Integrative Health and Sciences. 2026; 3(1):80
doi: 10.63688/ihs.v3.i1.80

ORIGINAL

Impact of socio environmental problems on human health and well-being in communities near the Cofán Bermejo Reserve

Impacto de los problemas socioambientales en la salud y bienestar humano en comunidades cercanas a la Reserva Cofán Bermejo

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Submitted: 09-01-2026 | Revised: 02-02-2026 | Accepted: 20-03-2026 | Published: 21-03-2026

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ABSTRACT

The analysis focused on how socio-environmental factors affect the decline in the three-toed sloth (Bradypus variegatus) population in the Cofán Bermejo Ecological Reserve, located in the Cascales canton, Sucumbíos province, during the years 2025 to 2026. The purpose was to study the connection between human activities and the conservation of this species in an Amazonian environment. A mixed-methods approach, both descriptive and cross-sectional, was used, combining quantitative analysis from surveys conducted with 32 residents of the area, along with qualitative analysis through a semi-structured interview with a park ranger and direct observations in the field. The findings showed a notable perception of deforestation, the growth of agriculture, illegal logging, and extractive activities as the main threats to the ecosystem, linked to the fragmentation of arboreal habitat and the reduction of suitable spaces for the species. In addition, a community agreement on the decline in the number of sightings of the sloth was corroborated. It was concluded that the observed reduction in the population of Bradypus variegatus was related to the gradual deterioration of its habitat and to local socioeconomic factors, thus highlighting the urgency of carrying out comprehensive conservation strategies based on ecological monitoring, environmental education and institutional strengthening.

Keywords: sloth; socio-environmental problems; deforestation; environmental conservation; Cofán Bermejo Reserve.

RESUMEN

El análisis se centró en cómo los factores socioambientales afectan la disminución de la población del oso perezoso de tres dedos (Bradypus variegatus) en la Reserva Ecológica Cofán Bermejo, ubicada en el cantón Cascales, provincia de Sucumbíos, durante los años 2025 a 2026. El propósito fue estudiar la conexión entre las actividades humanas y la conservación de esta especie en un entorno amazónico. Se utilizó un enfoque mixto, tanto descriptivo como transversal, que combinó un análisis cuantitativo a partir de encuestas realizadas a 32 residentes de la zona, junto con un análisis cualitativo a través de una entrevista semiestructurada a un guardaparque y observaciones directas en el terreno. Los hallazgos mostraron una notable percepción de la deforestación, el crecimiento de la agricultura, la tala ilegal y actividades extractivas como las principales amenazas para el ecosistema, vinculadas a la fragmentación del hábitat arbóreo y la reducción de los espacios adecuados para la especie. Además, se corroboró un acuerdo comunitario sobre la disminución en la cantidad de avistamientos del oso perezoso. Se llegó a la conclusión de que la reducción observada en la población de Bradypus variegatus estaba relacionada con el deterioro gradual de su hábitat y con factores socioeconómicos locales, destacando así la urgencia de llevar a cabo estrategias integrales de conservación que se basen en el monitoreo ecológico, la educación ambiental y el fortalecimiento institucional.

Palabras clave: oso perezoso; problemas socioambientales; deforestación; conservación ambiental; Reserva Cofán Bermejo.

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INTRODUCTION

The Ecuadorian Amazon is among the most diverse regions on Earth. Therefore, the Amazon stands out for being among the territories with the greatest biodiversity, containing a wide variety of flora and fauna [1].

Within the Amazon, the Cofán Bermejo Reserve is a protected area located in Cascales Canton, Sucumbíos Province; this reserve was created in 2002 with the aim of conserving the region's biodiversity and the natural resources of the Cofán, among the oldest indigenous ethnic groups in the Amazon [2]. The area plays a fundamental role in protecting humid tropical forest ecosystems and in preserving wildlife species that require good condition of the upper tree cover for survival.

However, in recent years, this protected area has faced many social and environmental pressures that threaten its ecological balance and the survival of several species, including the 3-toed sloth (Bradypus variegatus), a species essential to Amazonian ecosystems due to its contribution to forest dynamics and the nutrient cycle. According to Animal Bank, sloths "constitute the largest proportion of the biomass of the tropical moist forest", which demonstrates their ecological importance [3]. However, in the Cofán Bermejo Ecological Reserve, this species faces multiple threats that are deteriorating its conservation status.

In the Cofán Bermejo Ecological Reserve, Bradypus variegatus plays an important ecological role as a primary consumer and as a biological indicator of the forest's conservation status. The stable presence of this species is usually associated with ecosystems with high vegetation cover, low human disturbance, and adequate ecological connectivity. The greatest loss of wildlife is habitat destruction; annually, large extensions of forest are destroyed due to the spread of agricultural and urban areas, with a deteriorating effect on wildlife [4]. Nevertheless, the continuous loss of its natural habitat due to human activities has evidenced signs of decline in its local population, which is alarming given the ecological and conservation value of the reserve.

Likewise, the Cofán Bermejo Ecological Reserve faces an increase in socio-environmental conflicts, where the development of mining, especially mining carried out illegally, stands out as among the most significant impact aspects. Irregular gold extraction has moved closer to the Cofán Bermejo Ecological Reserve, which was among the best-preserved protected areas in Sucumbíos because it was far from urban or oil pressures. In a previous report, MAAP documented that between 2020 and 2024, 337 hectares of the buffer zone were affected by illicit activity. Furthermore, a hectare was already within the boundary of the Reserve [5]. Overall, these interactions cause a gradual deterioration of the natural environment, altering forest composition and reducing access to the vital resources that enable the existence of the sloth.

Deforestation and forest fragmentation are additional causes of the decline of this sloth species. According to the International Union for Conservation of Nature, these "are among the principal threats to Bradypus variegatus, since they interrupt the continuity of the tree canopy, forcing individuals to descend to the ground to move between vegetation patches" [6]. This situation increases the risk of mortality from predation, roadkill, and contact with human activities. Furthermore, the loss of connectivity limits gene flow between populations, favoring isolation and weakening the long-term viability of the species.

We also identified illegal wildlife trafficking as a threat to these sloths and to many species. This illicit activity involves the capture, transport, and unregulated trade of individuals extracted from their natural habitats. The sloth species is frequently a victim of illegal trafficking, mainly because of its docile appearance, slow behavior, and the perception that it can be kept as a pet. In many cases, offspring are captured after the death or forced separation of the mother, which significantly increases both direct and indirect mortality in the species. These practices reduce reproductive success and affect the stability of wild populations [7].

Although the sloth (Bradypus variegatus) is an important species for forest balance and currently faces an increasing number of human activities that affect its habitat in the Cofán Bermejo Ecological Reserve, few local studies systematically analyze the relationship between these environmental problems and the decline of the species. This lack of information hinders the development of adequate conservation strategies adapted to the reality of the territory.

In this sense, this study is locally relevant because it provides an integrated analysis of socio-environmental problems and their relationship to the status of the sloth in the reserve. Consistent with this need, the study aims to analyze the socio-environmental problems that affect the decline of Bradypus variegatus populations, identify the main threats present in the territory, and describe their relationship with the conservation of the species. In this context, socio-environmental problems not only affect biodiversity and ecosystems but also have direct and indirect implications for the

health and well-being of nearby human populations. Environmental degradation, deforestation, and alteration of natural habitats can influence air quality, access to essential resources, and ecological balance, increasing health risks and affecting the living conditions of communities. From an integrative health approach, it is essential to analyze these interrelationships to comprehensively understand the effects of environmental dynamics on human health.

METHODS

Type of research

This study is mixed-methods research because it integrates quantitative and qualitative approaches. This approach was selected because it allows complex phenomena to be understood from a broader perspective, combining the measurement of numerical data with the analysis of social perceptions and meanings. In socio-environmental studies, the mixed approach is pertinent because ecological problems involve not only measurable variables but also social and cultural dynamics [8].

The quantitative approach, according to Monkey, "is a methodology that helps collect numerical data that can be used to measure variables" [9]. In this research, it allowed measurable data to be obtained on the socio-environmental problems affecting the sloth through surveys. In turn, the qualitative approach, as Barrantes points out, "focuses on the study of the meanings of human actions and social life" [10]. This allows for assessing the perceptions and experiences of local actors through interviews, enriching the analysis of the phenomenon studied.

Both approaches were integrated during the interpretation phase. The statistical results obtained from the surveys were contrasted with and complemented by the qualitative information, allowing a more complete explanation of the relationship between human activities and the decline of the brown-throated sloth (Bradypus variegatus).

Type of study

The study was descriptive and cross-sectional. It was descriptive because it characterized the socio-environmental conditions and the perception regarding the conservation status of the species without manipulating variables. It was cross-sectional because data collection was conducted in a single period (2025–2026), allowing analysis of the situation at a specific point in time.

Population and sample

Population

The population consisted of people who lived in the Cofán Bermejo Ecological Reserve and surrounding areas and who maintained a direct relationship with the environment and with the socio-environmental activities carried out in the area. In addition, during the study period, 3 sloths sighted within the research area were recorded; these formed part of the analytical context related to the conservation status of the species. Sloth records were obtained through direct observation during daytime field surveys. An observation form was used as the recording technique; it included the approximate location, the behavior of the individual, and the characteristics of the environment where the individual was observed. In total, 3 field trips were conducted during the research period.

Sample

The sample consisted of 32 people who lived in or near the Cofán Bermejo Ecological Reserve. Participants were selected through non-probabilistic sampling based on accessibility and relevance criteria for the study. Although the sample size is small, it is methodologically acceptable in exploratory studies of local scope, whose main objective is to identify initial trends and perceptions rather than to make statistical generalizations [11].

Data collection techniques

2 instruments were used for data collection. The structured survey consisted of 12 closed-ended questions organized into 3 dimensions: environmental problems present in the area, interaction between the community and wildlife, and perception of and willingness toward conservation actions, to obtain quantitative data on these socio-environmental issues.

In addition, a semi-structured interview was conducted with a park ranger from the reserve, using questions aimed at identifying ecological threats, territorial dynamics, and institutional

conservation strategies. The research adhered to fundamental ethical principles. Verbal informed consent was obtained from participants before the administration of the instruments. Confidentiality and anonymity of the collected information were guaranteed. In addition, community authorization was obtained to conduct the fieldwork, respecting local norms and the cultural context.

Data Analysis Procedure

Data analysis was conducted through the organization and review of the information collected during fieldwork and documentary review. Quantitative data were organized into tables and analyzed using descriptive statistics (frequencies and percentages), which allowed the identification of trends regarding the presence of the sloth and the state of its habitat.

Qualitative data from interviews and observations were examined through content analysis, identifying common ideas and patterns related to socio-environmental problems. Finally, both sets of results were integrated to determine the influence of human activities on the population decline of Bradypus variegatus in the Cofán Bermejo Ecological Reserve.

RESULTS

Survey

Table 1. What is your relationship with the area of the Cofán Bermejo Reserve?

Response	Frequency	Percentage (%)
Resident of the area	30	93,8
Sector worker	2	6,3
Frequent visitor	0	0
Institutional authority or personnel	0	0
Total	32	100

Note. The vast majority of respondents (93.8%) are inhabitants of the community, which indicates that the results come mainly from people with direct and permanent contact with the area. This provides high reliability for the perception of environmental changes and the situation of the sloth, as it is based on everyday experience rather than occasional observation.

Table 2. How long have you lived in or had contact with the area?

Response	Frequency	Percentage (%)
Less than 1 year	3	9,4
Between 1 and 5 years	2	6,3
Between 6 and 10 years	14	43,8
More than 10 years	13	40,6
Total	32	100

Note. More than 80% of participants have lived in or had contact with the area for more than 6 years, with a predominance of those who have been there for between 6 and 10 years (43.8%) and more than 10 years (40.6%). This suggests that the surveyed population has historical knowledge of the territory, which enables the identification of progressive environmental changes and trends in the presence of the sloth.

Table 3. What environmental problems have you observed in the area? (Select multiple options)

Response	Frequency	Percentage (%)
Deforestation	28	87,5
Forest burning	1	3,1
Agricultural or livestock expansion	19	59,4
River or soil pollution	30	93,8
Construction of roads or infrastructure	3	9,4
Illegal logging	10	31,3
No problems observed	0	0
Total	32	100

Note. The most frequently reported problems were river and soil contamination (93.8%), deforestation (87.5%), and agricultural or livestock expansion (59.4%). This indicates strong environmental pressure on the ecosystem, especially from human activities that degrade the natural habitat. The presence of illegal logging also reflects processes of unregulated exploitation that contribute to biodiversity loss.

Table 4. Do you consider that these problems affect the sloth's habitat?

Response	Frequency	Percentage (%)
High	27	84,4
Moderate	5	15,6
Low	0	0
Nothing	0	0
Does not know	0	0
Total	32	100

Note. 84.4% consider that these problems greatly affect the sloth's habitat. This indicates a clear perception of a direct relationship between environmental deterioration and harm to the species, reinforcing the idea that ecosystem degradation compromises its survival.

Table 5. Have you observed a decrease in forested areas in recent years?

Response	Quantity	Percentage (%)
Yes, considerably	10	31,3
Yes, slightly	22	68,8
No	0	0
Not sure	0	0
Total	32	100

Note. 100% of respondents perceive a reduction in forested areas, with a predominance of those who consider it to have been slight (68.8%), followed by those who consider it to have been considerable (31.3%). This confirms a continuous process of vegetation cover loss, since vegetation cover is a fundamental element for the life of the sloth.

The results obtained correspond to the social perception of the respondents regarding sloth conservation. Because no direct ecological measurements related to population, habitat, or environmental effects were carried out, the data reflect the opinions and level of awareness of the community.

Interview

Table 6. Which human activities are most frequent in the area? (Select multiple options)

Response	Quantity	Percentage (%)
Agriculture	25	78,1
Livestock	1	3,1
Tree felling	26	81,3
Tourism	2	6,3
Hunting	2	6,3
Oil or extractive activities	32	100
Total	32	100

Note. The most frequently mentioned activities were oil or extractive activities (100%), tree felling (81.3%), and agriculture (78.1%). This demonstrates that the main pressures on the ecosystem come from economic activities that modify the natural environment, favoring habitat fragmentation.

An interview was conducted with a park ranger from the reserve, who mentioned that deforestation, caused by the expansion of agriculture and illegal logging, is among the greatest threats to the sloth. He stated that the decrease in vegetation directly affects the availability of food and shelter for this species.

Likewise, it was stated that environmental education programs focused on nearby communities have helped to increase awareness of the importance of preserving the natural habitat. However, it was stressed that it is essential to improve monitoring and control, both inside and outside the reserve, in order to reduce activities that negatively affect the ecosystem.

The park ranger highlighted that there is a willingness in the community to participate in conservation actions, although greater institutional support and resources are needed to carry out long-term sustainable projects.

DISCUSSION

The findings reveal that the reduction of the sloth population in the Cofán Bermejo Ecological Reserve is closely related to anthropogenic factors characteristic of the region, such as deforestation, the expansion of agriculture and livestock farming, illegal logging, and extractive activities. These results confirm the initial hypothesis of the study, which proposed that human activities constitute the main factor associated with the decline of this species in the area. The loss of vegetation and habitat fragmentation directly affect the availability of food, shelter, and connectivity of the tree canopy, which are essential elements for arboreal species such as the sloth [4-6].

These findings are consistent with studies conducted in Amazonian and tropical ecosystems, which indicate that forest fragmentation has a significant impact on species with limited mobility and high dependence on the canopy. Previous research has demonstrated that the loss of tree cover forces these animals to move on the ground, increasing the risk of predation, roadkill, and illegal capture [4,6,7]. In this sense, the results of the present study align with existing scientific literature. However, the distinctive contribution of this research lies in the incorporation of community perception as a key element for understanding the socio-environmental context surrounding the issue.

Likewise, the results show that the community recognizes the importance of environmental education and social participation as fundamental strategies for conservation. This finding aligns with contemporary approaches to environmental management, which hold that effective conservation requires not only ecological measures but also the active involvement of local communities and institutional strengthening. A relevant aspect is that no results contradictory to the reviewed literature were identified; on the contrary, the data obtained reinforce trends already documented in other Amazonian contexts.

However, it is important to note that the data are based mainly on perceptions obtained through surveys and interviews and therefore do not constitute a direct ecological measurement of the sloth population. Consequently, the results reflect social and community trends but do not provide precise estimates of population density or actual rates of decline.

This study has limitations that should be considered when interpreting the findings. First, the sample size was small (n = 32), which limits the generalizability of the results to other populations or territories, affecting external validity. Second, because it is based on opinions and perceptions, subjective biases may influence the internal validity of the study. In addition, no direct environmental measurements or systematic population monitoring were conducted, which restricts the ecological precision of the conclusions. Finally, the interview was conducted with a single key informant (park ranger), which limits the diversity of technical perspectives.

Despite these limitations, the study has important implications at both the theoretical and practical levels. From a theoretical perspective, it provides evidence that reinforces the relationship between anthropogenic pressure and the vulnerability of arboreal species in Amazonian contexts. In practical terms, the findings underscore the need to strengthen environmental education programs, implement more rigorous population monitoring systems, and promote participatory conservation strategies that actively involve the local community. Thus, the research constitutes a starting point for future studies that further investigate quantitative ecological analysis and contribute to the design of more effective conservation policies.

CONCLUSIONS

The study showed that human actions such as tree felling, expanding agriculture, pollution, and resource exploitation are causing considerable impact on the local ecosystem. The local population observes a gradual decrease in forested areas and understands that these changes directly affect the ecological balance of the area.

Furthermore, it was found that the sloth's environment is severely affected. The reduction of forests and the fragmentation of natural habitats limit its feeding and refuge sites, which endangers its survival and promotes its migration to areas more altered by human activity.

Similarly, it was found that interactions between the community and the sloth are common, although generally occasional, including actions such as hunting attempts. However, a high willingness among inhabitants to join environmental education initiatives and conservation campaigns was observed, which provides a valuable opportunity to improve protection actions for this species.

Overall, the findings reveal a clear awareness within the community regarding environmental

degradation and the risk faced by sloths due to human activities. This highlights the urgent need to implement sustainable conservation strategies based on active community participation and effective safeguarding of natural habitats.

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FUNDING

Not applicable.

CONFLICT OF INTEREST

Not applicable.

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