

**RECOVERY IMPLEMENTATION STRATEGY FOR
TEXAS SNOWBELLS
(*STYRAX PLATANIFOLIUS* SSP. *TEXANUS*)**

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Southwest Region
U.S. Fish and Wildlife Service
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Texas Snowbells Recovery Implementation Strategy

This Recovery Implementation Strategy (RIS) supplements the Texas snowbells revised recovery plan (Recovery Plan, U.S. Fish and Wildlife Service [USFWS] 2018a) and describes in greater detail how the site-specific, prioritized actions outlined in the revised recovery plan will be implemented, and estimates 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 tactics, therefore 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 below (Table 1). Priority 1 actions and activities are defined as those that must be taken to prevent extinction or to prevent the subspecies 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 subspecies. 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 Table 2 for a clear association among recovery actions, activities, and the threats they address.

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Acronyms Used.

CPC	Center for Plant Conservation	RIS	Recovery Implementation Strategy
ESA	Endangered Species Act	SBRP	Selah Bamberger Ranch Preserve
FR	Federal Register	SSA	Species Status Assessment
MVP	Minimum Viable Population	TNC	The Nature Conservancy
NMFS	National Marine Fisheries Service	TPWD	Texas Parks and Wildlife Department
NRCS	Natural Resources Conservation Service	USFWS	U.S. Fish and Wildlife Service

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Table 1. Recovery Actions and Activities.

Priority	Action	Activity	Description
1	1		Promote awareness and conservation of Texas snowbells on private lands in the upper Nueces, West Nueces, and Devils River watersheds.
		1.1	Prepare and distribute written and web-based information sources oriented toward private landowners.
		1.2	Establish personal contacts with interested landowners and work cooperatively with them to survey, monitor, protect, and manage populations.
		1.3	Provide technical and/or financial assistance, as needed, to support surveys, monitoring, protection, and management actions.
	2		Protect remnant populations and individuals of Texas Snowbells from ungulate browsers, and reduce browse intensity through population management of native white-tailed deer and introduced ungulates in the upper Nueces, West Nueces, and Devils River watersheds.
		2.1	Protect vulnerable individuals and colonies using deer fencing or other barriers. This temporary measure is most appropriate for protecting seedlings planted for augmentation and reintroduction, and to enhance spontaneous recruitment where ungulate browsing is intense.
		2.2	Reduce ungulate browsing on a landscape scale through ungulate population management, such as prescribed hunting.
	3		Conduct scientific investigations to guide conservation efforts.
		3.1	Determine the breeding system, pollination and pollinators, and the effect of distance between plants on fertilization rates.
		3.2	Investigate the subspecies' ecology, including habitat requirements, the geographic distribution of potential habitats, and the impacts of native and introduced browsers.
		3.3	Investigate the demography of the subspecies' populations and estimate a minimum viable population size for metapopulations.
		3.4	Investigate population genetics, including overall genetic diversity between and among populations and inbreeding coefficients; establish guidelines for the use of source material for augmentation and reintroduction efforts.

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Priority	Action	Activity	Description
2	4		Augment small populations and isolated individuals to increase reproductive rates, and reintroduce populations to restore gene flow between remnant populations and to increase metapopulation resilience in the upper watersheds of the Nueces, West Nueces, and Devils Rivers. Augmentation and reintroduction may also be appropriate in the Frio, West Frio, Dry Frio, and Sycamore Creek watersheds if natural populations are confirmed there, but is contra-indicated if other subspecies of <i>Styrax platanifolius</i> occur there, since this could lead to hybridization between subspecies.
		4.1	Prepare a controlled propagation and reintroduction plan, addressing the guidelines of the NMFS and USFWS policy (2000).
		4.2	Collect seeds from as many sources and individuals as possible within each metapopulation, following CPC Guidelines to limit impacts to extant populations. Maintain separate samples collected from each individual, and label the collection date and geographic coordinates.
		4.3	Investigate seed dormancy, germination, and viability to make the most efficient use of wild-collected seed.
		4.4	Allocate seed samples from each metapopulation for long-term storage in a seed bank so that metapopulations may be restored following catastrophic losses.
		4.5	Investigate silvicultural methods, leading to pilot reintroductions, to determine the most effective ways to establish viable individuals in the field.
		4.6	Based on the completion of Activities 3.1 through 3.5, augment isolated individuals and colonies with propagated individuals to increase genetic diversity and reproductive rates. Unless genetic studies indicate otherwise, use only source material that originates within the same metapopulation.
		4.7	Based on the completion of Activities 3.1 through 3.5, restore gene flow throughout each metapopulation, and increase metapopulation sizes to MVP levels, by reintroducing colonies into high-potential habitats that are within the pollinator forage ranges of neighboring colonies. Unless genetic studies indicate otherwise, use only propagated source material that originates within the same metapopulation.
		4.8	Monitor all augmentation and reintroduction efforts to determine their effectiveness, identify problems, and improve methods.

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Priority	Action	Activity	Description
3	5		Search for new populations in potential habitats throughout the subspecies' range. In particular, the discovery or confirmation of populations in the Frio, West Frio, Dry Frio, or Sycamore Creek watersheds would increase our knowledge of the subspecies' geographic range and adaptability, and might confer greater ecological and genetic diversity (representation) to the subspecies as a whole.
		5.1.	Conduct surveys for subspecies <i>texanus</i> (with landowner permission) within its known range in the upper Nueces, West Nueces, and Devils River watersheds. Focus on areas with concentrations of high-potential habitat, based on habitat models.
		5.2	Conduct surveys for all subspecies of <i>Styrax platanifolius</i> (with landowner permission) within the upper Frio, West Frio, Dry Frio, and Sycamore Creek watersheds. Focus on areas with concentrations of high-potential habitat, based on habitat models.
	6		Promote conservation and management of native bees, butterflies, and other pollinators in the upper Nueces, West Nueces, and Devils River watersheds.
		6.1	Conduct public outreach to promote pollinator conservation and management in Real, Edwards, Uvalde, and Val Verde counties, Texas.
		6.2	Promote and support the restoration and management of diverse native grasslands and savannas within the subspecies' range, prioritizing habitats that may serve as pollinator sources for Texas snowbells populations.
	7		Verify that viable, self-sustaining populations occur within each recovery unit.
		7.1	Monitor populations within each recovery unit to determine if MVP levels are met or exceeded in each recovery unit over a period of 20 years.
		7.2	Prepare Post-Delisting Monitoring Plan.

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Table 2. Factors affecting the survival of Texas snowbells (U.S. Fish and Wildlife Service 2017) and associated recovery actions, activities, and criteria.

ESA Listing Factors	Threats Description	Recovery		
		Actions	Activities	Criteria
Factor A The present or threatened destruction, modification, or curtailment of its habitat or range	Severe Floods	3, 4, 7	3.2, 4.2, 4.3, 4.4, 4.5, 4.6,7.1	III.1.1.a.
Factor C Disease or predation	Severe browsing by white-tailed deer and introduced ungulates	1, 2, 7	1.1, 1.2, 1.3, 2.1, 2.2, 3.2, 7.1	III.1.1.c.
Factor E Other natural or manmade factors affecting its continued existence	Small population sizes	1, 2, 3, 4, 5, 7	1.1, 1.2, 1.3, 2.1, 2.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.8, 5.2, 5.2, 7.1	III.1.1.a, b.
	Lack of genetic diversity	3, 4, 5, 7	3.1, 3.4, 4.1, 5.1, 5.2, 7	III.1.1.a, b.
	Population fragmentation and isolation	1, 3, 4, 5, 7	1.1,1.2,1.3, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.7, 4.8, 5.1, 5.2, 7.1	III.1.1.a, b.
	Pollinator deficiency	3, 6, 7	3.1, 3.4, 6.1, 6.2, 7.1	III.1.1.a, b.
	Climate changes	3, 4, 7	3.2, 4.2, 4.3, 4.4, 4.5, 7.1	III.2.

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Table 3. Recovery Implementation Schedule and Projected Costs.

Priority	Activity	Description	Threats	Duration (years)	Responsible Parties	Costs (\$1,000s) ¹ and Time Frames (Years)							
						Prior to 2017 ²	1-5	6-10	11-15	16-20	20-30	30-50	Total
1	1.1	Prepare and distribute written and web-based information sources oriented toward private landowners.	A, C, E	65	USFWS; TPWD; TNC; SBRP	5.0	1.0	1.0	1.0	1.0	1.0	1.0	11.0
1	1.2	Establish personal contacts with interested landowners and work cooperatively with them to survey, monitor, protect, and manage populations. ^{3.1, 3.3}	A, C, E	65	SBRP; TNC; TPWD; USFWS; Landowners	35.0	25.0	25.0	25.0	25.0	25.0	25.0	185.0
1	1.3	Provide technical and/or financial assistance, as needed, to support surveys, monitoring, protection, and management actions. ^{3.1, 3.3}	C, E	65	SBRP; TNC; TPWD; USFWS	35.0	25.0	25.0	25.0	25.0	25.0	25.0	185.0
1	2.1	Protect vulnerable individuals and colonies using deer fencing or other barriers. This temporary measure is most appropriate for protecting seedlings planted for augmentation and reintroduction, and to enhance spontaneous recruitment where ungulate browsing is intense. ^{3.1}	C	35	SBRP; TNC; TPWD; USFWS; Landowners	10.0	10.0	10.0	10.0	10.0	0.0	0.0	50.0
1	2.2	Reduce ungulate browsing on a landscape scale through ungulate population management, such as prescribed hunting. ^{3.2}	C	65	TPWD; Private Landowners; TNC	n/a	250.0	250.0	250.0	250.0	250.0	250.0	1,500.0
1	3.1	Determine the breeding system, pollination and pollinators, and the effect of distance between plants on fertilization rates. ^{3.3,3.4}	E	10	TPWD; Academic Institutions	30.0	100.0	0.0	0.0	0.0	0.0	0.0	130.0

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Priority	Activity	Description	Threats	Duration (years)	Responsible Parties	Costs (\$1,000s) ¹ and Time Frames (Years)							
						Prior to 2017 ²	1-5	6-10	11-15	16-20	20-30	30-50	Total
1	3.2	Investigate the subspecies' ecology, including habitat requirements, the geographic distribution of potential habitats, and the impacts of native and introduced browsers. ^{3.5}	A, C, E	10	TPWD, TNC, Academic Institutions	20.0	25.0	0.0	0.0	0.0	0.0	0.0	45.0
1	3.3	Investigate the demography of the subspecies' populations and estimate a minimum viable population size for metapopulations. ^{3.5}	E	20	TPWD, TNC, Academic Institutions	15.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0
1	3.4	Investigate population genetics, including overall genetic diversity between and among populations and inbreeding coefficients; establish guidelines for the use of source material for augmentation and reintroduction efforts. ^{3.6}	E	5	Academic Institutions, TNC	50.0	100.0	0.0	0.0	0.0	0.0	0.0	150.0
2	4.1	Prepare a controlled propagation and reintroduction plan, addressing the guidelines of the USFWS and NMFS policy (2000). ^{3.7}	B, E	0.2	USFWS	0.0	14.0	0.0	0.0	0.0	0.0	0.0	14.0
2	4.2	Collect seeds from as many sources and individuals as possible within each metapopulation, following CPC Guidelines to limit impacts to extant populations. Maintain separate samples collected from each individual, and label the collection date and geographic coordinates. ^{3.1}	B, E	35	SBRP; TNC; TPWD	20.0	25.0	5.0	5.0	5.0	0.0	0.0	60.0
2	4.3	Investigate seed dormancy, germination, and viability to make the most efficient use of wild-collected seed.	E	10	Academic Institutions; Seed Bank/Botanical Garden	10.0	5.0	0.0	0.0	0.0	0.0	0.0	15.0

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Priority	Activity	Description	Threats	Duration (years)	Responsible Parties	Costs (\$1,000s) ¹ and Time Frames (Years)							
						Prior to 2017 ²	1-5	6-10	11-15	16-20	20-30	30-50	Total
2	4.4	Allocate seed samples from each metapopulation for long-term storage in a seed bank so that metapopulations may be restored following catastrophic losses.	E	35	TNC; TPWD; Seed Bank/Botanical Garden	5.0	5.0	5.0	5.0	5.0	0.0	0.0	25.0
2	4.5	Investigate silvicultural methods, leading to pilot reintroductions, to determine the most effective ways to establish viable individuals in the field.	E	35	SBRP; TNC; Botanical Garden	10.0	10.0	5.0	5.0	5.0	0.0	0.0	35.0
2	4.6	Based on the completion of Activities 3.1 through 3.5, augment isolated individuals and colonies with propagated individuals to increase genetic diversity and reproductive rates. Unless genetic studies indicate otherwise, use only source material that originates within the same metapopulation. ^{3,1}	E	35	SBRP; TNC; TPWD; Private Landowners	35.0	50.0	50.0	5.0	5.0	0.0	0.0	145.0
2	4.7	Based on the completion of Activities 3.1 through 3.5, restore gene flow throughout each metapopulation, and increase metapopulation sizes to MVP levels, by reintroducing colonies into high-potential habitats that are within the pollinator forage ranges of neighboring colonies. Unless genetic studies indicate otherwise, use only propagated source material that originates within the same metapopulation. ^{3,1}	E	35	SBRP; TNC; TPWD; Private Landowners	5.0	50.0	50.0	50.0	50.0	0.0	0.0	235.0
2	4.8	Monitor all augmentation and reintroduction efforts to determine their effectiveness, identify problems, and improve methods.	E	65	SBRP; TNC; TPWD	10.0	10.0	10.0	10.0	10.0	20.0	30.0	100.0

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Priority	Activity	Description	Threats	Duration (years)	Responsible Parties	Costs (\$1,000s) ¹ and Time Frames (Years)							
						Prior to 2017 ²	1-5	6-10	11-15	16-20	20-30	30-50	Total
3	5.1.	Conduct surveys for subspecies <i>texanus</i> (with landowner permission) within its known range in the upper Nueces, West Nueces, and Devils River watersheds. Focus on areas with concentrations of high-potential habitat, based on habitat models. ^{3,3}	A, E	35	SBRP; TNC; TPWD; Private Landowners	10.0	10.0	10.0	10.0	10.0	0.0	0.0	50.0
3	5.2	Conduct surveys for all subspecies of <i>Styrax platanifolius</i> (with landowner permission) within the upper Frio, West Frio, Dry Frio, and Sycamore Creek watersheds. Focus on areas with concentrations of high-potential habitat, based on habitat models. ^{3,3}	A, E	65	SBRP; TNC; TPWD; Private Landowners	10.0	10.0	10.0	10.0	10.0	0.0	0.0	50.0
3	6.1	Conduct public outreach to promote pollinator conservation and management in Real, Edwards, Uvalde, and Val Verde counties, Texas.	A, E	65	USFWS; TPWD; NRCS	10.0	10.0	10.0	10.0	10.0	10.0	10.0	70.0
3	6.2	Promote and support the restoration and management of diverse native grasslands and savannas within the subspecies' range, prioritizing habitats that may serve as pollinator sources for Texas snowbells populations. ^{3,8}	A, E	65	USFWS; TPWD; NRCS; Private Landowners	50.0	50.0	50.0	50.0	50.0	50.0	50.0	350.0
3	7.1	Monitor populations within each recovery unit to determine if MVP levels are met or exceeded in each recovery unit over a period of 20 years. ^{3,3}	E	20	USFWS; TPWD; SBRP	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0
3	7.2	Prepare Post-Delisting Monitoring Plan		0.25	USFWS	0.0	0.0	0.0	0.0	0.0	0.0	20.0	20.0
Sub-total, conservation programs specifically for Texas Snowbells recovery						345.0	475.0	206.0	161.0	161.0	71.0	201.0	1,620.0
Sub-total, other existing conservation programs that will benefit Texas Snowbells						60.0	310.0	310.0	310.0	310.0	310.0	310.0	1,920.0
TOTALS :						405.0	785.0	516.0	471.0	471.0	381.0	511.0	3,540.0

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1. Cost estimates total contributions from all sources and include both cash and voluntary, in-kind support.
2. This column estimates the costs of all recovery activities completed after approval of the original recovery plan (USFWS 1987) and prior to approval of the first revised plan.
3. Basis for cost estimates:
 - 3.1 Costs and accomplishments of Texas Parks and Wildlife Department Landowner Incentive Program contract number 402393.
 - 3.2 These estimates acknowledge deer and ungulate population management by these agencies and private individuals, but does not imply additional USFWS funding for these activities.
 - 3.3 Costs and accomplishments of Fulton (2010).
 - 3.4 Comparable to Langley (2015).
 - 3.5 Costs and accomplishments of Janssen and Poole (1993).
 - 3.6 Comparable to Rayamajhi (2015).
 - 3.7 Comparable to USFWS (2012).
 - 3.8 These estimates acknowledge grassland restoration and management by these agencies and private individuals, and may include additional USFWS funding.

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Literature Cited:

- Fulton, S. 2010. Status assessment and ecological study of *Styrax platanifolius* ssp. *texanus*. Final Report, Grant No. TX-E-92-R. Texas Parks and Wildlife Department, Austin, TX. 21 pp. + 10 Appendices.
- Janssen, J.K. and J.M. Poole. 1993. Reproductive biology of Texas Snowbells (*Styrax texana*). Final Report, Job No. 3-1, Project No. E-1-4 (Section 6-funded project). Texas Parks and Wildlife Department, Austin, Texas. 4 pp. + 3 Appendices.
- Langley, L.A. 2015. The Pollination Ecology of *Sclerocactus brevihamatus* ssp. *tobuschii* (Cactaceae) in the Edwards Plateau region of West Central Texas. Master's Thesis, Angelo State University, San Angelo, Texas. 36 pp. + Appendix.
- Rayamajhi, N. 2015. Conservation genetics of *Sclerocactus brevihamatus* subsp. *tobuschii* and an assessment of its genetic relationship with *Sclerocactus brevihamatus* subsp. *brevihamatus*. Master's Thesis, Texas Tech University, Lubbock, Texas. 100 pp. + 1 Appendix.
- U.S. Fish and Wildlife Service. 1987. Texas Snowbells (*Styrax texana*) Recovery Plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 53 pp.
- U.S. Fish and Wildlife Service. 2012. Slender Rushpea (*Hoffmannseggia tenella* Tharp and L.O. Williams) Controlled Propagation and Reintroduction Plan. Corpus Christi Ecological Services Field Office, Corpus Christi, Texas. 31 pp.
- U.S. Fish and Wildlife Service. 2017. Species Status Assessment for Texas Snowbells (*Styrax platanifolius* ssp. *texanus*). October 2017 (Version 1.0). U.S. Fish and Wildlife Service, Region 2. Albuquerque, New Mexico. 60 pp.
- U.S. Fish and Wildlife Service. 2018a. Recovery plan for Texas Snowbells (*Styrax platanifolius* ssp. *texanus*). U.S. Fish and Wildlife Service, Southwest Region, Albuquerque, New Mexico. 13 pages.
- U.S. Fish and Wildlife Service and National Marine Fisheries Service. 2000. Policy Regarding Controlled Propagation of Species Listed Under the Endangered Species Act. Federal Register 65:56912-56922. September 20, 2000.