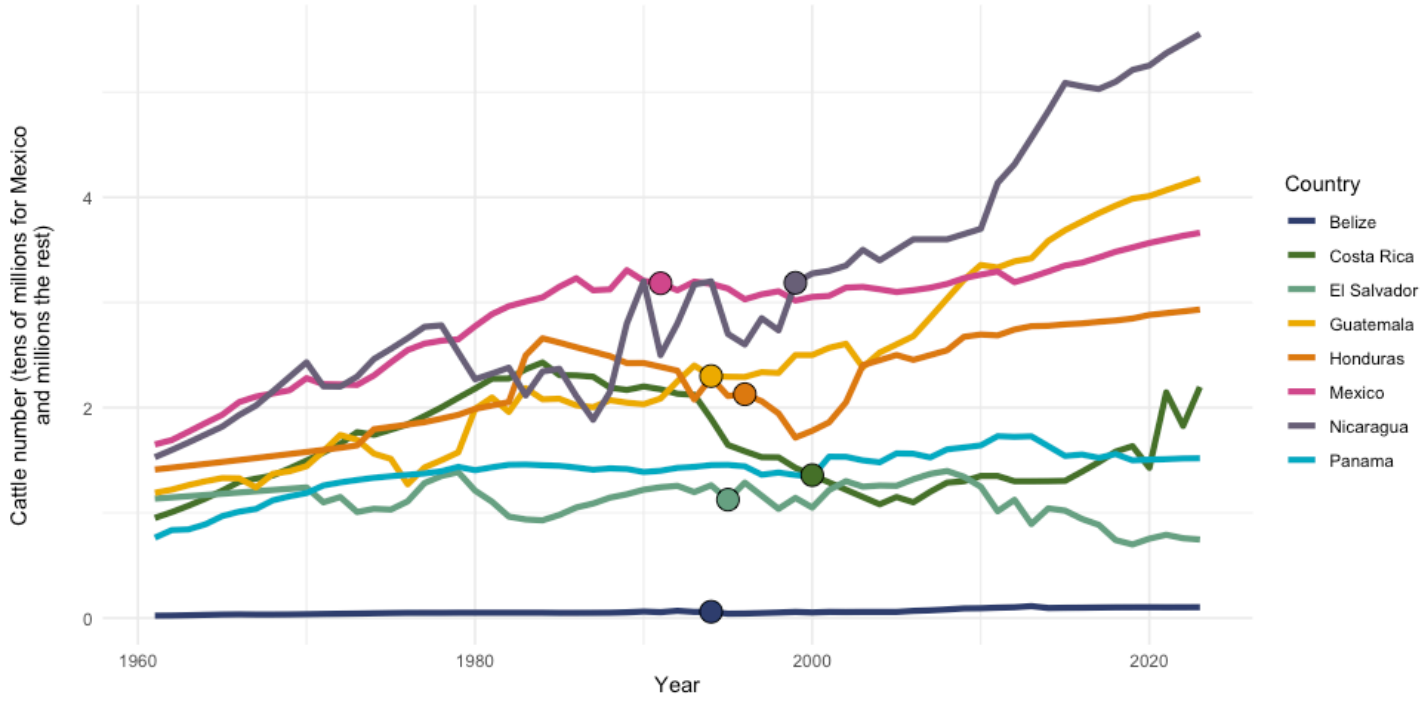
Supplementary Table S2. Number of cases of New World Screwworm in humans in Central America and Mexico since the reemergence of this parasite in each country as reported in the last national surveillance bulletin available in July, 2025.

Country	Number of cases	Source	Official Source
Panama	116 by week 28, 2025	https://www.minsa.gob.pa/sites/default/files/publicacion-general/boletin_epidemiologico_semanal_se28final-mm.pdf	Yes
Costa Rica	56 cases by week 27, 2025	https://www.ministeriodesalud.go.cr/index.php/biblioteca/material-educativo/material-publicado/boletines/boletines-vigilancia-vs-enfermedades-de-transmision-vectorial/boletines-epidemiologicos-2025/9420-boletin-epidemiologico-n-27-6/file	Yes
Nicaragua	125 cases by July 9th , 2025	https://www.lavanguardia.com/vida/20250607/10764415/nicaragua-reporta-117-casos-gusano-barrenador-humanos-abril-2024-agenciaslv20250607.html https://nicaraguainvestiga.com/nacion/162216-reportan-100-casos-gusano-barrenador-humanos-nicaragua/#utm_source=chatgpt.com	No
Honduras	126 cases by week 29, 2025	https://drive.google.com/drive/u/0/folders/1DS2ZYq6Jecm786xXtaaRml5TgIwn9Reu	Yes
El Salvador	3 cases by week 27, 2025	https://boletin.salud.gob.sv/superset/dashboard/2/?standalone=2	Yes
Belize	0 cases	No cases found. However, the website of the ministry of health was not functional by the time of data searching	No
Mexico	31 cases by week 28, 2025	https://www.gob.mx/cms/uploads/attachment/file/1009372/sem28.pdf	Yes

Supplementary Table S3. Cases of screwworm infestation in wild species in Central America as reported in unofficial sources.

Country	Species as reported in the source	Number of cases	Captivity status	Source	Report by Official Government Source	Case confirmation
Costa Rica	Three-toed sloth (*Bradypodidae*)	Unknown	Unknown	https://news.mongabay.com/2024/11/a-deadly-fly-is-spreading-through-central-america-experts-blame-illegal-cattle-ranching/?utm_source=chatgpt.com	No	The source reports confirmation of cases by an official source
	Two-toed sloths (*Choloepus sp*)					
	New World Porcupine (*Erethizontidae)*					
	Howler monkey (*Alouatta sp*)					
Honduras	Egret (*Egretta sp*)	1	Unknown	https://criterio.hn/tras-casi-30-anos-de-erradicacion-honduras-enfrenta-una-emergencia-sanitaria-por-el-gusano-barrenador	No	The source reports confirmation of the case by an official source
Nicaragua	Unknown	26	Unknown	https://radiolaprimerisima.com/managua-lidera-casos-de-personas-afectadas-por-gusano-barrenador/	No	The source reports confirmation of cases by an official source
El Salvador	Deer	1	Unknown	https://diario.elmundo.sv/economia/un-venado-aves-y-mapaches-positivos-a-gusano-barrenador-docente-de-la-ues-advierte-de-riesgo-a-la-biodiversidad	No	The source reports confirmation by official an source
	Racoon (*Procyon lotor*)	Unknown				
	Bird					
Guatemala	Common possum (*Didelphis marsupialis*)	1	Free-ranging		No	Unverified
Belize	Howler monkey (*Alouatta sp*)	2	Unknown	https://www.facebook.com/100063547151268/posts/1315123747282518/	No	Unverified
Mexico	Deer (*Capreolinae sp*)	1	Unknown	https://solyucatan.mx/gusano-barrenador-llega-a-la-fauna-silvestre-confirman-caso-en-venado-en-yucatan/	No	The source reports confirmation by official an source

Supplementary Figure S1. Cattle numbers per country and year according to data by the Food and Agriculture Organization of the United Nations. The points show the year of eradication per country (exemption in Panama where eradication has never been accomplished). Values reported for Mexico were divided by 10.



Supplementary Table S4. Derivation of *Cochliomyia hominivorax* infestation cases in Costa Rica in 2024.

Variable	Value	Source
Cumulative screwworm infestation cases in cattle in 2023	142	Servicio Nacional de Sanidad Animal - Costa Rica https://www.senasa.go.cr/informacion/centro-de-informacion/informacion/estado-sanitario/informes-epidemiologicos-anuales/10066-2023-informe-sobre-situacion-sanitaria-de-costa-rica/file
Cumulative screwworm infestation cases in cattle between 2023 and 2024	10,611	Servicio Nacional de Sanidad Animal - Costa Rica https://www.senasa.go.cr/informacion/centro-de-informacion/informacion/estado-sanitario/boletines-epidemiologicos-extraordinarios-gusano-barrenador-1/10237-2025-01-04-boletin-epidemiologico-extraoridnario-gusano-barrenador/file
Cumulative screwworm infestation cases in cattle in 2024	10611 - 142	See above
Cattle numbers in Costa Rica in 2023	~ 1.5 million	Instituto Nacional de Estadísticas y Censos - Costa Rica https://admin.inec.cr/sites/default/files/2024-10/reagropecENAPECUARIO2023-01.pdf

Cattle numbers in Costa Rica in 2024	~ 2 million	Food and Agriculture Organization of the United Nations https://www.fao.org/faostat/en/#compare
Cattle cases in 2024 by 10 thousand animals	(10611 - 142) * 10000/1600000 or (10611 - 142) * 10000/2000000	-

Supplementary Figure S2. Pig (*Sus scrofa*) infested with *Cochliomyia hominivorax* larvae found in Laguna del Tigre National Park, Petén, Guatemala.