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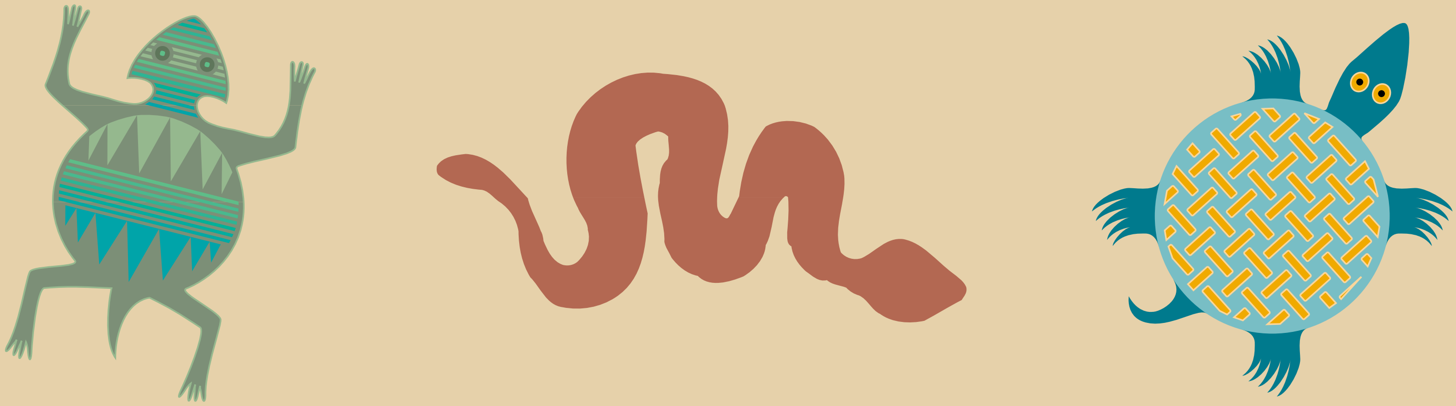
Amphibians and Reptiles of Los Alamos County



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Amphibians and Reptiles of Los Alamos County, New Mexico

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Amphibians and Reptiles of Los Alamos County, New Mexico

ABSTRACT

Recent studies have shown that amphibians and reptiles are good indicators of environmental health. They live in terrestrial and aquatic environments and are often the first animals to be affected by environmental change. This publication provides baseline information about amphibians and reptiles that are present on the Pajarito Plateau. Ten years of data collection and observations by researchers at Los Alamos National Laboratory, the University of New Mexico, the New Mexico Department of Game and Fish, and hobbyists are represented.

1.0 Introducing Amphibians and Reptiles

1.1 About the Study

This publication represents approximately 10 years of data collection and observations by a number of researchers working at Los Alamos National Laboratory (LANL), the University of New Mexico, the New Mexico Department of Game and Fish, and hobbyists. The purpose of the guide is to compile what we know about amphibians and reptiles so that the researcher, the layman, and the hobbyist can identify and protect these important groups of animals. There is considerable myth and lore around many amphibians and reptiles. This leads to fear, misunderstanding, and lack of knowledge of amphibian and reptile species. This publication also provides a baseline to understand what species of amphibians and reptiles are present within the habitats of the Los Alamos National Environmental Research Park, LANL, so that we can better manage the ecosystems in which they live to maintain biological diversity.

In the species profiles (Section 6.0), we have included all species that have been identified in the area by various researchers. Additionally, we have included information on some species that have not been identified but are found in adjoining counties and likely occur within Los Alamos County.

1.2 About Amphibians and Reptiles

Amphibians include salamanders, toads, and frogs. There are 350 species of salamanders and 3500 species of frogs and toads worldwide. Reptiles include turtles, lizards, alligators, and snakes. There are over 6000 species of reptiles living in a variety of habitats worldwide.

1.2.1 Amphibians

The name amphibian means “those who lead a double life.” The name describes a group of species that spend part of their life cycle in water and part on land. What would a spring and summer night be without the call of the frog or toad from its watery habitat? Amphibians belong to an ancient group that dominated the planet over 300 million years ago and were the first vertebrates that could live both in water and on land.

Most amphibians have the following characteristics:

They have naked skin not covered by fur, feathers, or scales.
The skin is smooth or rough, wet or dry, or slimy.
They have toes but no claws.
The skin contains many glands.
They are ectotherms (body temperature conforms to environmental conditions).
Water is absorbed through the skin.
Larvae have gills, adults have lungs.

Frogs, toads, and salamanders breath air and have no internal control of their body temperature, thus are affected by the heat and cold of the outdoor environment. They will move between sunlight and shade to regulate body temperature. They are highly adaptable, living in habitats ranging from tropical to sub-Arctic, and are tolerant of low temperatures. If temperatures are high and the environment is dry, certain groups such as salamanders and spadefoots can go into dormancy.

As a group, most amphibians are carnivorous, feeding on worms, insects, spiders, or other amphibians, including their own kind. The frogs and toads are specialized in their ability to feed. Their eyes, tongue, and teeth work together to capture prey.

1.2.2 Reptiles

Reptiles include turtles, lizards, crocodiles, alligators, and snakes. This incredible group of animals became the first vertebrates to live on land during Paleozoic times over 250 million years ago. Nearly every child and many adults are fascinated by the thought of dinosaurs wandering through hills and valleys of the Cretaceous times. The descendents of these large and small creatures live in nearly every environment except cold places and at high altitudes.

Reptiles are distinguished from other vertebrates by the following characteristics:

They have skin covered with tough scales.
They have claws on their toes.
Eggs have a flexible, leathery shell.
At least one lung is present.

As a group, reptiles eat a variety of food. Many lizards eat insects (insectivorous); turtles are most often herbivorous; and snakes eat living prey (carnivorous). Reptiles have various reproductive strategies. Some lay eggs, bury them, and abandon them. Yet, others bear live young.

Reptiles are also ectotherms. Their behavior is adjusted to maintain body temperatures throughout seasonal variations. When they bask in the sun they can absorb heat, which keeps them mobile and active as well as increasing digestion. When temperatures are too hot such as in desert and semiarid environments, many species will live in burrows, among rocks, or buried in sand. Most become dormant during seasons that are not conducive to their body rhythms.

Nearly all reptiles are wary and secretive, their abundance is often much greater than expected. Most snakes and some lizards are active primarily at night (nocturnal) or only during evening and morning hours (crepuscular). Most lizards and turtles are active during daylight hours (diurnal).

2.0. Importance of Amphibians and Reptiles

Amphibians and reptiles have historically been underrepresented in environmental monitoring programs because of their small body or populations sizes, fossorial or cryptic habitats, patchy distribution, and unpredictable seasonality (Gibbons 1988). Additionally, they have secretive habits during the non-breeding season and complex life cycles that make them difficult to study. Amphibians, such as terrestrial salamanders, pose problems in monitoring because of limited ranges, patchy distribution, and a retiring nature (Brooks 1996). In arid and semiarid environments, studies have particular difficulties, primarily with the timing and duration of the existence of standing water (Sredl et al. 1996). Sredl et al. indicate that there is a great need for conservation studies of amphibians.

As part of the nongame fauna, amphibians and reptiles are of less interest to the public. However, recent studies have shown that amphibians and reptiles are good indicators of general environmental health. Anurans (frogs and toads) are valuable as indicator species capable of integrating environmental changes occurring in both the terrestrial and aquatic phases of their habitats. Furthermore, because they occupy small ponds and shallow margins of lakes, anurans are likely to be the first vertebrates to come in contact with contaminated run-off or acidified snowmelt. This makes them useful as an early warning detection system for environmental contamination because these animals are especially sensitive to pollution and loss of aquatic habitat (Campbell 1976, Hall 1980). Studies related to radiation hazards to amphibians and reptiles indicate that acute radiation exposure adversely affects limb regeneration, alters DNA metabolism, and increases the frequency of chromosomal aberrations (Eisler 1994). Various amphibian populations have been found to be sensitive to acidic deposition (Freda et al. 1991).

Part of the problem in monitoring the declines in amphibian and reptile populations is that much of the past information is anecdotal, that is, no documentation exists, only verbal reports. Therefore, studies are needed to establish baseline information. Not only is it important to develop studies that can monitor these fluctuating populations, but also to develop monitoring networks so the question of declining populations can be investigated.

Conservation concerns for amphibians and reptiles began to surface in 1977 when Tom van Devender, in letters to the Arizona Game and

Fish Department and the U.S. Forest Service, expressed concern for the probable extinction of the Sycamore Canyon population of the Tarahumara frog (*Rana tarahumarae*) (Scott 1997). By the 1980s, scientists began to recognize that amphibians, particularly frogs and toads, from widely separated parts of the world were declining, suggesting some far-reaching environmental change or cause rather than simple natural fluctuations in population densities (Stebbins and Cohen 1995). In the past decade, various studies investigated the causes for these declines, which may include fungal infections or changes in solar radiation. Species like leopard frogs (*Rana* spp.) that were once common have declined, and local extirpation has occurred because of many factors, including changes in habitat; predation; competition with introduced species like the bullfrog (*Rana catesbeiana*), exotic fishes, and crayfish; commercial or scientific exploitation; toxicants; acid rain; pathogens; and parasites (Clarkson and Rorabaugh 1989, Hayes and Jennings 1986, Fernandez and Rosen 1996). There have been numerous articles or reports of declining amphibians in FROGLOG, the newsletter of the World Conservation Union, Species Survival Commission, Declining Amphibian Population Task Force.

Amphibians and reptiles are important in food chains, and they make up large proportions of vertebrates in certain ecosystems (Bury and Raphael 1983). Because of recent concern for nongame wildlife, biologists and land managers find themselves faced with studies and management needs for a group of animals they know little about (Jones 1986).

3.0. Amphibians and Reptiles on the Pajarito Plateau

The State of New Mexico and the Pajarito Plateau have amphibian and reptilian fauna typical of semiarid regions. Table 1 compares the numbers of species confirmed to occur on the Pajarito Plateau with the total numbers found in the State of New Mexico (Degenhardt et al. 1996). Each species of the Pajarito Plateau is separately discussed in the following species accounts.

Table 1. Number of Amphibian and Reptile Species on the Pajarito Plateau and in the State of New Mexico

Herptofauna	**New Mexico**	**Pajarito Plateau**
Salamanders	3	2
Frogs and Toads	23	5
Lizards	41	11
Turtles	10	0
Snakes	46	12
TOTAL	123	30

3.1 Early Studies of Amphibians and Reptiles on the Pajarito Plateau

Few studies of amphibians and reptiles have been conducted on the Pajarito Plateau. Degenhardt (1975) and his colleagues collected in Bandelier National Monument in the 1970s. The first known survey of LANL lands was done by Charles Bogert. Bogert collected specimens primarily within Pajarito and Sandia Canyons in 1978 and 1979 for the 1979 Site-wide Environmental Impact Statement. Species located during his surveys are included in Table 2. Bowker and Ferenbaugh (1983) and Bowker et al. (1986) did studies on thermal regulation of several species of lizards including plateau striped whiptail (*Cnemidophorus velox*), Chihuahuan spotted whiptail (*C. exsanguis*), prairie lizard (*Sceloporus undulatus*), collared lizard (*Crotaphytus collaris*), and tree lizard (*Urosaurus ornatus*). Hein and Whittaker (1997) studied the homing of prairie lizards. Hein and Myers (1995) compared methods to estimate population sizes of the same species. Pierce (1996) studied the behavior of the western chorus frog (*Pseudacris triseriata*) and looked at asymmetry. Studies have been conducted to determine the habitat and location of the endemic Jemez Mountains salamander (*Plethodon neomexicanus*) (Ramotnik 1986, Trippe and Haarmann 1996). Trippe and Haarmann did modeling of Jemez Mountains salamander habitats using remote sensing techniques. Further studies were conducted by Ladyman and Altenbach (1998) to determine the relationship of microhabitat conditions to salamander frequency. The locations of various individual sightings have been noted by researchers in association with other studies (Hinojosa 1997, Altenbach and Painter 1998) and reported as incidental sightings by the public. These locations have been recorded in a wildlife database that is maintained by the Ecology group at LANL.

Baseline studies of amphibians and reptiles of the Pajarito wetlands at LANL began in 1990 and have been conducted by the Ecology group for seven years. With the data gathered from 1990 through 1997 (excluding 1992), we have examined the annual and seasonal population changes of four species of amphibians and reptiles. The four species studied are Woodhouse’s toad (*Bufo woodhousii*), the western chorus frog, the many-lined skink (*Eumeces multivirgatus*), and the plateau striped whiptail (Nelson et al. 1998). Much of this information gathered during these seven years is incorporated into the species profiles included within this atlas.

3.2 Status of the Amphibians and Reptiles

The New Mexico Natural Heritage Program maintains a database that provides a global ranking for various species, both plant and animal. Table 3 gives the rankings that are maintained within their database for the amphibians and reptiles that occur within the area. It should be noted that there is only one species that is considered threatened—the Jemez Mountains salamander. All species on the Los Alamos County list, with the exception of the Jemez Mountains salamander, are considered a G5 ranking, indicating that they, at this time, appear to be globally secure but may be rare within portions of their range. The State of New Mexico also ranks species. Seven species (Table 3)

Table 2. Amphibians and Reptiles found on the Pajarito Plateau

Common Name	Scientific Name	Source*
Lizards		
Prairie lizard	*Sceloporus undulatus*	1, 2, 3, 4, 7
Tree lizard	*Urosaurus ornatus*	1, 2
Collared lizard	*Crotaphytus collaris*	1, 2
Short-horned lizard	*Phrynosoma douglasii*	1, 2, 3
Chihuahuan spotted whiptail	*Cnemidophorus exsanguis*	1, 2, 4
Plateau striped whiptail	*Cnemidophorus velox*	1, 2, 4
Great Plains skink	*Eumeces obsoletus*	1, 2, 3
Many-lined skink	*Eumeces multivirgatus*	1, 2, 3
Snakes		
Ringneck snake	*Diadophis punctatus*	2
Gopher snake	*Pituophis melanoleucus*	1, 2, 3
Western terrestrial garter snake	*Thamnophis elegans*	1, 2
Blackneck garter snake	*Thamnophis cyrtopsis*	1, 2
Night snake	*Hypsiglena torquata*	1, 2
Western diamondback rattlesnake	*Crotalus atrox*	1, 2
Western rattlesnake	*Crotalus viridis*	1, 2
Striped whipsnake	*Masticophis taeniatus*	1, 2
Coachwhip	*Masticophis flagellum*	2, 9
Mountain patchnose snake	*Salvadora grahamiae*	1, 2
Smooth green snake	*Liochlorophis vernalis*	1, 2
Great Plains rat snake	*Elaphe guttata*	1, 2
Salamanders		
Tiger salamander	*Ambystoma tigrinum*	1, 2, 3
Jemez Mountains salamander	*Plethodon neomexicanus*	1, 4, 5, 6, 8
Frogs and Toads		
New Mexico spadefoot	*Spea multiplicata*	1, 2, 3
Woodhouse’s toad	*Bufo woodhousii*	1, 2, 3
Red-spotted toad	*Bufo punctatus*	1, 2
Western chorus frog	*Pseudacris triseriata*	1, 2, 3
Canyon treefrog	*Hyla arenicolor*	1, 2, 3
Bullfrog	*Rana catesbeiana*	1

*****(1) Degenhardt et al. 1996, (2) Charles Bogert (1979) and (3) in Pajarito Canyon study, (4) Bowker, et al. (1986), (5) Trippe and Haarmann, (1996), (6) Ladyman and Altenbach (1998), (7) Hein, et al. (1995), (8) Ramotnik (1986), and (9) Painter and Nelson (1998).

Table 3. New Mexico Natural Heritage Program Rankings for Amphibians and Reptiles in Los Alamos County and Vicinity

Scientific Name	Common Name	Global Rank	State Rank
Ambystoma tigrinum	Tiger salamander	G5	S5
Plethodon neomexicanus	Jemez Mountains salamander*	G2	S2
Spea bombifrons	Plains spadefoot toad	G5	S5
Spea multiplicata	New Mexico spadefoot toad	G5	S5
Bufo punctatus	Red-spotted toad	G5	S5
Bufo woodhousii	Woodhouse's toad	G5	S5
Hyla arenicolor	Canyon treefrog	G5	S4
Pseudacris triseriata	Western chorus frog	G5	S5
Rana catesbeiana	Bullfrog	G5	S5
Crotaphytus collaris	Collared lizard	G5	S5
Phrynosoma douglasii	Short-horned lizard	G5	S5
Sceloporus undulatus	Prairie lizard	G5	S5
Urosaurus ornatus	Tree lizard	G5	S5
Uta stansburiana	Side-blotched lizard	G5	S5
Holbrookia maculata	Lesser earless lizard	G5	S5
Cnemidophorus exsanguis	Chihuahuan spotted whiptail	G5	S5
Cnemidophorus grahamii	Checkered whiptail	G5	S5
Cnemidophorus inornatus	Little striped whiptail	G5	S5
Cnemidophorus velox	Plateau striped whiptail	G5	S5
Cnemidophorus neomexicanus	New Mexico whiptail	G5	S5
Eumeces multivirgatus	Many-lined skink	G5	S5
Eumeces obsoletus	Great Plains skink	G5	S5
Diadophis punctatus	Ringneck snake	G5	S4
Elaphe guttata	Great plains rat snake	G5	S5
Hypsiglena torquata	Night snake	G5	S5
Lampropeltis getula	Common kingsnake	G5	S5
Lampropeltis triangulum	Milk snake	G5	S4
Liochlorophis vernalis	Smooth green snake	G5	S4
Masticophis taeniatus	Striped whipsnake	G5	S5
Masticophis flagellum	Coachwhip	G5	S5
Heterodon nasicus	Western hognose snake	G5	S5
Pituophis melanoleucus	Gopher snake	G5	S5
Salvadora grahamiae	Mountain patchnose snake	G5	S4
Thamnophis cyrtopsis	Blackneck garter snake	G5	S5
Thamnophis elegans	Western terrestrial garter snake	G5	S4
Thamnophis sirtalis	Common garter snake	G5	S4
Crotalus atrox	Western diamondback rattlesnake	G5	S5
Crotalus viridis	Western rattlesnake	G5	S5

*****This species is listed as a species of concern by the U.S. Fish and Wildlife Service and as threatened by the State of New Mexico.

are ranked S4 indicating they are apparently secure in the State, with many occurrences. The remainder of the species, with the exception of the Jemez Mountains salamander, are ranked an S5, indicating that they are demonstrably secure in the State under present conditions.

3.3 Observing

The benefits of amphibians and reptiles are often overlooked. Those kinds of snakes that make their meals of rodents are beneficial in certain areas. The benefits of lizard predation on insects are less obvious but are also helpful. All amphibians and reptiles play a role in the intricate web of life and are thus important elements in their particular habitats and ecosystems.

With the increasing public concern for our vanishing wildlife, the pursuit of herpetology should increasingly emphasize field observation with minimal disturbance. Although presently secure and seemingly widespread, some species are declining from over-collection. Astonishingly little is known about amphibian and reptilian behavior under natural conditions. We should learn to live and let live. Beyond the natural predators, human activity and disturbance are the primary factors driving many species to scarcity. Some species are killed out of fear and misunderstanding. Factors such as habitat destruction, egg collecting as a source of income, and contamination are contributing to declines.

4.0 Habitats for Amphibians and Reptiles within Los Alamos County

4.1 Regional Description

4.1.1 Location

Los Alamos County is located in north-central New Mexico, approximately 100 km (60 mi) north-northeast of Albuquerque and 40 km (25 mi) northwest of Santa Fe (Figure 1). The County is approximately 283 km^2 (109 mi^2). LANL comprises 111 km^2 (43 mi^2) of the County where most of the amphibian and reptile studies have been conducted. The County and its surrounding environments encompass a wide range of environmental conditions. This is attributed in part to the prominent elevational gradient in the east-west direction, diverse topography, and major canyon-mesa complexes.

The spectacular scenery that is a trademark of the Los Alamos area is a result of the prominent elevation gradient of the region. The difference between its lowest elevation in the eastern extremities and its highest elevation on the western boundaries represents a change of approximately1568 vertical meters (5146 feet). At the lowest point along the Rio Grande, the elevation is approximately 1631 m (5350 ft) above mean sea level. At the opposite elevation extreme, the Sierra de Los Valles, which is part of the more extensive Jemez Mountains, forms a continuous backdrop to the landscapes of the study region. The tallest mountain peaks in the Sierra include Pajarito Mountain at 3182 m (10,441 ft), Cerro Rubio at 3185 m (10,449 ft), and Caballo Mountain at 3199 m (10,496 ft).

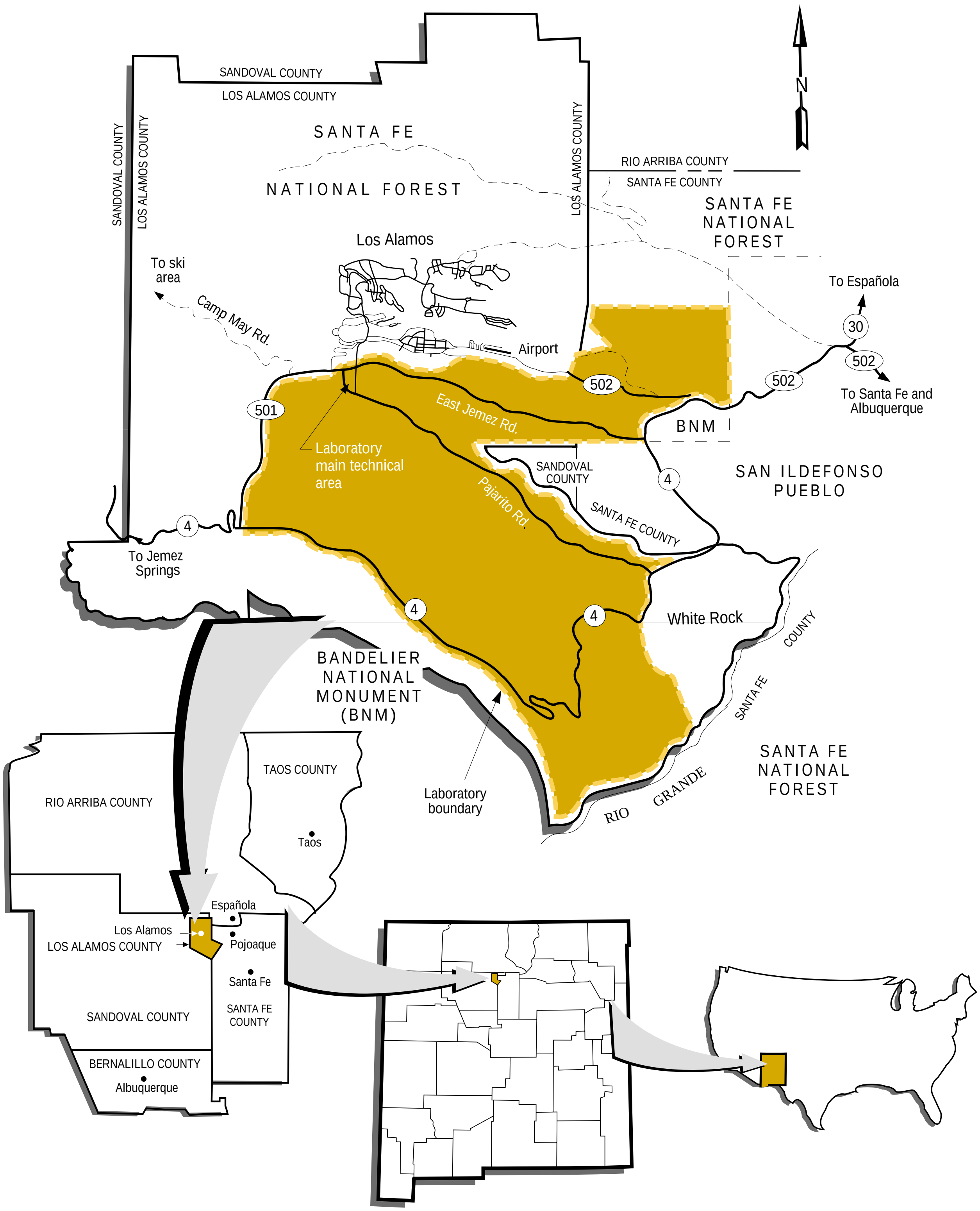


Figure 1. The location of Los Alamos National Laboratory within Los Alamos County.

The Los Alamos region is topographically complex. Within Los Alamos County, there are three main physiographic systems (Nyhan et al. 1978). From east to west, these systems are the White Rock Canyon, the Pajarito Plateau, and the Sierra de los Valles. White Rock Canyon occurs below 1890 m (6200 ft) above sea level. This rugged canyon is approximately 1.6 km (1 mi) wide and extends to a depth of nearly 275 m (900 ft). White Rock Canyon, through which the Rio Grande flows, occupies about five percent of Los Alamos County. The Pajarito Plateau is the largest of the three physiographic systems, occupying nearly 65 percent of Los Alamos County. The Pajarito Plateau is a broad piedmont that slopes gently to the east and southeast. At a more localized scale, the Pajarito Plateau is also topographically complex. The surface of the plateau is dissected into narrow mesas by a series of east-west trending canyons. Above 2377 m (7800 ft), the Sierra de los Valles rises to the western extremity of the study region. These mountains occupy approximately 30 percent of Los Alamos County. The Sierra is also dissected into regularly spaced erosion features, although these canyons in the mountains are not so prominent as the canyons on the Pajarito Plateau.

Most of the mesas in the Los Alamos area are formed from Bandelier Tuff, which includes ash fall, ash fall pumice, and rhyolite tuff. The tuff, ranging from nonwelded to welded, is more than 300 m (1000 ft) thick in the western part of the plateau and thins to about 80 m (260 ft) eastward above the Rio Grande. It was deposited as a result of major eruptions in the Jemez Mountains' volcanic center about 1.2 to 1.6 million years ago.

The County is composed of lands administered by the County of Los Alamos, LANL, and Santa Fe National Forest. Bandelier National Monument borders the County on the south, the Pueblo of San Ildefonso borders the Laboratory to the east, and the Pueblo of Santa Clara is on the north.

On the western part of the Pajarito Plateau, the Bandelier Tuff overlaps onto the Tschicoma Formation, which consists of older volcanics that form the Jemez Mountains. The tuff is underlain by the conglomerate of the Puye Formation in the central plateau and near the Rio Grande. Chino Mesa basalts interfinger with the conglomerate along the river.

Surface water in the Los Alamos area occurs primarily as short-lived or intermittent reaches of streams. Perennial springs on the flanks of the Jemez Mountains supply base flow into upper reaches of some canyons, but the volume is insufficient to maintain surface flows across the Laboratory site before they are depleted by evaporation, transpiration, and infiltration. Runoff from heavy thunderstorms or heavy snowmelt reaches the Rio Grande several times a year in some drainages. Effluents from sanitary sewage, industrial waste treatment plants, and cooling-tower blowdown enter some canyons at rates sufficient to maintain surface flows for varying distances and creating artificial wetlands.

4.1.2. Weather

Los Alamos has a temperate, semiarid mountain climate. However, this climate is strongly influenced by elevation, and large temperature and precipitation differences are observed in the area because of the topography. Los Alamos has four distinct seasons. Winters are generally mild, but occasionally storms dump large snows and cause below-freezing temperatures. Spring is the windiest season of the year. Summer is the rainy season in Los Alamos when afternoon thunderstorms and associated hail and lightning are common. Fall marks the end of the rainy season and a return to drier, cooler, and calmer weather.

Several factors influence the temperature in Los Alamos. An elevation of 2226 m (7400 ft) helps to counter Los Alamos' southerly location, making for milder summers than nearby areas at lower elevations. The sloping nature of the Pajarito Plateau causes cold-air drainage, making the coolest air settle into neighboring valleys and canyons. Also, the Sangre de Cristo Mountains to the east act as a barrier to arctic air masses affecting the central and eastern United States. The temperature does occasionally drop well below freezing, however. Another factor is the lack of moisture in the atmosphere. With less moisture there is less cloud cover, which allows a significant amount of solar heating during the daytime and radiative cooling at night.

This heating and cooling often cause a wide range of daily temperature. Winter temperatures range from -1°C to 10°C (30°F to 50°F) during the daytime to -9°C to -4°C (15°F to 25°F) during the nighttime. The record low temperature recorded in Los Alamos is -28°C (-18°F). Winter is usually not particularly windy, so extreme wind chills are uncommon. Summer temperatures range from 21°C to 31°C (70°F to 88°F) during the daytime to 10°C to 15°C (50°F to 59°F) during the nighttime. Temperatures occasionally break 32°C (90°F).

The average annual precipitation (including both rain and the water equivalent of frozen precipitation) in Los Alamos is 47.6 cm (18.7 in.). The average snowfall for a year is 149.6 cm (58.9 in.); freezing rain and sleet are rare. Winter precipitation is often caused by storms entering the United States from the Pacific Ocean or by cyclones forming or intensifying in the lee of the Rocky Mountains. When these storms cause upslope flow over Los Alamos, large snowfalls can occur. The record snowfall for one day is 56 cm (22 in.), and the record snowfall in one season is 389 cm (153 in.). The snow is usually a dry, fluffy powder, with an average equivalent water-to-snowfall ratio of 1:20. The summer rainy season accounts for 48 percent of the annual precipitation. During the July-September period, afternoon thunderstorms form because of the monsoonal flow of moist air from the Gulf of Mexico and the Pacific Ocean and because of convection and the orographic uplift as air flows up the sides of the Jemez Mountains. These thunderstorms can bring large downpours, but sometimes they only cause strong winds and lightning. Hail frequently occurs from these rainy-season thunderstorms.

4.1.3 Plant Communities

The Pajarito Plateau, including the Los Alamos area, is biologically diverse. This diversity of ecosystems is due partly to the dramatic 1500-m (5000-ft) elevation gradient from the Rio Grande on the east to the Jemez Mountains 20 km (12 mi) to the west and partly to the many steep canyons that dissect the area. Five major vegetative community types are found in Los Alamos County: juniper-grassland, piñon-juniper, ponderosa pine, mixed conifer, and spruce-fir. The juniper-grassland community is found along the Rio Grande on the eastern border of the plateau and extends upward on the south-facing sides of canyons at elevations between 1700 and 1900 m (5600 and 6200 ft). The piñon-juniper community, generally in the 1900- to 2100-m (6200- to 6900-ft) elevation range, covers large portions of the mesa tops and north-facing slopes at the lower elevations. Ponderosa pines are found in the western portion of the plateau in the 2100- to 2300-m (6900- to 7500-ft) elevation range. These three communities predominate, each occupying roughly one-third of the Laboratory site. The mixed conifer community, at an elevation of 2300 to 2900 m (7500 to 9500 ft), overlaps the ponderosa pine community in the deeper canyons and on north slopes and extends from the higher mesas onto the slopes of the Jemez Mountains. The subalpine grassland community is mixed with the spruce-fir communities at higher elevations of 2900 to 3200 m (9500 to 10,500 ft). Human-made and natural wetlands and several riparian areas enrich the diversity of plant and animals found on LANL lands. The plants and animals found on or near LANL property include approximately 500 plant species, 29 mammals, 200 birds, 17 reptiles, 7 amphibians, and a large variety of insects. Roughly 20 of these are designated as threatened, endangered, or a species of concern at the federal and/or state level.

4.2 Important Habitats of Amphibians and Reptiles

4.2.1 Wetlands and Riparian Zones

Wetlands and associated green belts along streams (riparian zones) are considered sensitive and are important habitat for wildlife. This is particularly true in the arid and semiarid environments of the Southwest. Jones et al. (1985) and Jones and Glinski (1985) found that mesic-adapted or upland amphibians were restricted to cottonwood-willow riparian habitats in the Sonoran Desert. This was attributed to the moderating effects of leaf litter and logs, shading of trees, and accumulation of debris from periodic floods (Jones 1988). Jones (1988) conducted studies along the Salt and Hassayampa rivers in Arizona and found a greater species diversity for amphibians and reptiles compared to nonriparian sites. At LANL, analyses done in 1991 showed species of amphibians and reptiles in the Pajarito wetland were much greater than in the dry Cañada del Buey. An estimated one-third of all known species of plants and animals are associated with wetlands and riparian zones. Further estimations indicate that 12% of all plant and animal species found on the federal list of endangered or threatened species heavily depend on wetlands for food or habitat.

4.2.2 Talus Slopes and Rocky Canyons

Many reptiles and some amphibians prefer rocky talus slopes for three reasons: to avoid potentially lethal temperature extremes, for communal hibernicula (hybernation areas), and for reproductive activities (Herrington 1988). Talus slopes can be defined as large groupings of weathered rock fragments (typically with an associated cliff face) of the canyons (Herrington 1988). The collared lizard, canyon treefrog, checkered whiptail, and western diamondback rattlesnake are found at lower elevations. Throughout White Rock Canyon, these species can be seen sunning on basalt outcrops, hiding under rocks and vegetation, or basking on the riverbank. At higher elevations the western rattlesnake (found up to over 8000 ft), the prairie lizard, and gopher snake can be found in a variety of habitats, including rocky talus slopes, under trees on mesas, and in pine forests. Within the protective environment of the talus slopes, species can breed, reproduce, and hibernate.

4.2.3 Deep Wooded Areas

The higher, moister elevations of the County are potential habitats for the Jemez Mountains salamander (Ladyman and Altenbach 1998, Trippe and Haarmann 1996). This salamander lives in decaying logs and under rocks of primarily the mixed conifer forests and on the moister slopes of the ponderosa pine zone.

4.2.4 Rodent Burrows

Rodent burrows provide a refuge from the dry and hot landscape. Species such as the tiger salamander and Woodhouse’s toad will use the burrow most of its adult life, leaving to seek out water for breeding. Various snakes, including the gopher snake, use the burrows for shelter and for seeking prey.

5.0 Taxonomy of Amphibians and Reptiles

Systematics is the science of naming and classifying organisms. Taxonomic classification provides a unique name for each organism and puts them in a hierarchy of groups (taxa) based on their evolutionary relationships. Names of organisms are in Latin to provide universality and stability. Latin also prevents translating the names into many different languages; regardless of the language the name is associated with the same group of organisms.

The species is the basic category in all classification. Species are defined as populations of organisms that share one or more similarities not found in related species. The name is composed of two words: the first is the genus and the second is the specific name. These names are italicized, and the first letter of the generic name is capitalized (Example: *Hyla arenicolor).*

Common names vary from country to country and even within the same area. Because of this the names are not used in formal scientific identification. We have included both the common name and the scientific name. We encourage you to learn the scientific name.

The general classification of the amphibians and reptiles found in the area is shown in Table 4. The Amphibian Monitoring Program of the Biological Resources Division of the US Geological Survey offices at the Smithsonian Institute has developed a species and coding list of amphibians to help standardize computerized storage, retrieval, and sharing of amphibian monitoring data (McDiarmid 1994). This database can be accessed to determine the latest species and common name information. We have included keys for each Class or Order of amphibians and reptiles in this document. These keys are based not on taxonomic characteristics but on obvious behavioral or structural characteristics. For taxonomic keys, the following references are suggested: Stebbins (1985), Degenhardt et al. (1996), and Smith and Brodie (1982).

5.1 Order Caudata: Salamanders

Salamanders are tailed amphibians that appear lizard-like but are distinguished by their lack of scales and claws. They have four limbs, the front limbs with four toes. The skin is moist and continues to grow even after they reach sexual maturity. All species are carnivorous. Salamanders are preyed upon by fish, snakes, small mammals, birds, and other salamanders.

The origin of the name salamander is Arab-Persian meaning "lives in fire." This came from the belief that the yellow and black European salamander could pass through fire unscathed. The fossil record shows that salamanders date to 150 million years ago. They are found exclusively in the Northern Hemisphere (Cogger and Zweifel 1992).

Some salamanders are entirely aquatic, others are terrestrial and return to water to reproduce, while others are entirely terrestrial. Both reproductive types (aquatic and terrestrial) are found in Los Alamos County and the Jemez Mountains. The males deposit a gelatinous spermatophore during mating. This spermatophore is sucked in by the cloacal lips of the females where the sperm remain to fertilize the eggs as they are laid. Some salamanders lay their eggs in water, some on land. The life cycle of the tiger salamander is shown in Figure 2. The female tiger salamander lays eggs—lacking a protective shell but surrounded by a gelatinous layer—in slow-moving or still water. When the larvae hatch they look very different than an adult, having a tail and external gills. After a few days to years, the larvae will undergo metamorphosis to an adult, leave the water, and seek out burrows. The Jemez Mountains salamander lays eggs in moist subterrenean cavities. The young do not undergo metamorphosis but look like small adults.

Table 4. Living Orders, Suborders, and Families of Amphibians and Reptiles in Los Alamos County

CLASS AMPHIBIA	
Order CAUDATA	SALAMANDERS AND NEWTS
Suborder Salamandroidea	
Ambystomatidae	Mole salamanders
Plethodontidae	Lungless salamanders
Order ANURA	FROGS AND TOADS
Suborder Pelobatoidae	
Pelobatoidae	Spadefoots
Suborder Neobatrachia	
Hylidae	Hylid treefrogs
Bufonidae	Toads
CLASS REPTILIA	
SUBCLASS LEPIDOSAUROMORPHA	
Order SQUAMATA	SQUAMATES
Suborder Lacertilia	Lizards
Teiidae	Whiptails
Scincidae	Skinks
Crotaphytidae	Collared and leopard lizards
Phrynosomatidae	Earless, spiny, tree, side-blotched, horned lizards
Suborder Serpentes	SNAKES
Colubridae	Harmless and rear-fanged snakes
Viperidae	Vipers

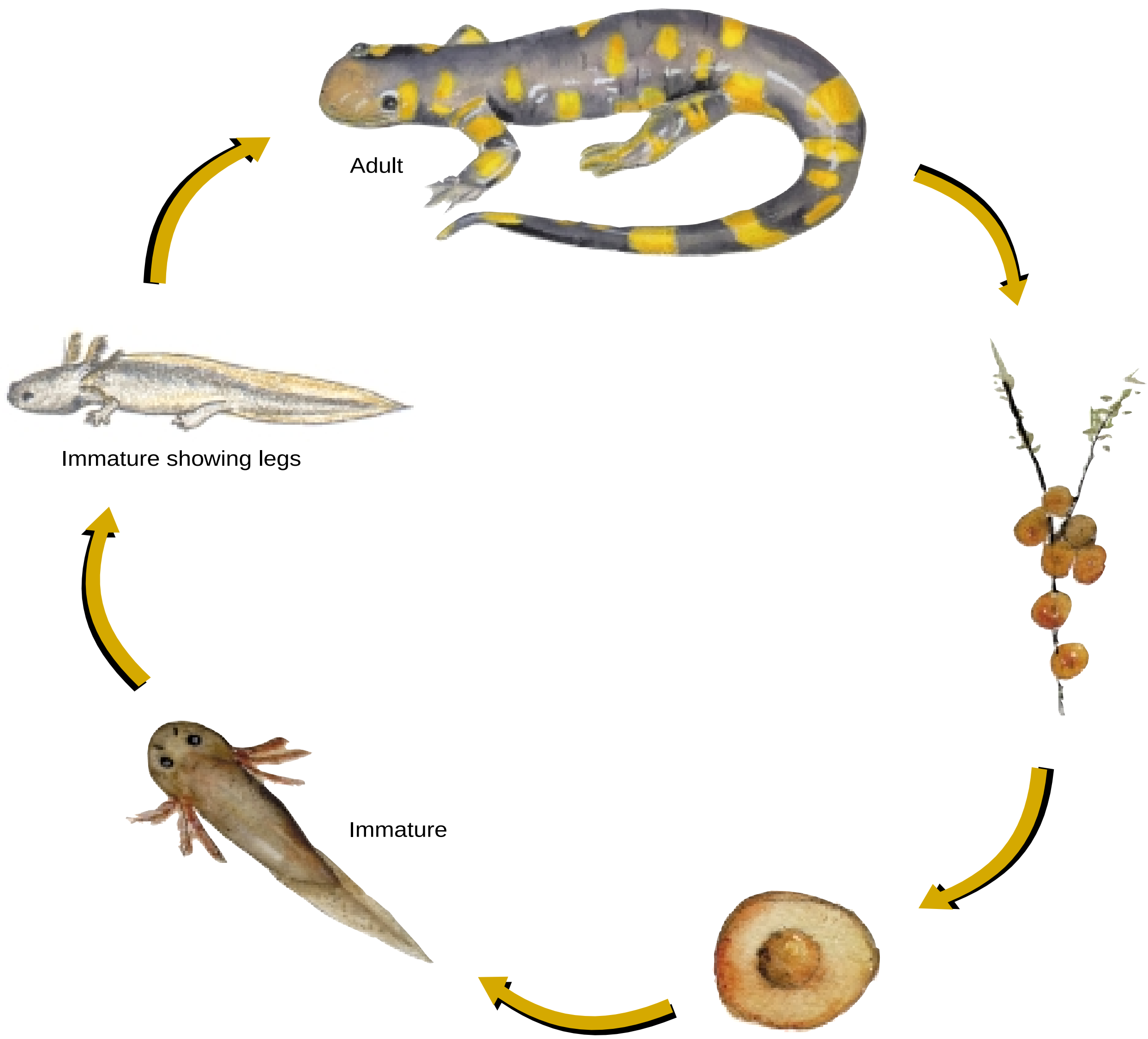


Figure 2. Life cycle of the tiger salamander.

5.1.1. Key to the Salamanders

1. Salamander with large stocky body and black coloration with yellow or cream spots. Reproductive stages are found in water. Adults may be found in water, burrows, old buildings, or basements: ***Tiger Salamander***.

2. Salamander is small, brown, and slender. It is found in and under rotting logs or under rocks. Reproductive stages are not found in water: ***Jemez Mountains Salamander***.

5.2 Order Anura: Frogs and Toads

In Los Alamos County there are three families and five genera of frogs and toads. Frogs and toads are amphibians that lack tails (Anura means "without tail") and have fully developed limbs in the adult stage. Anurans have four well-developed limbs, no conspicuous tail, and well-developed eyes with lids. There are mucous glands to keep the skin moist. In general, toads are squatty in form and have a rough skin covered with poison glands. Frogs are smooth skinned and streamlined with well-developed, powerful hind legs.

Although frogs and toads exhibit a wide array of reproductive strategies, the typical life history of a frog or toad begins when the eggs are laid in water (Figure 3). The number of eggs can be a few to many thousands. Each egg is individually encased in a gelatinous material, and the eggs are laid in masses under water or as a film on top of the water.

The newly hatched larvae are called tadpoles (French meaning "toad head"). The tadpole has external gills that become covered by the body wall forming spiracles. The tadpole develops a tail that propels it through the water. Each tadpole has mouth parts that are specialized for scraping algae and eating plant material. Although many species may become cannibalistic, most tadpoles are herbivorous, whereas the adults are carnivorous. After a period of time, the tadpole develops legs—hind legs first—and absorbs the tail. Lastly, the forelegs appear, and soon the tadpole becomes a froglet or toadlet that can emerge from the water and enter the terrestrial environment. In the case of the spadefoot, the process of egg to toadlet is very rapid and may be as short as 8 to 10 days. In other species, the process takes much longer.

The mating calls of frogs and toads are often heard throughout the breeding season. Generally, most female Anurans are voiceless. The males force air from the lungs vibrating the vocal sacs. The calls serve to attract females and define territories. The calls are highly species specific, so they can be used to identify the species. Some calls are described in Table 5.

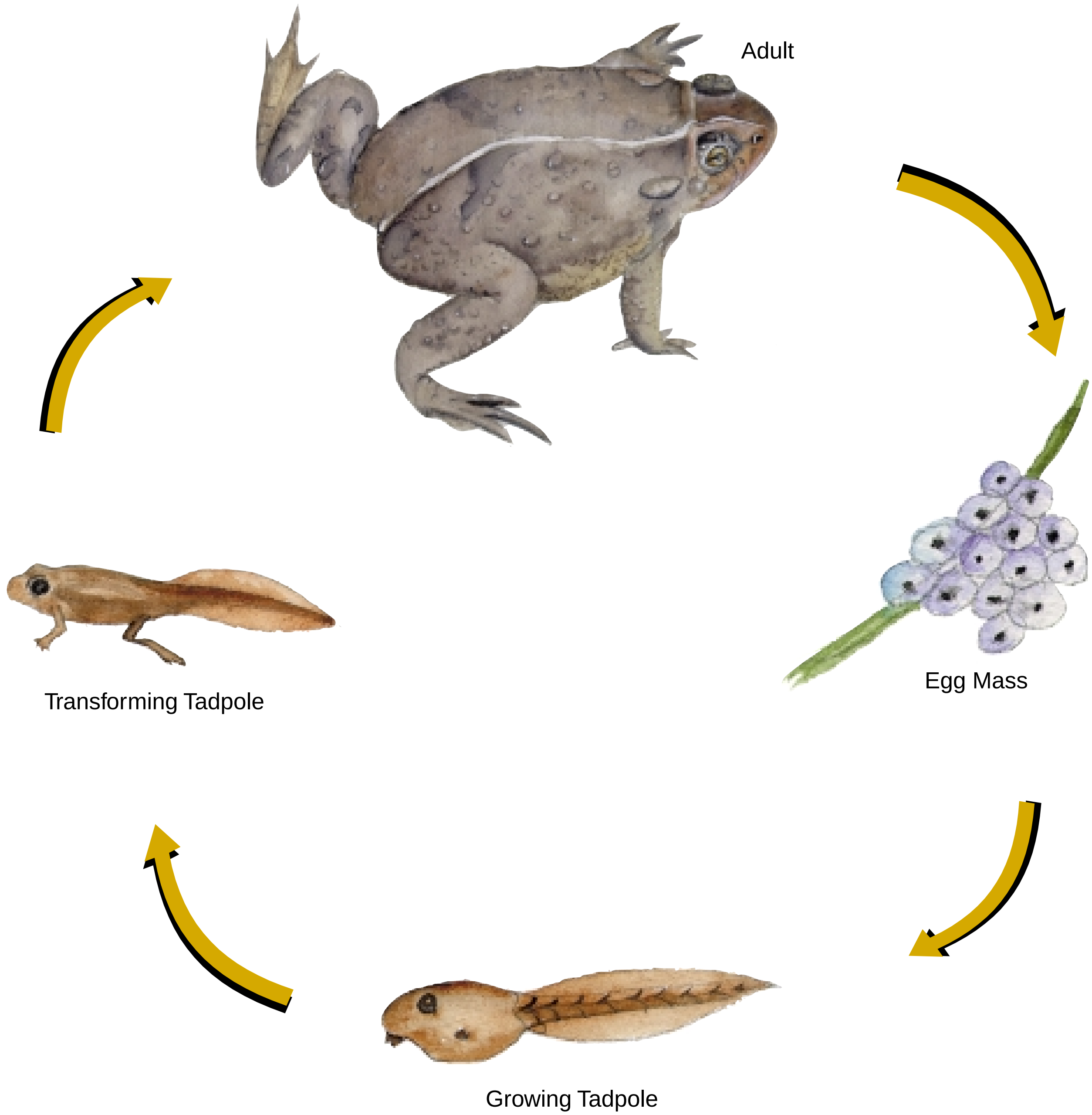


Figure 3. Life cycle of frogs and toads.

Table 5. Species-Specific Calls for Some Frogs and Toads (Smith 1978, Stebbins 1985, and Degenhardt et al. 1996)

Species	Location of Calls	Time Period	Characteristics
Canyon treefrog	Canyons	April-June	A slow buzz or trill of 1 to 3 seconds. An explosive, single-pitched whirring that sounds like a rivet gun and lasts 0.5 to 3 seconds.
Western chorus frog	Ponds	April-June	Similar to the sound of pulling a thumb over the teeth of a comb. A vibrant ‘preeep, preeep’ with a rising inflection.
Woodhouse’s toad	Ponds	April-June	A dissonate trill-like bleat; an explosive wheezy sound lasting 1 to 2.5 seconds.
Red-spotted toad	Ponds	April-June	A high-pitched trill lasting 6 to 10 seconds.
Spadefoot	Ponds	July	A sharp quack lasting 0.2 to 0.7 seconds.

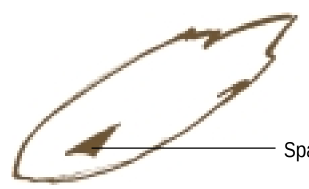
5.2.1 Key to Frogs and Toads

1. Small, long-legged frogs with horizontal pupils. (Go to 2)
1. Stout toads, short legs, smooth or warty skin. (Go to 3)

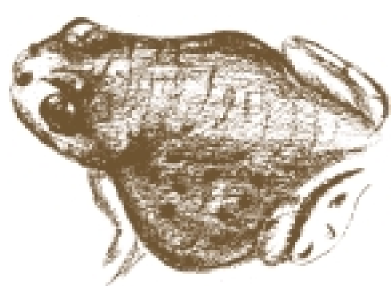
Horizontal pupil

2. A brownish to grayish frog, with a plump body and warty toad-like skin. Toe tips with adhesive discs: ***Canyon Treefrog***
2. A small, brown, olive green, or grayish frog. Adults have a dark stripe that extends from the nostril, through the eye, and above the forelimb to the groin. Toe tips without adhesive discs: ***Western Chorus Frog***

3. Toad with verticle pupils, or “cat-like” eyes, smooth skin, no parotid glands (a gland behind the eye). They have a sharp-edged “spade” on each hind foot: ***Spadefoot***
3. Toad with warty skin, parotid glands, and no sharp-edged “spade” on each hind foot. (Go to 4)



Vertical pupil



Spadefoot

4. Toad with a dorsal white stripe, dry skin with many warts, an oval parotid, and colored gray to olive green. Young may have red spots: ***Woodhouse's Toad***
4. Toads without white dorsal stripe, light gray, olive, or reddish with reddish or orange spots and a round parotid: ***Red-Spotted Toad***

5.3 Order Squamata: Scaled Reptiles; Suborder Lacertilia: Lizards

In Los Alamos County and the adjacent Jemez Mountains, there are 11 species of lizards in five families. Lizards are closely related to snakes, but are easily recognized because they have limbs and short bodies. Snakes have no limbs and elongated bodies. Lizards have five toes on each foot and scaly skins, eyelids are movable, and most have an ear opening on each side of the head. Most species are egg-laying, but some, such as the horned lizard, give birth to live young. Most lizards live in the hot, dry areas of the County. The life cycle of the lizard is shown in Figure 4.

5.3.1 Key to Lizards

1. Large agile lizard with long legs and a long tail with a collar around the neck: ***Collared Lizard***
1. Lizard without a collar around the neck. (Go to 2)

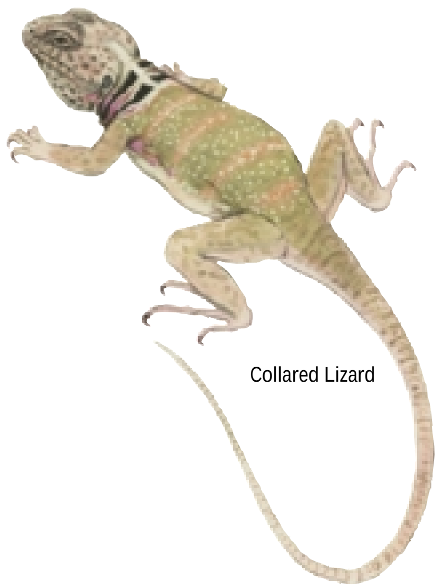
2. Lizard with a spine covered body, body is squat: ***Horned Lizard***
2. Lizard may or may not be spine covered, body is not squat. (Go to 3)

3. Lizard with blue blotches on the underside: ***Prairie Lizard***
3. Lizard without blue blotches on underside. (Go to 4)

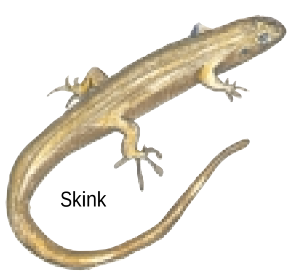
4. Lizard with distinct head and body. (Go to 6)
4. Lizard with head and body the same width. (Go to 5)

5. Lizard with smooth, flat scales that produce a glossy, silky appearance. Legs are short. Swift runners with sometimes a snake-like movement. Generally found in moist environments: ***Skinks***
5. Lizard not glossy, silky in appearance. Backs either striped or spotted. Tail is twice as long as the body. Legs are long: ***Whiptails***

6. Collar-like crossbar at the shoulders, entire belly is blue, orange, or yellow: ***Tree Lizard***
6. Dark spots on the back. Sides with black bars surrounded by a blue patch: ***Lesser Earless Lizard***


Collared Lizard


Horned Lizard


Skink


Whiptail

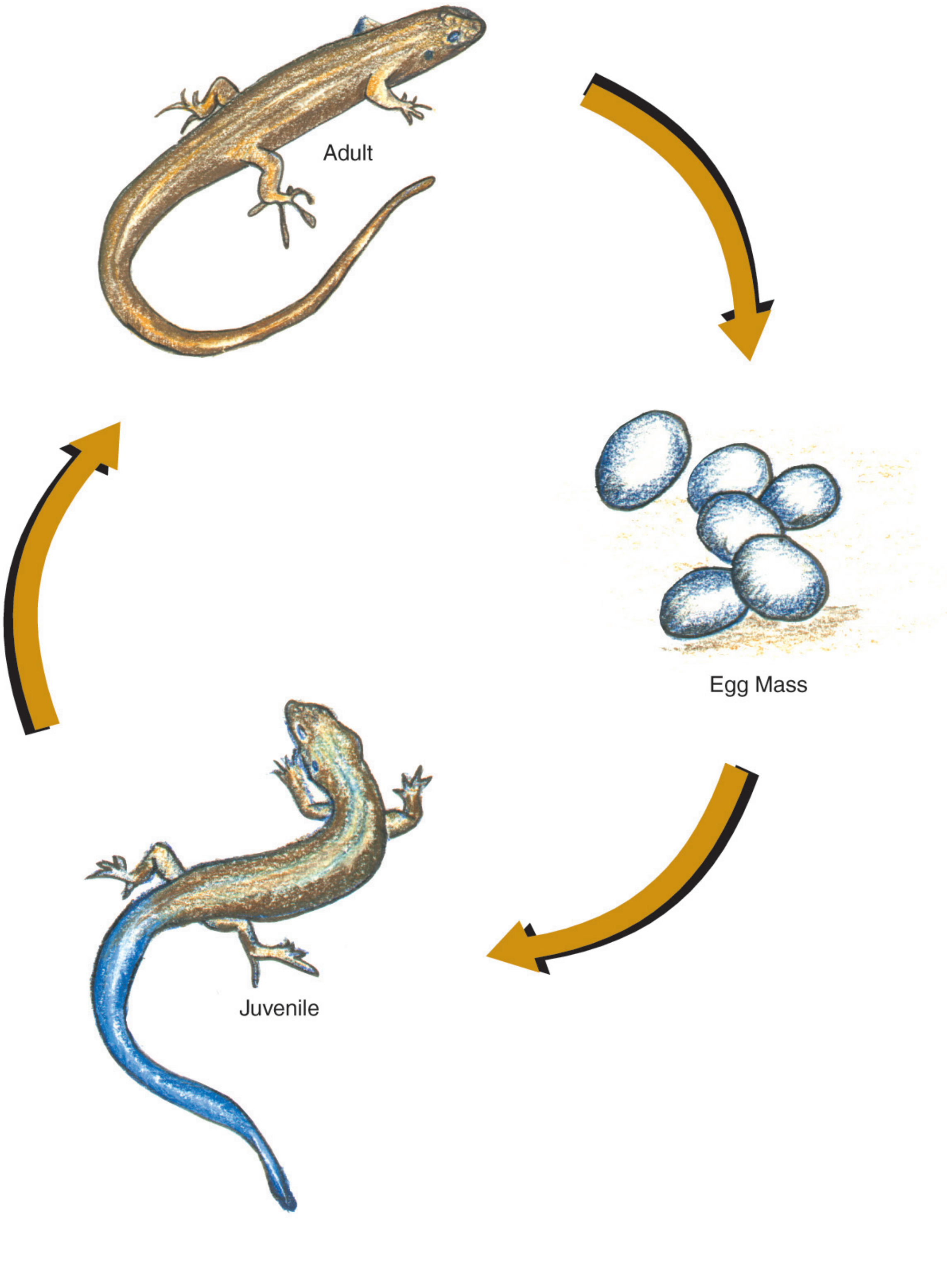


Figure 4. Life cycle of the lizard.

5.4 Order Squamata: Scaled Reptiles; Suborder Serpentes: Snakes

Snakes are the most successful of all living reptiles. There are 16 snake species on the Pajarito Plateau and along the Rio Grande. Two families are represented. Snakes lack limbs, ear openings, and eyelids. The upper and lower jaws move separately to swallow large prey whole. Snakes detect prey with their forked tongue and by sensing vibrations through the ground. No snakes are herbivorous. Most are specialized in capturing prey; others have modified teeth to inject poison. The only poisonous snakes of concern in the area are the western diamondback rattlesnake and the western (prairie) rattlesnake. Snakes are found in a variety of habitats from dry to wet; lower as well as higher elevations. Most of the snakes in the area are egg-layers, but some give birth to live young (e.g., garter snakes). The mother does not care for the young, and they must quickly learn to fend for themselves. Behavior differs by species. The gopher snake is active in the day, others such as the night snake are nocturnal.

Smith and Brodie (1982) divide the snakes of the Colubrid family into two subfamilies. Those in the subfamily Colubrinae are divided into various groups based on behavioral characteristics, food habits, and morphology.

Rattles

No Rattles

5.4.1 Key to Snakes

1. Tail with rattles. (Go to 10)
1. Tail without rattles. (Go to 2)

Hognose

2. Rostral (tip of snout) is modified—much enlarged, turned up, and pointed: ***Hognose Snake***
2. Rostral is normal and not greatly enlarged. (Go to 3)

3. Snake has yellow stripe down its back, may be near water but in many moist habitats: ***Garter Snake***
3. Snake does not have the yellow stripe; brightly colored or brown, black, or gray. (Go to 4)

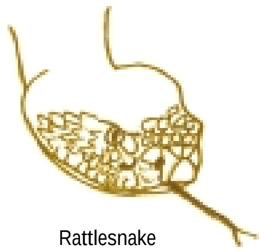
4. Snake is brightly colored—green, orange, or red coloration. (Go to 5)
4. Snake is black, brown, or gray but is not brightly colored. (Go to 6)

5. Snake has red, white, and black alternating stripes: ***Milk Snake***
5. Snake is not red, white, and black but green. (Go to 8)

6. Snake moves rapidly and sometimes climbs trees: ***Whipsnakes***
6. Snake does not move rapidly. (Go to 7)

Gopher Snake

7. Large slow moving snake, cream or yellow with light brown to dark brown blotches: ***Gopher Snake***
7. Moderately active snake that is black or gray. (Go to 8)



Rattlesnake

8. Slender-bodied snake that is pale gray, light brown or beige with brown blotches. It is generally active during mornings and evenings. (Go to 9)
8. Snake is all green: ***Smooth Green Snake***

9. Snake is large with bands of black or dark brown, white to pale yellow. It is active during morning and evenings: ***Common Kingsnake***
9. Large snake with bands of black or dark brown, white to pale yellow with rattles on the tail. It is active during morning and evenings. (Go to 10)

10. Snake with black and white bands before the rattle: ***Western Diamondback Rattlesnake***
10. Snake without black and white bands before the rattle: ***Prairie Rattlesnake***