Recovery Implementation Strategy
for the
Mexican Long-nosed Bat (*Leptonycteris nivalis*)

Southwest Region
U.S. Fish and Wildlife Service
Albuquerque, New Mexico

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This Recovery Implementation Strategy (RIS) supplements the Mexican Long-nosed Bat Recovery Plan (Recovery Plan, U.S. Fish and Wildlife Service (USFWS) 2024). This document describes in greater detail how the site-specific, prioritized actions outlined in the Recovery Plan will be implemented and includes more detailed estimates of the time and costs to complete recovery. The RIS may be revised at any time during the recovery process, whenever experience and information gained call for a change in approach, thereby maximizing flexibility of recovery implementation. As used here, "actions" are broad measures that clearly describe what needs to be done to accomplish the goal of long-term viability. "Activities" are the detailed, on-the-ground tactical steps needed to implement the higher-level recovery actions.

Prioritized recovery actions from the Recovery Plan and their associated activities are listed in the Implementation Schedule below (Table 1). Priority 1 actions and activities are defined as those that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future. Priority 2 actions and activities are those that must be taken to prevent a significant decline in population size or habitat quality or some other significant negative impact. Priority 3 actions and activities are all other measures that are necessary to provide for full recovery of the species. The assignment of priorities does not imply that some actions and activities are of low importance, but instead implies that lower priority items may be deferred while higher priority items are being implemented. Please refer to the Recovery Plan for a clear association among listing factors, threats, and recovery actions affecting the survival of the Mexican long-nosed bat (USFWS 2024; Table 1, p 18).

The Implementation Schedule (Table 1) is intended to assist the USFWS and other stakeholders in planning and implementing activities to carry out the recovery actions in the Recovery Plan. The Implementation Schedule includes activity numbers; activity descriptions; activity duration; potential responsible parties; and estimated costs. It is a guide for planning and meeting the objectives discussed in this strategy. The Implementation Schedule currently estimates costs for carrying out the next 40 years of recovery activities, as well as the total estimated cost to implement activities through the year 2064, the approximate date to reach the goal of recovery. Actual expenditures by agencies and other partners are contingent upon appropriations and other budgetary constraints.

While the Endangered Species Act of 1973 (ESA), as amended (54 FR 2131), assigns a strong leadership role to the USFWS for the recovery of listed species, it also recognizes the importance of other federal agencies, States, and other stakeholders in the recovery process. The "Responsible Parties" column of the Implementation Schedule identifies partners who can make significant contributions to specific recovery tasks. The identification of agencies and other stakeholders within the Implementation Schedule does not constitute any additional legal responsibilities beyond existing authorities (e.g., ESA).

LITERATURE CITATIONS AND AVAILABILITY

Literature citation should read as follows:

U.S. Fish and Wildlife Service. 2024. Mexican Long-nosed Bat Recovery Implementation Strategy. Southwest Region, Austin, Texas, USA. 17 pages.

An electronic copy of this RIS and Recovery Plan will be made available at: Austin Texas USFWS Field Office webpage and ECOS species profile for Mexican long-nosed bat webpage.

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Recovery Action 1. Conserve, Restore, and Protect Habitat: This action includes the successful conservation, restoration, and protection of foraging habitat. This means securing land rights and protection status for all caves, enforcing existing laws, and creating action protocols for monitoring, reporting, and resolving threats covered by laws and regulations (e.g., chain of command, jurisdictions, enforcement mechanisms, coordination among institutions, etc.). It also includes defining a strategy for land acquisition, management, and promoting sustainable practices that minimize disturbance.

1. Enforce existing laws to halt further development and construction of buildings (of any type) on land directly on top of Cueva del Diablo.
Since Cueva del Diablo is the only known mating roost of the Mexican long-nosed bat, it is critical that any development and construction cease and be prohibited. This roost is currently federally protected, but destructive activities may still be taking place. This work will require coordination between Mexico's federal government and ejidos in the area.

2. Compile an exhaustive record of landowners and stakeholders related to Cueva del Diablo and the associated protected area.
This record will support the coordinated protection of Cueva del Diablo and increase local buy-in to ensure continued health of the roost.

3. Design, with authorities, an action protocol for monitoring, reporting, and resolving threats covered by laws and regulations (e.g., chain of command, jurisdictions, enforcement mechanisms, coordination among institutions, etc.) for Cueva del Diablo.
In order to support the long-term persistence of the Cueva del Diablo roost, a reliable, effective, and realistic action plan should be drafted and implemented.

4. Secure land rights for Cueva del Diablo. Define a strategy for land acquisition, project socialization, and management. Search and prepare proposals for potential funding agencies. When funding is available, implement strategy for land acquisition.
Due to Cueva del Diablo's highly sensitive nature (i.e., changes to the cave's air flow and temperature caused by development have the potential to render it useless to the species) and its importance as the only known mating roost for the Mexican long-nosed bat, one way to ensure the long-term persistence of the cave is to purchase land on top of and in close proximity of the roost. A land acquisition strategy is a key strategic step to protecting this roost.

5. Halt mining activities that disrupt the Todos Santos roost.
Caves used by the Mexican long-nosed bat have particular air flow and temperature regimes. Mining activities threaten to alter these patterns, which has the potential effect of rendering the cave useless as a roost. Therefore, mining activities at Todos Santos roost should be suspended. Pursuance of this goal should include collaboration with the federal and local governments.

6. Grant state and federal protection status to the Todos Santos roost and habitat buffer.
Official protection of the land both atop and surrounding the roost will support the long-term health of the cave as a roost for the Mexican long-nosed bat.

7. Continued federal protection of Emory Cave. Continue limited human access and prohibitions against trespassing. Monitor cave entrance remotely to identify human impact on roost.
Emory Cave is the primary maternity roost for the Mexican long-nosed bat in the U.S. As such, it is extremely important to the ongoing health of the species. The exact location of the roost is remote and located away from hiking trails, which has resulted in minimal disturbance. Going forward, areas around the roost should continue to be monitored to ensure trespassing does not occur. If off-trail access to the cave is detected, these access areas should be blocked with shrubbery and obscured from view of the trail.

8. Protect any additional roosts identified across the species range.
As a migratory species, the Mexican long-nosed bat requires roosts throughout the range to support its year-round roosting and migration. Therefore, any and all roosts are worthy of conservation and protection.

9. Enforce existing regulations to protect Infierno Cave from disturbance by cave visitors and dumping.
As the only confirmed maternity roost in northeastern Mexico, Infierno Cave benefits from federal protection, but can still be subject to degradation. Existing federal protections should be enforced to ensure this critical cave remains in good condition.

10. Deter any future guano mining in Rosillo Cave. If necessary, promote sustainable practices that minimize disturbance.
Rosillo Cave is a potential additional maternity roost in northeastern Mexico that benefits from federal protection. Protecting the cave from disturbances and enforcing its protections will help ensure the long-term viability of the Mexican long-nosed bat.

11. Minimize land degradation and promote sustainable agricultural practices (e.g., using agave as a tool for soil erosion control and soil restoration) within 50 kilometers (km) [31 miles (mi)] of all roosts and along the migratory pathway, ensuring maintenance of *Agave* species diversity across the range.
The Mexican long-nosed bat needs access to foraging resources in close proximity of where they roost and along their migration pathway. By minimizing destruction of foraging resources for the bats within 50 km (31 mi) of all roosts and along the migratory pathway, the current condition of their range can be preserved.

Recovery Action 2. Establish Agave Restoration Program: This action includes agave replanting, along with teaching and supporting bat-friendly management practices (e.g., limit harvest and/or support current practices that maintain agave populations, allow development of flowering stalks, reduce or eliminate cattle foraging to induce recruitment of young agave) in areas where cultivated and wild agave are harvested for human consumption.

1. Agave replanting and bat-friendly management practices (e.g., limit harvest and/or support current practices that maintain agave populations, allow development of flowering

stalks, reduce or eliminate cattle foraging to induce recruitment of young agave) in areas where cultivated and wild agave are harvested for human consumption.
Agave species are a critical species of plant material needed for the survival of the Mexican long-nosed bat. Replanting agave that has been harvested can help to maintain the current condition. Further, additional planting of agave can help improve the condition of the range.

Recovery Action 3. Identify Effective Management Strategies: Project and adapt restoration and management plans according to climate change projections for all roosts and along the migratory pathway.

1. Project and adapt restoration and management plans in response to climate change projections for all roosts and along the migratory pathway.
The suitability of each roost is dependent on its features, including air flow and temperature. As climate change projections predict warmer climates, it will be imperative to anticipate and plan for changes to the subterranean roost environment and the aboveground habitat and foraging grounds of the Mexican long-nosed bat.

Recovery Action 4. Research including but not limited to:

1. Conduct a study and design a strategy to preserve the structural integrity of the Aguacatitla roosting tunnel in the long-term. Repair the main roosting tunnel to prevent collapse and maintain integrity of the entrance.
Aguacatitla Tunnel currently lacks structural integrity. Since it has previously been reported to have an estimated population size of 13,596 bats and is recognized as a major roost for the species, its conservation is imperative. Improving structural integrity will continue to ensure the long-term viability of the Mexican long-nosed bats that utilize this roost.

2. Identify potential roost locations using a habitat model.
While 30 previously reported and potential roosts of the Mexican long-nosed bat have been identified, there may be more unidentified roosts across the range, some of which may be critical to the ongoing longevity of the species. By creating a habitat model, using the features common to confirmed roosts (e.g., elevation, geology, and vegetation), previously unidentified roosts can be detected, protected, and managed for species health.

3. Conduct research on the location of migratory pathways and foraging grounds and roosts associated with them.
By researching the location of migratory pathways and foraging grounds for the Mexican long-nosed bat, conservation activities can be targeted to ensure an appropriate amount of foraging material is available throughout the range. It can also help support the detection of previously undocumented roosts, so they can be protected and managed for long-term viability.

4. Track bat movements to identify alternate roosts near known roosts.

Research that leverages the existing locations of Mexican long-nosed bat roosts to survey for and identify previously undocumented roosts can: broaden knowledge of the range, identify new roosts critical to species health, and inform where conservation efforts should be applied.

5. Determine the diet of the bat across the range to identify *Agave* species that are part of the Mexican long-nosed bat's diet, as well as other potential food resources.
A better understanding of what plant species Mexican long-nosed bat forages on at different times of the year and locations of the range can be used to target conservation and replanting efforts.

6. Research the threat and effect of fire on *Agave* species.
Wildfire has the potential to significantly disrupt the Mexican long-nosed bat's range, as extensive fire can decimate its foraging resources. Understanding the effect of wildlife on *Agave* species will support land managers in planning for the protection of foraging resources.

Recovery Action 5. Education & Outreach: Promote and enforce cave-friendly conservation and management practices through environmental education and public outreach programs for all roosts. Develop environmental awareness programs to support bat-friendly agave management and land restoration programs using agave for all roosts.

1. Promote and enforce cave-friendly conservation and management practices through environmental education and public outreach programs for all roosts.
The ongoing preservation of roosts is contingent upon minimal disturbance by human visitors. By promoting and enforcing cave-friendly conservation and management practices, standardized management protocols can be enacted, and the public can better understand how to interact with caves without disturbing their sensitive ecosystems.

2. Develop environmental awareness programs to support bat-friendly agave management and land restoration programs using agave for all roosts.
Ensuring the long-term health and viability of the Mexican long-nosed bat will require that foraging resources are available throughout the range. By developing programs that support agave management and land restoration, stewards of the Mexican long-nosed bat can grow the coalition of individuals working to maintain a suitable environment for the species.

Recovery Action 6. Effective Planning and Coordination: Host a workshop with Nivalis Conservation Network (NCN) and the government of Mexico (Commission on Natural Protected Areas [CONANP]) to design and approve the PACE (Action Program for the Conservation of Species) and link it to management plans for protected areas in Mexico. This work will include partnering with other protected lands in the vicinity of each roost and conducting meetings with landowners, stakeholders, and authorities to raise awareness of laws and regulations that protect the species and its habitat for all roosts. It will also include development of a fire management plan for Big Bend National Park that addresses

the protection of Emory Cave and work with the Bureau of Land Management to create a management plan for Romney Roost.

1. Workshop with NCN and CONANP to design and approve the PACE and link it to management plans for protected areas in Mexico.
Conserving the Mexican long-nosed bat across the many regions of Mexico and the U.S. will require coordination with the U.S. government, government of Mexico, and NCN, a group comprised of academic researchers and stewards deeply familiar with the species. A PACE will standardize conservation practices throughout the species' range.

2. Partner with other protected lands in the vicinity of each roost and conduct meetings with landowners, stakeholders, and authorities to raise awareness of laws and regulations that protect the species and its habitat for all roosts.
The expansive nature of the Mexican long-nosed bat's range necessitates a coalition of land stewards to effectively manage the landscape for the ongoing health of the species. Partnering with a variety of individuals will allow for a large-scale, coordinated conservation effort.

3. Fire management plan for Big Bend National Park and Emory Cave
As the site of the primary maternity roost in the U.S., it is critical that Big Bend National Park have a fire management plan that addresses the protection of Emory Cave. This will help avoid or minimize the effects of wildfire both in the cave and on nearby foraging grounds.

Recovery Action 7. Expand Monitoring: Design a standardized monitoring program for roosts and foraging habitat across the species' range.

1. Design a standardized monitoring program for roosts and foraging habitat across the species' range.
The long-term health and viability of the Mexican long-nosed bat cannot be verified until there is a standardized monitoring program in place for all roosts and foraging grounds. This will support confirmation of the health of roosts and foraging grounds, and, in the event that an area is experiencing negative disturbances, will allow stewards to identify where conservation practices are most needed.

2. Monitor the phenology of *Agave* species across the Mexican long-nosed bat's range.
Monitoring the phenology of *Agave* species can provide clues as to how the range of the Mexican long-nosed bat will change as climate change progresses and support planning efforts.

3. Monitor nightly behaviors of the Mexican long-nosed bats near roosts between May and August to identify important foraging areas.
The protection, conservation, and restoration of foraging areas is dependent on an understanding of foraging area locations and the relative important of each. Monitoring of nightly behaviors can help inform these practices and ensure that they are effective.

4. Monitor poorly known roosts or potential roosts for demographics, seasonality, stability, etc. and evaluate the conservation status of historical roosts and determine their contribution to the viability of the species.

Monitoring known and potential roosts can help direct limited resources to the areas where they will have the greatest impact.

Table 1. Implementation schedule for next 40 years of recovery actions (2024–2064) for the Mexican long-nosed bat, along with Responsible parties. Responsible party acronyms are as follows: Procuraduría Federal de Protección al Ambiente (PROFEPA); Commission on Natural Protected Areas (CONANP); Non-governmental organizations (NGOs); Secretaría de Economía (SE); Secretaria de Medio Ambiente y Recursos Naturales (SEMARNAT); Red Latinoamericana y del Caribe para la Conservación de los Murciélagos (RELCOM); Secretaria de Agricultura y Desarrollo Social (SADER); and Comision Nacional Forestal (CONAFOR).

Priority	Action	Recovery Action	Action Duration (years)	Responsible Parties	Total Estimated Cost ($1,000s)	Estimated Cost ($1,000s) by Fiscal Years					
						1-5	6-10	11-15	16-20	21-30	31-40
1	1.1	Enforce existing laws to halt further development and construction of buildings (of any type) on land directly on top of **Cueva del Diablo**.	20	CONANP, PROFEPA, State and Local Government	48	12	12	12	12	0	0
1	1.2	Complete an exhaustive record of landowners and stakeholders related to **Cueva del Diablo** and the associated protected area.	5	CONANP, State and Local Government	2	2	0	0	0	0	0
1	1.3	Design, with authorities, an action protocol for monitoring, reporting, and resolving threats covered by laws and regulations (e.g., chain of command, jurisdictions, enforcement mechanisms, coordination among institutions, etc.) for **Cueva del Diablo.**	20	CONANP, PROFEPA,	51	27	12	6	6	0	0

1	1.4	Secure land rights for **Cueva del Diablo.** Define a strategy for land acquisition, project socialization, and management. Search and prepare proposals for potential funding agencies. When funding is available, implement strategy for land acquisition.	20	Academic institutions, NGOs, CONANP, State and Local Government	314	202	17	17	16	31	31
1	1.5	Halt illegal mining activities that disrupt the **Todos Santos** roost.	20	CONANP, State and Local Government, SE	100	100	0	0	0	0	0
1	1.6	Grant state and federal protection status to the **Todos Santos** roost and habitat buffer.	10	CONANP, SEMARNAT, State and Local Government, RELCOM	102	102	0	0	0	0	0
1	1.7	Continued federal protection of **Emory Cave**. Continue limited access to tourists and limited knowledge of the cave location. Monitor cave entrance remotely to identify human impact on roost.	40	CONANP, State and Local Government, NGOs	66	11	11	11	11	11	11

1	1.8	Protect any additional roosts identified across the species range.	40	CONANP, State and Local Government, Academic Institutions	112	112	0	0	0	0	0
1	1.9	Enforce existing regulations to protect **Infierno Cave** from disturbance by cave visitors and dumping.	40	CONANP, State and Local Government, NGOs	92	17	15	15	15	15	15
1	1.10	Deter any future guano mining in **Rosillo Cave**. If necessary, promote sustainable practices that minimize disturbance.	40	CONANP, State and Local Government, NGOs	32	7	5	5	5	5	5
1	1.11	Minimize land degradation and promote sustainable agricultural practices (e.g., using agave as a tool for soil erosion control and soil restoration) within 50 kilometers (31 miles) of **all roosts** and along the **migratory pathway,** ensuring maintenance of *Agave* species diversity across the range.	40	CONANP, SADER, CONAFOR, State and Local government, Academic Institutions, NGOs	1,017	340	340	169	86	65	17

1	2.1	Agave replanting and bat-friendly management practices (e.g., limit harvest and/or support current practices that maintain agave populations, allow development of flowering stalks, reduce or eliminate cattle foraging to induce recruitment of young agave) in areas where cultivated and wild agave are harvested for human consumption.	40	CONANP, SADER, CONAFOR, Academic Institutions, State and Local government, NGOs	3,383	1,354	1,017	510	257	193	52
2	3.1	Project and adapt restoration and management plans according to climate change projections for **all roosts** and along the **migratory pathway**.	40	CONANP, SEMARNAT, CONAFOR, Academic Institutions	124	16	16	16	16	30	30
2	4.1	Conduct a study and design a strategy to preserve the structural integrity of the **Aguacatitla** roosting tunnel in the long-term. Repair the main roosting tunnel to prevent collapse and maintain integrity of the entrance.	40	Academic institution, NGOs, Aguacatitla landowners	96	21	11	11	11	21	21

2	4.2	Identify potential roost locations using a habitat model.	5	Academic Institutions	500	500	0	0	0	0	0
2	4.3	Research on the location of migratory pathways and foraging grounds and roosts associated with them.	10	Academic Institutions	1,008	504	504	0	0	0	0
2	4.4	Track bat movements to identify alternate roosts near known roosts.	10	Academic Institutions	708	504	204	0	0	0	0
2	4.5	Determine the diet of the bat across the range to identify *Agave* species that are part of the diet as well as food resources other than agave.	10	Academic Institutions	308	244	64	0	0	0	0
2	4.6	Research the threat and effect of fire on agave.	40	Academic Institutions, CONAFOR	281	151	26	26	26	26	26
2	5.1	Promote and enforce cave-friendly conservation and management practices through environmental education and public outreach programs for **all roosts.**	40	CONANP, NGOs, Academic Institutions	326	42	42	42	42	79	79
2	5.2	Develop environmental awareness programs to support bat-friendly agave management and land restoration programs using agave for **all roosts.**	40	CONANP, NGOs, Academic Institutions	144	49	19	19	19	19	19

3	6.1	Workshop with Nivalis Conservation Network and the government of Mexico (Commission on Natural Protected Areas CONANP) to design and approve the PACE (Action Program for the Conservation of Species) and link it to management plans for protected areas in Mexico.	5	CONANP, Academic Institutions, NGOs	19	19	0	0	0	0	0
3	6.2	Partner with other protected lands in the vicinity of each roost and conduct meetings with landowners, stakeholders, and authorities to raise awareness of laws and regulations that protect the species and its habitat for **all roosts.**	40	SEMARNAT, PROFEPA, CONANP, State and Local Government	636	61	61	61	91	181	181
3	6.3	Fire management plan for Big Bend National Park and **Emory Cave**	40	federal government	90	30	30	30	0	0	0
3	7.1	Design a standardized monitoring program for roosts and foraging habitat across the species' range.	10	CONANP, Academic Institutions	44	22	22	0	0	0	0
3	7.2	Monitor the phenology of *Agave* species across the species' range.	40	Academic Institutions	187	52	27	27	27	27	27

3	7.3	Monitor nightly behaviors of the Mexican long-nosed bats near roosts between May and August to identify important foraging areas.	10	Academic Institutions	308	204	104	0	0	0	0
3	7.4	Monitor poorly known roosts or potential roosts for demographics, seasonality, stability, etc. and evaluate the conservation status of historical roosts and determine their contribution to the viability of the species.	5	Academic Institutions, CONANP	1,129	1,129	0	0	0	0	0
		TOTAL ESTIMATED COST ($1,000s):		**$**	**11,227**	**5,834**	**2,559**	**977**	**640**	**703**	**514**

Literature Cited

U.S. Fish and Wildlife Service. 2024. Final revised recovery plan for the Mexican long-nosed bat (*Leptonycteris nivalis*). U.S. Fish and Wildlife Service, Southwest Region, Albuquerque, New Mexico. 34 pages.