

Bio/Diversity Project

Lesson Title: Causes and Consequences of Biodiversity Decline + Conservation Efforts

Teacher: Erin Scott and Emily Granado

Grade Level: 9th

Time: 45 minutes

AZ State Science Standard:	<i>8.L3U3.10</i> <ul style="list-style-type: none">• <i>Communicate how advancements in technology have furthered the field of genetic research and use evidence to support an argument about the positive and negative effects of genetic research on human lives.</i>
Content Objective: Math, Reading, Science, Writing, Other:	<ul style="list-style-type: none">• <i>Students will be able to create and communicate solutions to today's conservation issues regarding loss of biodiversity.</i>• <i>Students will be able to create and propose solutions to future problems created by climate change and biodiversity decline.</i>
Language Objective: (Optional)	N/A
Scientist of the Week:	<ul style="list-style-type: none">• <i>Rachel Carson</i>• <i>Born in Springdale, Pennsylvania</i> <hr/> <ul style="list-style-type: none">• <i>Marine Biologist and Environmentalist</i>• <i>Was one of the first people to notice the negative effects of pesticides and advocated for their governmental regulation</i>

Vocabulary	Materials
<ul style="list-style-type: none"> ● Climate Change ● Irrigation ● Conservation 	<ul style="list-style-type: none"> ● Info sheets of organisms (Included) ● Evaluation form (Included) ● Worksheet (Included)

Seasonality:

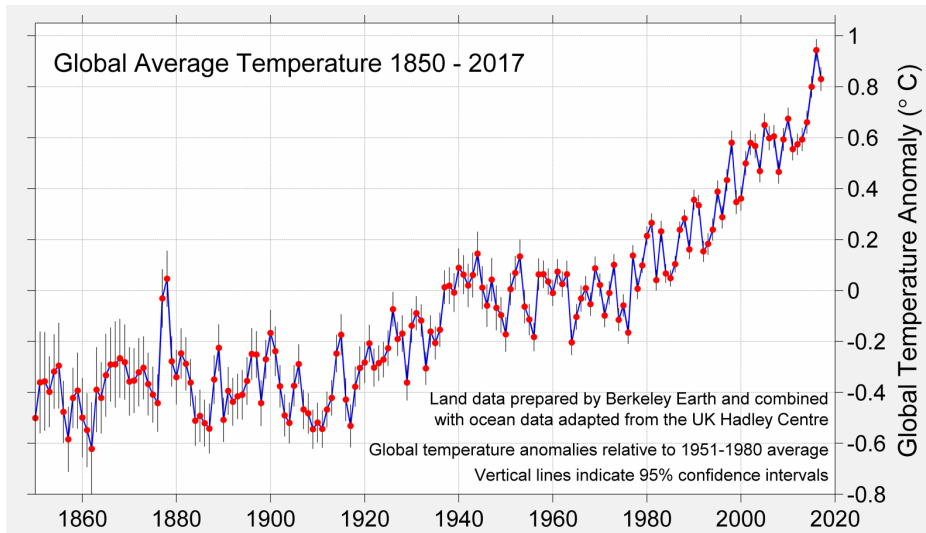
<i>Monsoons</i> July-Sept.	<i>Autumn</i> Oct.-Nov.	<i>Winter</i> Dec.- Feb.	<i>Spring</i> Mar.-Apr.	<i>Dry Summer</i> May-June
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Guiding Questions:

- What is the effect of climate change on biodiversity decline?
- What are the costs of biodiversity loss?

Engagement/Introductory Activity:

- Ask students “What do you think conservation is?”
- Explain to students that conservation is a careful preservation and protection of something; especially planned management of a natural resource to prevent exploitation, destruction, or neglect water **conservation** wildlife **conservation**.
- Ask students why they think this might be important?
 - Potential answer: Can cause a loss of biodiversity. Examples include decrease in water for plants which may cause them to die, if plants die, some animals lose their food which may cause more death, lack of water for animals. All of these contribute to decrease in biodiversity.
- Explain that the Sonoran Desert is one of the most biodiverse places in the world
- Provide an intro to endangered Sonoran Desert species and why they are endangered.
- Define endangered species and causes for population decline
 - Endangered species- a species of animal or plant that is seriously at risk of extinction.
 - What causes it? Invasive species, wildfires, diseases, destruction of habitat, pollution, hunting, fishing, and climate change.
- Introduce climate change and how it effects biodiversity
 - What is climate change? Growing emissions of carbon dioxide from human activities (for example: cars release a lot of carbon dioxide) are driving up temperatures. This is increasing the possibility of extreme weather, melting polar ice and hastening global sea level rise. <https://www.bbc.com/news/science-environment-24021772>

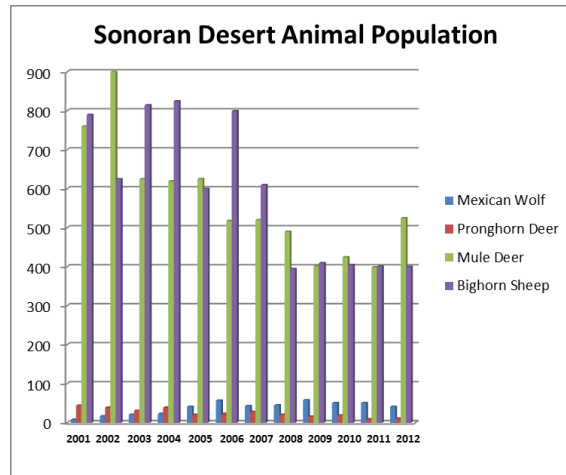


Exploratory Activity:

- Assign each group of students a plant or animal native to the Sonoran Desert that is endangered.
- Give students info sheets on the organism that outline what the organism is, its threat level, its role in the ecosystem, what is causing its decline, data on population decline, and an explanation of its importance.
- Have students come up with a conservation plan for that organism that gives the following three things:
 - Physical response to the problem: what can you and others go out and do to make change?
 - Educational response to the problem: what can you and others do through teaching others to create change?
 - Political response to the problem: What can you and others do through letter writing, calling, community organizing, etc. to create change?
- Have each group share out their plans to protect their threatened organism.
- Give each group the agreed conservation plan and ask them what similarities and differences they had with the official plan

Explain:

- Explain to students that this kind of problem solving is the same work that conservation scientists do for their job.
- Explain that there are different threat levels for organisms based on their population levels:
 - The four categories of endangered species are vulnerable, endangered, critically endangered, and extinct in that order.
- Explain that this concept of extinction has not been around that long:
 - The number of humans on earth has increased over time which also leads to an increase in deforestation, climate change, construction of more cities and development which causes the decrease of animals and can lead to extinction.
- Explain the stats of extinction in the Sonoran Desert



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- Explain why protecting these species is important:
 - Remind students of the food web activity and how all the animals are connected in the Sonoran Desert. If one animal goes extinct (especially keystone species), then other animals will be affected.
 - Example: if bees in the desert go extinct, plants will lose a large source of pollinators, decrease in population, and food for animals will be decreased which can kill them.
- Explain the challenges of protecting species in a changing climate:
 - Due to increase in temperature, there will be a loss of habitat which means loss of plants that are food for animals and increase in species loss. Loss of habitat also means less land for animals/ plants to live in.

Evaluation/Extension Activity/Questions

- Go over how climate change is predicted to affect the Sonoran Desert:
 - <https://www.nps.gov/articles/climate-change-in-the-sonoran-desert.htm>
 - The Sonoran Desert is expected to become hotter and drier. These changes are likely to have strong impacts on the abundance and distribution of the region's plant species.
 - Species without drought-survival mechanisms may decrease or experience high mortality.
- How would your plans change twenty years from now with higher temperatures and lower rainfall?
- Ask students to respond in 5 sentences

Mexican Grey Wolf



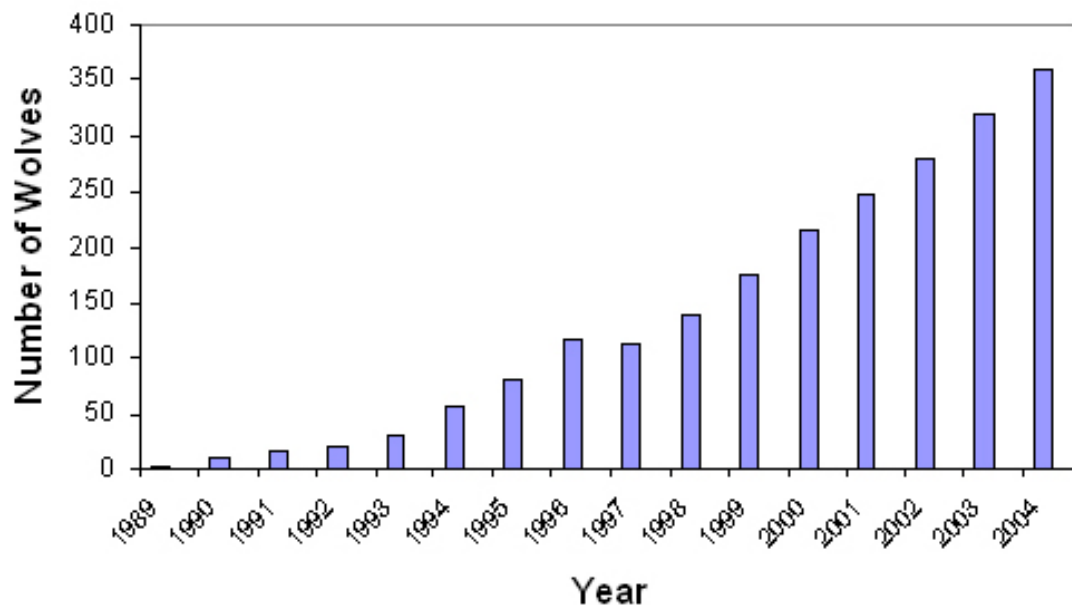
The Mexican gray wolf is a large dog-like carnivore, weighing between sixty and eighty pounds. The wolf has a fur coat of reddish brown, buff, black, and gray, with a white chin and throat.

Habitat: *Canis lupus baileyi* once lived in mountain areas and avoided desert areas.

Range: Historically, the wolf ranged in southeastern Arizona, southwest New Mexico, much of Mexico, and southwestern Texas. Currently, the Mexican wolf is considered wiped out from its historic range in the southwestern United States. Research has not confirmed the existence of the wolf in Mexico since 1980.

Reproduction: Wolves have one litter per year. Mating takes place in February. The female digs a den under a rock ledge, roots of a large tree, or under a bush. The den is lined with leaves and fur. In April, five to six pups are born.

Diet: The Mexican wolf feeds on deer, elk, javelina, bighorn sheep, pronghorn antelope, rabbits and small rodents. The wolf may also take livestock when other prey sources are scarce.



Status: The Mexican gray wolf was listed as endangered in 1976. In 1982, a recovery plan was approved with the goal of establishing a self-reliant population of 100 wolves within a 5,000 square mile area. As of 2018, the captive population included 300 animals, with 114 in the wild.

Cause of decline: Habitat loss and hunted by humans. The wolves will eat livestock is resources are scarce, ranching cleared a lot of the wolves resources, leaving cattle for them to eat. Ranchers saw the wolves as a threat to their livelihood and killed the wolves. Although wolf-related livestock deaths are minimal (less than one percent per year) and no people have been attacked since the reintroduction of Mexican gray wolves in the United States, people are still afraid and resentful of these creatures' presence near their communities.

Importance to the environment: The Mexican Grey Wolf is one of the most endangered mammals in North America. They are hunters and help maintain healthy prey population levels in the ecosystem. The more diversity that exists in an ecosystem, the stronger it will be to protect itself from disease and change.

Ocelot



The ocelot is a medium sized cat weighing from 12--30 pounds, and its length varies from 30--41 inches.

Habitat: The ocelot inhabits a wide range of habitats. It can be found in tropical forests, savannah grasslands, and dense thorn scrub. In Arizona, its presence is usually found in desert scrub communities. The unifying factor is the presence of thick undercover.

Range: Historically, the ocelot ranged from most of Texas, southeastern Arizona as far as Fort Verde, much of Mexico, and Central and South America. The current range is similar, but with a much smaller distribution of ocelots.

Reproduction: Females can begin to breed at 18 to 22 months, while males begin breeding at 15 to 30 months. The gestation period is 79 to 85 days with a litter of 1-2 kittens produced.

Diet: The ocelot is primarily a nocturnal hunter. Its diet consists of small to medium sized animals, such as rabbits, mice and birds.



Status: On July 2, 1982, the ocelot was included as a federally endangered animal under the Endangered Species Act of 1973. In Arizona, the ocelot is protected by order of the Arizona Game and Fish Commission. Also, under Arizona Wildlife Regulation, the ocelot is considered "prohibited wildlife." Therefore, "live" taking, possession, importation, exportation, etc., are generally regulated. The ocelot does have a recovery plan, yet the degrees of implementation in Arizona are unknown. In the U.S., just around 50 ocelots remain in an isolated population in southeast Texas.

Cause of decline: Habitat loss for human development of mining and agriculture. Human hunting and unintentional killing from roadkill.

Importance to the environment: The Ocelot's varied diet allows them to adapt easily to a change in habitat. They are hunters and help maintain healthy prey population levels in the ecosystem. The more diversity that exists in an ecosystem, the stronger it will be to protect itself from disease and change.

Kearney's Blue Star



Kearney's Blue Star is a perennial herb which grows to about 2.5 feet high and three feet wide. Stems are produced from the root with alternating bright green leaves.

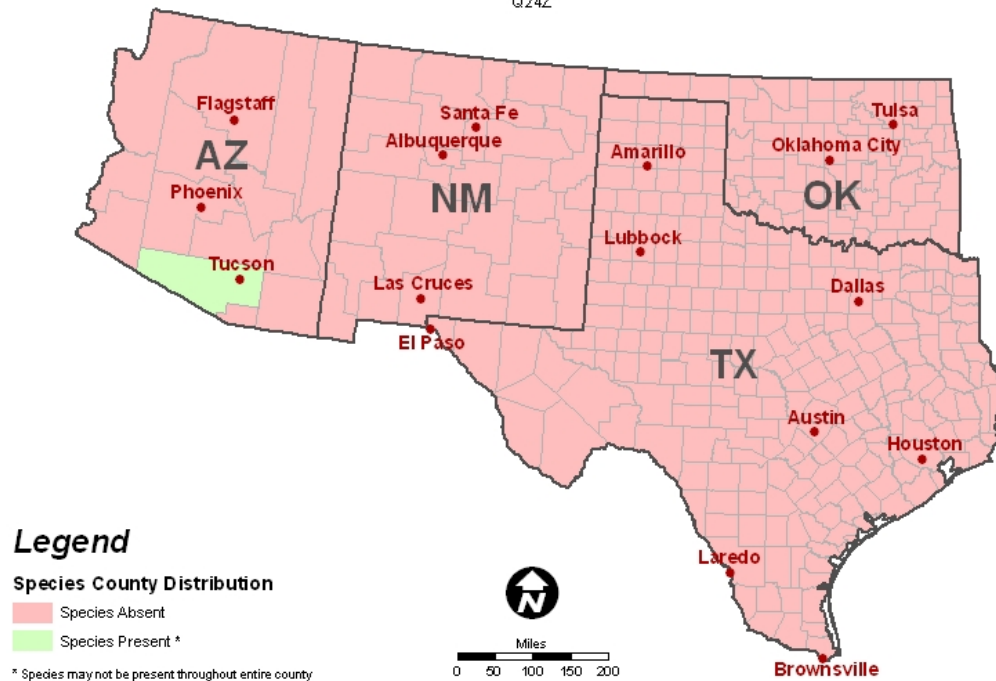
Habitat: The plants grow in coarse soil along a partially shaded dry wash. The wash is lined with desert riparian trees and shrubs, such as Arizona walnut, catclaw acacia, and velvet mesquite.

Range: Found in a west facing drainage wash in the Baboquivari Mountains. Currently, only one natural population of Kearney's blue star exists in South Canyon. Potential habitats in the Baboquivari Mountains exist in other west-facing drainage washes.

Kearney's blue-star

Amsonia kearneyana

Q24Z



Status: This species is listed as endangered and has an approved recovery plan. It is protected as a Highly Safeguarded Species by the Native Plant Law. Species in this category may not be removed from their habitat without a permit from the Arizona Department of Agriculture.

Cause of decline: The plant is threatened by habitat degradation by livestock, damage by flooding, and low reproduction rates.

Importance to the environment: Kearney's Blue Star has pollen and nectar to support native pollinators. No animals eat the leaves or petals. Insects eat the seeds. The more diversity that exists in an ecosystem, the stronger it will be to protect itself from disease and change. Only 110 individuals are currently known in the wild.

Chiricahua Leopard Frog



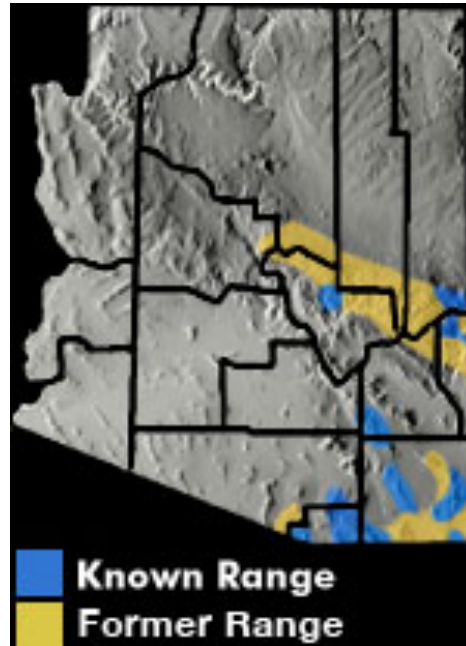
The Chiricahua leopard frog is a medium sized, stout bodied frog with green-brown skin, many spots on its back, and pale yellow to white skin below.¹ Adults are distinguished from other leopard frogs by their unique "salt and pepper" thigh pattern.

Habitat: Highly aquatic and need permanent water to reproduce. They can be found in rocky streams with deep rock-bound pools, ponds, earthen stock tanks, and permanent springs.

Range: This species is found in the mountain regions of central and southeastern Arizona, southwestern New Mexico, and the southeastern mountains of Arizona and adjacent Sonora, Mexico.

Reproduction: At low elevations, the frog breeds from mid-February through June, while at higher elevations breeding occurs from May until August.

Diet: The Chiricahua leopard frog feeds on many insects and fresh-water shrimp. Tadpoles feed on algae and other minute organisms.



Status: Due to declining numbers, in August 2001, the U. S. Fish and Wildlife Service agreed with several conservation groups to list the Chiricahua leopard frog for protection under the Endangered Species Act. The frog was listed in 2002. Once found in more than 400 aquatic sites in the Southwest, the frog is now found at fewer than 80.

Cause of Decline: Destruction of habitat by livestock grazing, groundwater pumping, water diversion and dams, and introduction of species such as the bullfrog. Loss of Chiricahua leopard frog populations fits a pattern of global amphibian decline, suggesting other regional or global causes of decline may be important as well, such as elevated ultraviolet radiation, pesticides or other contaminants, and climate change.

Importance to the environment: The Chiricahua leopard frog is a predator to insects and keeps their population in balance. The frog is also a food source to bigger animals in the ecosystem like birds and snakes. The more diversity that exists in an ecosystem, the stronger it will be to protect itself from disease and change.

Jaguar



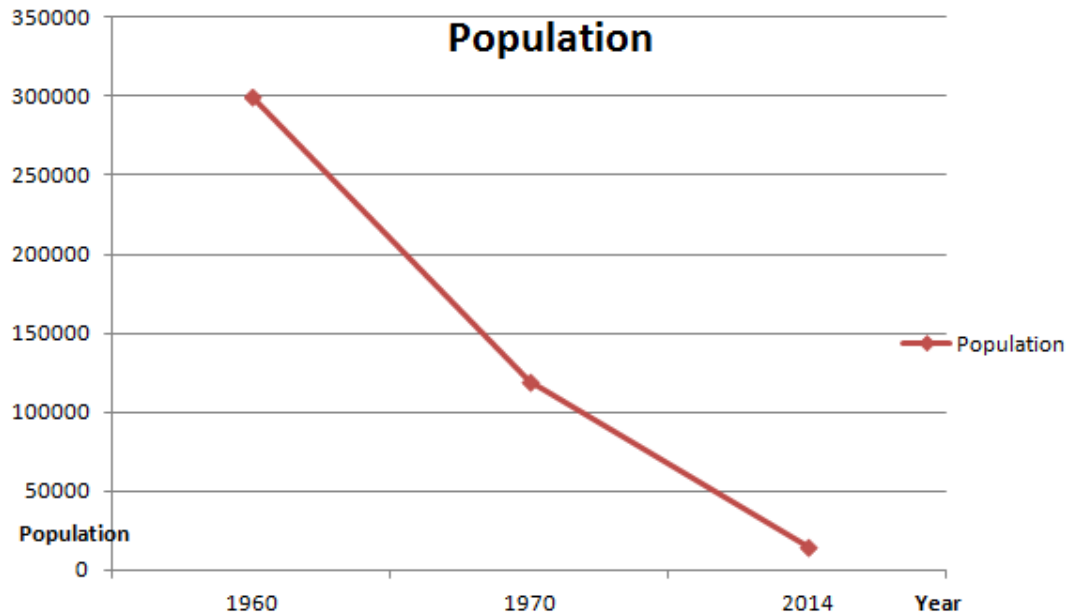
The jaguar is the largest cat native to the Western Hemisphere. The weight of an adult male averages around 120--200 pounds.

Habitat: The jaguar's habitat varies from wet lowland habitats on its center range to arid habitats along its northern range.

Range: The jaguar can be a far ranging animal, traveling distances up to 500 miles. They may become sedentary depending on availability of food. The jaguar is territorial and marks its boundaries with scents. The home range of the jaguar is between 10 and 40 square kilometers.

Reproduction: Jaguars breed year round with about a 100-day gestation period. A litter of one to four cubs is usually produced, with the average being two cubs.

Diet: The jaguar's diet includes up to eighty-five species. Some prey species include the javelina, deer, turtles, birds, fish, and livestock. On the U.S. and Mexico borderlands, javelina and deer are presumed to be the jaguar's primary food source.



Status: On July 22, 1997, the U.S. Fish and Wildlife Service granted endangered status to the jaguar throughout its range under the Endangered Species Act of 1973. The jaguar is now listed as endangered in the United States, Mexico, and Central and South America. In the United States, illegal shooting is the greatest threat to the jaguar. There are about 15,000 jaguars living in the wild today (as of 2016)

Causes of Decline: The jaguar is endangered because it is hunted for its fur, and farmers kill the jaguar because it killed their cattle. Jaguars are reputed to be so destructive of cattle and horses that the larger Mexican ranches retain a 'tiger hunter' to kill them or at least drive them away.

Impact on the Environment: Jaguars are the top predators in their environment, so they play an important role in controlling the populations of other species. This helps keep a balance in the food chain, and a healthy environment. The more diversity that exists in an ecosystem, the stronger it will be to protect itself from disease and change.

Lesser Long-Nosed Bat

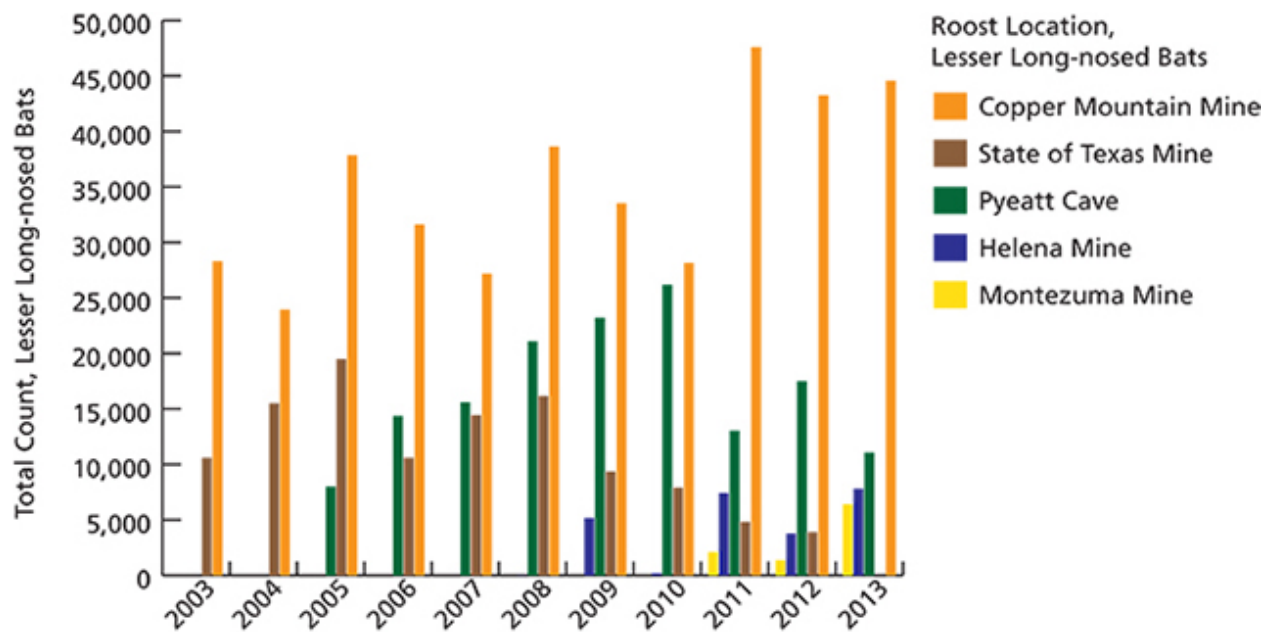


The lesser long-nosed bat is a medium sized bat. Adults have yellow-brown or gray fur above, and rusty brown fur below.

Habitat: In the United States, lesser long-nosed bats are typically found in the desert scrub habitat. Roosting occurs in caves, abandoned buildings and mines which are usually located at the base of mountains where food sources are present.

Range: Historically, the lesser long-nosed bat ranged from central Arizona and southwest New Mexico through much of Mexico and El Salvador. Currently, the bat ranges from the Picacho and Agua Dulce Mountains in Arizona to southwestern New Mexico, and includes the coasts of Mexico. It is a migratory species that spends summers in Arizona and New Mexico.

Diet: The lesser long-nosed bat is one of the three North American bats that feeds almost exclusively on fruit and nectar from night-blooming columnar cacti such as saguaro and organ pipe. Agave flowers also play a principal role in the bat's diet. By eating the nectar, pollen, and fruit of these species of plants, the bat is an important pollinator.



Status: On August 30, 1988, the lesser long-nosed bat was listed as endangered throughout Mexico and Arizona. A recovery plan is approved for the bat. There are around 200,000 bats living in at least 75 roosts between the US and Mexico

Cause of Decline: Causes are not clear, but it is thought that general habitat destruction and overharvesting of Agave plants for the manufacture of mescal plays a part in their decline. Also, people mistake the bat for the Vampire Bat and destroy the bats roosts and harm bats.

Importance to the Environment: The bat is a "keystone mutualist" because of its role as a pollinator. Without the bats to pollinate numerous species of cacti and agave, many fear the desert ecosystem would begin to decline. The more diversity that exists in an ecosystem, the stronger it will be to protect itself from disease and change.

Sonoran Pronghorn Antelope

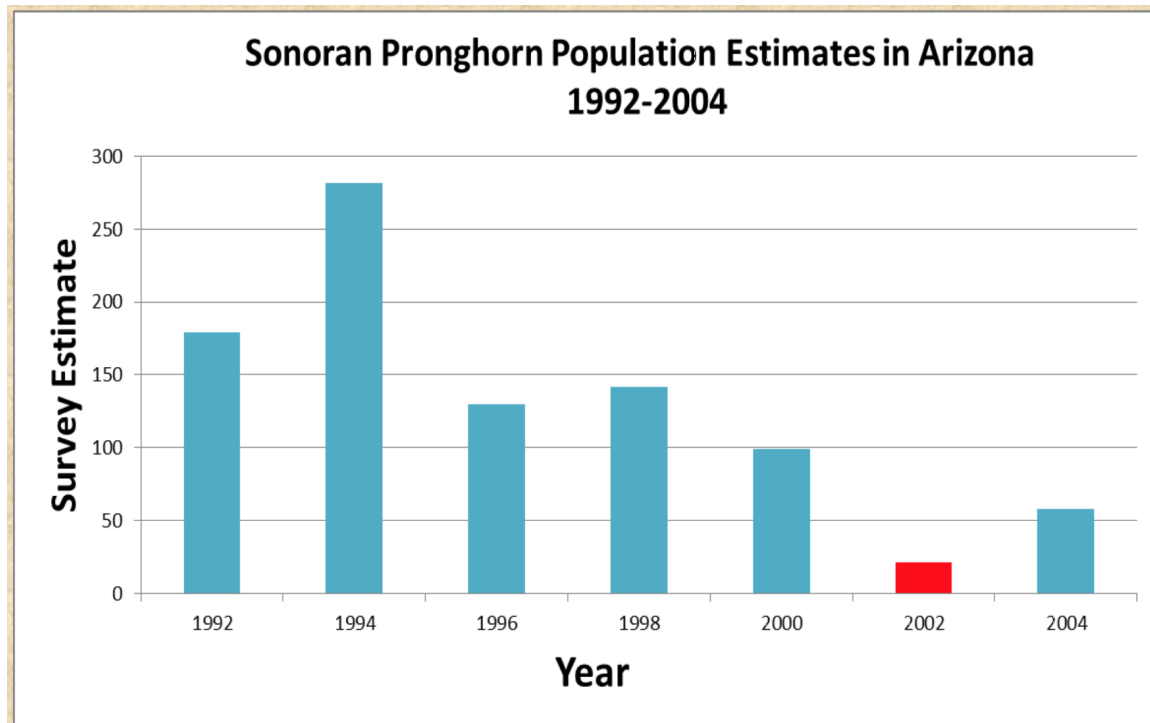


Both males and females have horns; males have larger horns. Males weigh 100--130 pounds, females weigh 75--100 pounds. Their long, slender legs and efficient respiratory system allow them to run as fast as 60 miles per hour.

Habitat: Within the Sonoran desert, the pronghorn is found in broad, alluvial valleys separated by granite mountains and mesas. Vegetation is scarce throughout most the Sonoran pronghorn's habitat due to little and sporadic rainfall.

Range: Historically, the Pronghorn inhabited southwest Arizona and the northern part of Sonora, Mexico. Presently, a small population of antelope survive in the arid flatlands of southwestern Arizona and Mexico.

Reproduction: Does are ready to mate at 16 months and bucks are ready by one year of age. The Sonoran pronghorn breed from July through September. Gestation is about 245 days. At birth, fawns weigh from five to seven pounds.



Diet: The Sonoran pronghorn feeds on herbs, cacti, and desert grasses. Similar to cows, the pronghorn has a rudiment stomach, or a four-part stomach. This is especially beneficial to the antelope because it allows for the digestion of roughly textured foods (cacti and other desert plants) and allows for a high level of water retention.

Status: The Sonoran pronghorn has been listed federally endangered since June 2, 1970. There are only about 500 surviving **Sonoran pronghorn**, roughly 100 of those live in the United States.

Cause of decline: wide-spread habitat loss as a result of incompatible grazing practices, off road driving, and accelerated erosion and the replacement of plants unfavorable to pronghorn. Water has also been diverted away from their habitat.

Importance to the Environment: Pronghorn are prey to large animals in the ecosystem. The more diversity that exists in an ecosystem, the stronger it will be to protect itself from disease and change.

Cactus Ferruginous Pygmy-Owl



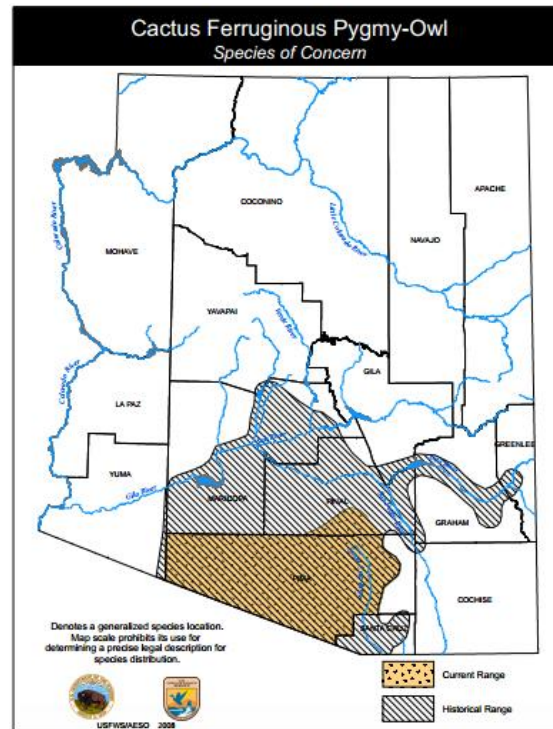
The cactus ferruginous pygmy-owl is a small bird, averaging 6.5 inches in length and weighing 2.5 ounces. This owl is diurnal. Its call, consisting of a monotonal 'put-put-put' note, can be heard during dusk and dawn.

Habitat: Current information allows only a broad general description of habitat. The cactus ferruginous pygmy-owl occurs in a variety of habitats, including river bottom woodlands, mesquite bosques, desert scrub, and plains and desert grasslands.

Range: Historically, this subspecies appears to be geographically isolated into eastern and western populations. The western population was near central Arizona and the Eastern ranged near southern Texas.

Diet: The owl is an opportunistic predator feeding on what is available. The prey ranges from insects to mourning doves which outweigh the owl by two and a half times.

Reproduction: The cactus ferruginous pygmy owl nests in cavities in trees or cacti such as the organ pipe or saguaro. Three to five eggs are laid in late April/-May. The young are fed by both parents.



Status: The cactus ferruginous pygmy-owl was listed as Federally Endangered in 1997. The species was listed because current and historical evidence suggests a significant population decline has occurred in Arizona, and that the owl has been nearly extirpated. Now they can only be found between Tucson and the Mexican border, and less than 50 remain in the state.

Cause of Decline: owl's population decline is thought to be linked to intensive woodcutting and the construction of the first dams, causing deforestation and reduced water flow early in the 20th century.

Importance to the Environment: The Cactus Ferruginous Pygmy-Owl is a predator of many insects, lizards and small birds. It helps keep these populations in check. The more diversity that exists in an ecosystem, the stronger it will be to protect itself from disease and change.

Southwestern Willow Flycatcher



The Southwestern Willow Flycatcher is a small bird standing six inches high and weighs half an ounce. It is most recognized by its calls: a sharp wit! or a "sneezy witch-pew or fitz-bew."

Habitat: The Southwestern Willow Flycatcher occurs in dense riparian habitats along streams, rivers, and other wetlands. This sub-species exists only in fragmented and scattered locations throughout the state.

Range: Historically, the breeding range reached from southern California to northwestern Mexico. The flycatcher is a migratory bird with little known about its winter range. It is currently thought that it winters in Mexico, Central America, and northern South America.

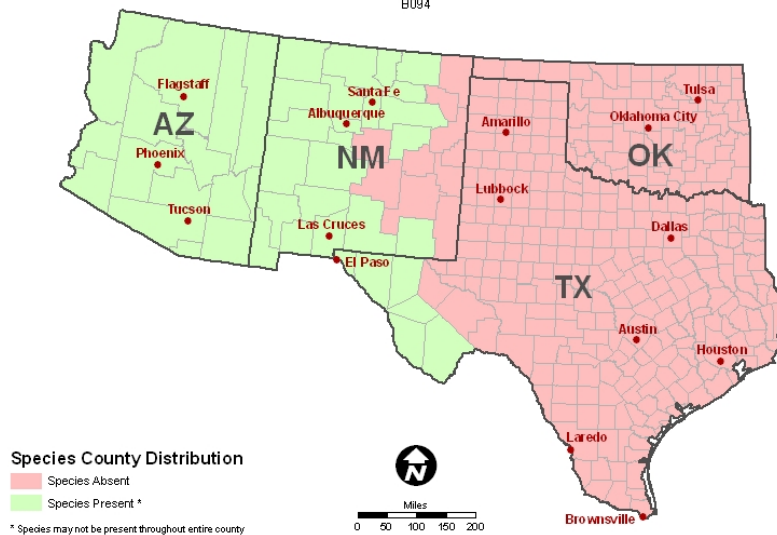
Diet: The Southwestern Willow Flycatcher is an insectivore, taking insects from the air, or picking them from the foliage.

Reproduction: The Southwestern Willow Flycatcher is present on breeding grounds by mid-May. Typically, three eggs are laid and then incubated for 12--13 days. Breeding success is heavily affected by predation and brown-headed cowbird parasitism.

southwestern willow flycatcher

Empidonax traillii extimus

B094



Status: The Southwestern Willow Flycatcher was declared endangered March 29, 1995, under the Endangered Species Act of 1973. It is included on the Arizona Game and Fish Department's draft version of Wildlife of Special Concern in Arizona. The species does have an approved recovery plan and designated critical habitat. By 2002, it was estimated that only 900 to 1100 pairs existed.

Causes of Decline: One of the primary reasons for the decline of this species is the loss and degradation of dense, native riparian habitats due to urban and agricultural development. Water impoundment (dams), water diversion for agriculture, and groundwater pumping all have altered streamflow and thus riparian vegetation.

Importance to Environment: This little flycatcher has a big impact, controlling insect populations around wetlands and waterways. The more diversity that exists in an ecosystem, the stronger it will be to protect itself from disease and change.

Conservation Response Sheet

Physical response to the problem: what can you and others go out and do to make change?

Educational response to the problem: what can you and others do through teaching others to create change?

Political response to the problem: What can you and others do through letter writing, calling, community organizing, etc. to create change?