



# State of the Lizard



See p. 11 for photo credits and species

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The “2012 – Year of the Lizard” campaign is sponsored by Partners in Amphibian and Reptile Conservation (PARC) to raise awareness for lizard conservation. Why lizards, and why now? The growth of human communities and its effects on natural habitats are taking a toll on our lizards. Threats to lizards include habitat loss and fragmentation, invasive species, predation, overexploitation, and climate change. The good news is that most of these concerns have solutions. With some focused attention, we can engineer a future for our lizards within our developing world.

As 2012 unfolds, PARC will shine a spotlight on our amazing lizard fauna and highlight the work of researchers, land and resource managers, and the public to develop conservation measures that will identify threats and forestall losses at local levels. Here, we provide a brief background on our lizards today, identify urgent needs for the conservation of this fauna, and outline actions that can aid in their persistence. With place-based management, local populations can thrive. Lizards are a taxonomic group that can benefit by Citizen Science actions. YOU can help.

*“Precisely the least, the softest, lightest, a lizard’s rustling, a breath, a flash, a moment -- a little makes the way of the best happiness” --- Friedrich Nietzsche.*



**2012 - Year of the Lizard**  
([www.yearofthelizard.org](http://www.yearofthelizard.org))  
aims to raise awareness for  
lizard conservation.

## What are Lizards?

Lizards are reptiles. They are:

- 1) vertebrates, having a backbone like fish, amphibians, birds, and mammals; and
- 2) ectothermic, deriving their body heat from the outside world.

Lizards characteristically have dry, scaly skin. They are generally distinguished from their close relatives the snakes by their limbs and external ears. A great variety of forms exist among lizards, however, as can be seen when you compare whiptails with Gila Monsters (photos at right). Some lizards have overlapping scales or are legless, like snakes. Some can drop their tails without injury to themselves to distract a predator and escape. Some lay eggs, and others give birth to live young. They have myriad social behaviors, with some lizards known for using push-ups, head bobbing, and posturing to communicate. Interestingly, most lizards have color vision, which explains the spectrum of hues characterizing the different species, as seen in the brilliant blues of skink tails and the wild variety of color patterns in other families. Coloration is often seasonal, becoming vivid in the mating season. Many species are territorial—each male defends a territory and the females within it against rivals. But then there are the whiptails of the American Southwest: some species are all females, and their eggs can develop without fertilization by a male! The diversity among lizards today is quite astounding.



*The Gila Monster, Heloderma suspectum, is a venomous lizard of the southwestern US and northwestern Mexico. This species has near-threatened status under the IUCN, and is protected in Arizona, New Mexico, and Nevada. Photo © C Klinger.*



*New Mexico Whiptails, Aspidoscelis neomexicana, are all females and can reproduce without mating with males. Unfertilized eggs develop and become clones of the mother. Photo © LLC Jones.*



### 2012 is also the Chinese Year of the Dragon. Are dragons lizards?

**Yes and No.** Some lizards have 'dragon' in their names. These include the Australian Water Dragon (*Physignathus lesueurii*) and Central Bearded Dragon (*Pogono vitticeps*), and the Komodo Dragon (Komodo Monitor, *Varanus komodoensis*, right) of Indonesia. So in one sense some dragons are lizards. Dragons are also mythological beasts that have lizard-like features, such as scales. However, lizards do not breathe fire or have wings to fly like fictional dragons, although the Common Gliding Lizard (*Draco sumatranus*) of southeast Asia has skin flaps that allow it to soar between tree trunks. Some dragon legends place the creatures into aquatic realms. Today, most lizards occur on land in often arid settings, and only a few such as the famous Marine Iguanas (*Amblyrhynchus cristatus*) of the Galapagos Islands venture into water. A common theme among both dragons and lizards is that they are revered in many cultures, and are symbolic of power and wisdom. Photo from <http://reptilepictures.net/Komodo-Dragon.html>

Over 5,000 species of lizards live on Earth today, and they can be found on all continents but Antarctica. Our North American fauna is a small subset of the world's lizards, with only 118 species occurring north of Mexico. Spanning the United States and Canada, whiptails and spiny lizards are most diverse, with 21 and 22 species, respectively. The American Southwest is the regional hotspot, with ~96 known species, inclusive of northern Mexico. Latitudinal and longitudinal gradients in diversity are quite apparent—for example, 16 species are known in northwestern North America, 10 species occur in the northeastern U.S., with only one species in New England, 18 species occur in the southeastern U.S., and only 6 native species are recorded for Canada.

## Threats: At a Loss for Lizards

Unfortunately, our understanding of lizard status is incomplete. The IUCN Red List of Threatened Species acknowledges that their assessment is lacking relative to arid and semi-arid species, including lizards. The IUCN recognizes that these systems are expanding, and a focus on the world's 5,000+ lizards is needed.

In North America, we have a better understanding of lizard status through the various lists categorizing Endangered, Threatened, or Sensitive species, including the U.S. Endangered Species Act (ESA) and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). To date, more than 20% of lizards

### Are salamanders lizards?

**No.** Although both salamanders and lizards have elongate bodies, four legs and a long tail, salamanders are not reptiles. Salamanders (and newts) are amphibians. Lizards have scales covering their skin and can live in very dry areas, whereas salamanders generally have smooth skin that must remain moist or they will dry out and die. However, in folklore the “fire lizard” was likely a salamander that emerged from campfires because salamanders often are found within decaying wood. In the southeastern U.S., salamanders used for bait are called ‘spring lizards’.

### How about Alligators and Crocodiles?

**No.** These are not lizards, either. Today, thanks to technological advances, modern crocodylians are considered to be most closely related to birds, and more distantly related to lizards and snakes! There may be a link between crocodiles and dragons, as it has been suggested that the symbolic Chinese dragon is a stylized crocodile.

north of Mexico have status rankings of concern. We are truly ‘at a loss for lizards’! In the U.S., 38 lizard species are considered under the ESA, with five species identified as Endangered or proposed Endangered, five species listed as Threatened, and 20 are Species of Concern. An additional three species are Endangered in Canada. Other lizard species are in concern categories within U.S. states.



*Lizards are common art icons in our everyday life today, and in native cultures worldwide. This mural of a dinosaur-sized Desert Iguana, Dipsosaurus dorsalis, can be seen in 29 Palms, California! Photo © LLC Jones.*

Lizards listed as Threatened or Endangered by the United States Endangered Species Act (ESA) and by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) ([http://ecos.fws.gov/tess\\_public/SpeciesReport.doc](http://ecos.fws.gov/tess_public/SpeciesReport.doc); <http://www.cosewic.gc.ca/eng/>; accessed 18 November 2011).

Common Name	Scientific Name	Status
St. Croix Ground Lizard	<i>Ameiva polops</i>	Endangered (ESA)
Maria Island Ground Lizard	<i>Cnemidophorus vanzoi</i>	Endangered (ESA)
Hierro Giant Lizard	<i>Gallotia simonyi simonyi</i>	Endangered (ESA)
Blunt-nosed Leopard Lizard	<i>Gambelia sila</i>	Endangered (ESA)
Dunes Sagebrush Lizard	<i>Sceloporus arenicolus</i>	Proposed Endangered (ESA)
Blue-tailed Mole Skink	<i>Plestiodon egregius lividus</i>	Threatened (ESA)
Florida Sand Skink	<i>Plestiodon reynoldsi</i>	Threatened (ESA)
Ibiza Wall Lizard	<i>Podarcis pityusensis</i>	Threatened (ESA)
Coachella Valley Fringe-toed Lizard	<i>Uma inornata</i>	Threatened (ESA)
Island Night Lizard	<i>Xantusia riversiana</i>	Threatened (ESA)
Greater Short-horned Lizard	<i>Phrynosoma hernandesi</i>	Endangered (COSEWIC)
Five-lined Skink	<i>Plestiodon fasciatus</i>	Endangered (COSEWIC)
Prairie Skink	<i>Plestiodon septentrionalis</i>	Endangered (COSEWIC)

### Primary Threats to Lizards

- Habitat loss, degradation, fragmentation
- Invasive species
- Over-exploitation
- Predation
- Climate change

#### 1. Habitat Loss, Alteration, and Fragmentation

Habitat loss, degradation, and fragmentation are the most significant threats to lizards, overall. These threats coincide with human development, and are resulting from the outright conversion of land for rural or urban expansion, the incursion of energy development into remote areas, a relatively recent threat in the U.S. west, and additional human-associated threats that tag along with our growing population.

Lizard habitats are quite diverse because the different species can live in different biomes such as deserts, forests, or prairies. They usually live on the ground or climb up into vegetation or over rocks. In North America, physical habitat conditions are of paramount concern for many lizards. Two prime habitat elements of consideration for lizards include temperatures suitable for thermoregulation and substrates suitable for burrowing or providing spaces used for cover. Vegetation is key for providing a variety of hiding places, refugia from predators, and habitat for their prey. As these elements are altered, so are lizard habitats, and lizard survival and/or reproduction also may be affected.



*The Island Glass Lizard, Ophisaurus compressus, is US ESA-listed as a Species of Concern due to habitat loss and degradation. It is legless and occurs in sandy scrub habitats of South Carolina, Georgia and Florida. Photo © JD Willson.*

Habitat fragmentation is a subtle change to the spatial arrangements of habitats that alters lizard distributions and their interactions with each other. In particular, roads disrupt habitat connectivity and can affect habitat suitability for individuals and the dynamics among individuals that characterize lizard populations. Maintenance of connected habitats across large areas is an emerging concern for all wildlife species.

Two examples follow. The Dunes Sagebrush Lizard, *Sceloporus arenicolus*, of New Mexico and Texas occurs in a small area of shinnery oak dunes habitat. Its habitat is threatened by oil and gas development, off-road vehicle

traffic, brush invasion, and chemical spraying. The Flat-tailed Horned Lizard, *Phrynosoma mcallii*, occurs in sandy desert hardpan or gravel flats in southern California, southwestern Arizona, and northwestern Mexico. Agricultural, urban, and geothermal developments, in addition to off-road vehicles and sand and gravel mining, restrict its habitat. Federal protection was withdrawn for this lizard in 2006, and it is listed as 'near threatened' by IUCN and a species of special concern in California. Ongoing monitoring efforts are assessing population status of this species

## 2. Invasive Species

Invasive species concerns for lizards are numerous, and this threat category overlaps with two other threat categories—habitat degradation and predation. Non-native plants invading arid western landscapes are a particular threat to lizard habitats. For example, Buffelgrass (*Pennisetum ciliare*) is changing the southwestern U.S. and northern Mexico ecosystems from desert to grassland. Buffelgrass outcompetes native plants, is drought tolerant, persisting in dry years, and appears to deplete soil fertility. Its spread has changed fire dynamics, from a desert system without fire and fire-adapted communities, to systems in which hotter fires may be created year-round and subsequent loss of desert species. This grass degrades habitat for lizards such as the Reticulate Collared Lizard (*Crotaphytus reticulatus*), a species listed as vulnerable by the IUCN and threatened in the state of Texas.



*Green Anoles (Anolis carolinensis) are some of the most common lizards in the pet trade. A pet store may call it a chameleon. They can be captive-bred, which reduces stress on animals and threats to wild populations. Green Anole declines in Florida are associated with both increasing non-native anoles and habitat degradation. Photo © JD Willson.*



*Is this a horned frog or horny toad? No, this is a horned lizard! This Round-tailed Horned Lizard (*Phrynosoma modestum*) lives in desert scrub and semi-desert grassland with gravelly or rocky soil in Texas, New Mexico, Arizona, and Mexico. It eats ants! Due to its very specialized diet, the ant-eating horned lizards generally make poor pets – watch these and other native lizards in the wild; don't take them home. Photo © JD Willson.*

Another example is Cheatgrass (*Bromus tectorum*), an invasive grass of western American shrub-steppe communities, which is suggested to have negative effects on lizards such as Desert Horned Lizards (*Phrynosoma platyrhinos*) in the Great Basin Desert of Utah. These horned lizards appear to avoid areas with Cheatgrass, which impairs their mobility.

Non-native species are competitors and predators of native lizards, with cascading effects through food-web dynamics. Forty introduced exotic lizard species occur in the southeastern U.S., mostly in Florida. Many of these have origins from the pet trade; release of non-native animals into the wild can harm native species through both food web dynamics, displacement from habitats, and disease introductions. Another non-native species concern for lizards is ants. Some invasive ants displace native ants, depleting the main food resource for horned

lizards. In a 'turn of the tables', invasive Fire Ants eat lizards. Additional threats that both non-native and native predators pose to lizards are included in the next section.

### 3. Predation

Domestic and feral cats eat lizards, and they can be a dominant threat to lizard species. Cats are named as key threats to the Common Five-lined Skink in Canada. In New Zealand, a single cat was found with 49 skinks in its stomach—that one animal was a significant threat. The Galapagos National Park and the Charles Darwin Research Center spent years removing feral cats from a single island, Baltra, just to restore the ecosystem and native land iguanas there. Domestic cats may sometimes bring home only a lizard's tail. Perhaps sacrificing that tail saved the lizard's life for the moment, but tail loss can affect locomotion, social status, and longer-term survival and reproduction. Keeping domestic cats indoors and reducing feral cat populations are the best ways to reduce this threat to wild lizard populations.

Other human-associated mammals have been implicated as being threats to lizards as well. The St. Croix Ground Lizard (*Ameiva polops*) is a U.S. Endangered species. Its main threat appears to have been the Indian Mongoose which was introduced into the U.S. Virgin Islands in the late 1800s. Dogs, pigs, and rats are other known non-native predators that may be threats to lizards in different parts of the world.



*This Common Five-lined Skink, *Plestiodon fasciatus*, may be on the menu for your outdoor cat. Unprecedented predation rates by domestic or feral cats are key threats to many lizards. Photo © JD Willson.*

Natural predators of lizards include a diversity of snakes, birds, and mammals. Predation rates of native predators on lizards may increase with human development. For example, with human development has come increased fencing, and electrical and telephone poles and wires. These are perches for avian predators. Predation rates on lizards by their natural bird predators may have increased due to the artificial perches and the heightened visibility such perches afford birds. As human development fragments lizard habitat, predation edge effects may result – meaning more of a lizard’s habitat may be near a boundary with human habitation or development and these edges may have new perches for avian predators. Avian predator use of power-line grids was discussed in the 2010 ESA-listing proposal for the Dunes Sagebrush Lizard; this potential threat warrants further research. Another example is the increasing raccoon populations associated with human development; this is another potential threat to lizards from native predators.

#### 4. Over-Exploitation

Collection of wild animals can lead to over-exploitation.

Lizard over-exploitation is an issue of particular concern for the rare and unique species, but common species also can be locally extirpated due to over-collection of wild animals. Lizards may be valued highly for a variety of human uses, including pets, skins (monitors), meat (iguanas), traditional or modern medicines (monitor fat–antibacterial; monitor oil–aphrodisiac; geckos–miracle cures), and souvenirs (stuffed horned lizards!). This is not solely an issue for other parts of the globe—large numbers of lizards or lizard products are sold in the U.S. every year, although the demand for lizards is higher elsewhere. The lack of harvest and trade regulations and difficulty in the enforcement of existing regulations exacerbate this over-exploitation problem.

Reptile trade issues currently are a focus of attention in the U.S. and abroad. For the U.S., PARC and State Partners have developed Model State Herpetofauna Regulatory Guidelines (<http://parcplace.org/publications/>) to assist wildlife management agencies in creating or modifying their regulations regarding the collection, manipulation, possession, and sale of native and non-native herpetofauna. For the average citizen in the U.S. or Canada, please check with your state or province regulations before

### Were dinosaurs lizards?

Dinosaurs flourished in the Age of Reptiles, the Mesozoic period of ~100-250 million years ago, a time when reptiles dominated life on the planet. Many different groups of reptiles coexisted during the Mesozoic: dinosaurs were part of a larger group of reptiles, the Archosaurs, and lizards stem from another lineage called the Lepidosaurians.



*The Southern Alligator Lizard, Elgaria multicarinata, can be found in chaparral, forests, grasslands, and urban areas from Washington to Mexico. They have a reputation for being fierce, and will bite. Climate change is a concern for altering microclimates upon which this species relies. Photo © B McCreary.*



*The Eastern Collared Lizard, Crotaphytus collaris, is widespread in North America, native to areas from Kansas to Mexico. Males are brightly colored during the breeding season. They eat a variety of arthropods and other lizards. Over-collection of collared lizards is a conservation concern. Photo © LJ Vitt.*

taking them out of the wild. Permits may be required, and collection of rare animals for personal use may be prohibited. However, in many places, it is legal to collect lizards.

For prospective pet owners, with proper care, some lizards make excellent pets, and help connect us to the wonders of the natural world. Although lizards can be bred in captivity, and lizard trade enthusiasts have been transitioning to the trade of captive-bred stock, there is no real certification process to ensure that wild animals are not taken illegally and sold. The onus is upon the buyer to

ensure that their purchase either has been legally collected or is a captive-bred animal. Release of captive animals back into the wild is problematic due to disease issues and potential mixing of isolated genetic populations; these concerns also hold for wild-caught animals brought into captivity temporarily. Non-native species that are turned loose also can compete with or prey on native populations, upsetting the balance of a local animal community. For more information, “Don’t turn it loose!” brochures are available at: <http://parcplace.org/images/stories/pdfs/DontTurn.pdf>.

## 5. Climate Change

The first fossil lizards have been dated to 250 million years ago, and fossils from about 140 million years ago begin to look like modern lizards. Although climates have changed radically over the last hundred million years, the combined effects of the more-recent heightened rate of climate change, the restricted distribution of many of today’s lizards, lizard dispersal limitations, and the fragmentation of current lizard habitats due to extensive human developments are proposed to be putting today’s lizards at unprecedented risk. They may not be resilient enough to ‘weather this storm,’ especially species with restricted distributions. This is a hot topic for lizard researchers today.



*Males of the Greater Earless Lizard, Cophosaurus texanus, become brightly colored in the mating season. They do not have external ear openings, and thus appear to be earless. Photo © LLC Jones.*

“Altered thermal niches” are an emerging concern for the effects of climate change on lizards. A recent study of Mexican lizards found that 12% of local populations have been lost since 1975, and local extirpations were projected to reach 40% by 2080—the study provides support for climate change as the cause. The basic premise of this threat is that lizards are active during optimal temperatures because they are ectothermic, and the timing of these ‘windows’ may vary with weather patterns and climate change trends. With current climate change scenarios, these windows of activity can narrow during critical active seasons such as during breeding, and also at inappropriate times such as during winter hibernation.

Mounting evidence suggests that climate change is affecting some species. For example, in Oregon, reproductive ‘busts’ from variable spring conditions narrowing the time window

of suitable breeding conditions have been reported in the Side-blotched Lizard, *Uta stansburiana*. In Alberta, Canada, lizard mortality has been seen with unseasonal warm weather midwinter, followed by more cold weather. Winter survival for the Greater Short-horned Lizard, *Phrynosoma hernandesi*, in Alberta may rely on persistent snow cover, which insulates hibernating animals from such warm spells. North temperate zones may be particularly susceptible to such year-round weather vagaries, and in North America, lizard range boundaries are coincident with areas subject to widely fluctuating weather patterns. In short, if the rate of climate change increases, lizards may be in peril. It should be noted that predicting weather patterns from climate-change trends is not straightforward, many complex factors come into play, including geographic variation in climate drivers. However the point here is that it is also not a straightforward conclusion to assume that global warming trends will create warmer habitats that will be ‘good’ for ectothermic lizards, expanding population boundaries. Nevertheless, in Spain’s Mediterranean-influenced environments, one study has found a significant northward expansion of lizard ranges between two time periods, 1940-1975 and 1991-2005. Those researchers pointed out constraints in lizard range shifts in their region due to the geographic barriers of the Cantabrian Sea and the Pyrenees



*The Western Banded Gecko, Coleonyx variegatus, is nocturnal, and occurs in arid habitats of southern California, Arizona, Nevada, and Mexico. Photo © LLC Jones.*

### Are geckos lizards?

**Yes.** Geckos are indeed lizards, and there are almost 1,500 species of geckos on Earth. They are found in warm areas and can be very colorful. Many geckos can produce sounds and are excellent climbers. Geckos can be found in pet stores, and some varieties are captive-bred and make excellent pets. However, prospective gecko owners need to do their homework to make their selection a successful endeavor for both the gecko and the human!

Mountains. Such dispersal limitations can also be caused by anthropogenic habitat fragmentation. The relationships between lizard ecology and climate may have regional and taxonomic patterns. These topics warrant closer inspection.

## **Conservation Needs:**

### **1) Conservation Actions**

Members of the public, biologists, land and resource managers, and policy makers all have roles in wildlife conservation. Effective lizard conservation can occur within local communities. Citizen-scientists, school groups, and nature enthusiasts can have a strong voice in managing local areas to retain and improve lizard habitats and connectivity among habitats. At larger scales, county, state and provincial planning efforts can identify priority areas for lizards, and then address habitat-management and connectivity-corridor alternatives accordingly. Habitats for lizards are habitats for a wealth of biodiversity, so connecting lizards to other species and conserving the jointly used habitats will help communities of organisms. By dedicating conservation efforts to lizards while we still have thriving populations, we will also address ecosystem sustainability, and retain our treasured natural heritage for future generations, bio-medical research opportunities, bio-ethics, and aesthetics.

### **2) Public awareness and education**

Raising conservation awareness for lizards is an educational theme that can have rewarding benefits for ‘children of all ages’! Lizards are watchable wildlife, and as such can help us to connect to our natural world. As the ‘2012 – Year of the Lizard’ campaign unfolds, watch for newsletters and other informational materials at [www.yearofthelizard.org](http://www.yearofthelizard.org). Contribute to these newsletters with your own stories—share your experiences. ‘Pay it Forward’ by helping to raise lizard-conservation awareness in your area!

### **3) Research**

A greater understanding of emerging threats to lizards is a priority research need. Each of the threats discussed above has associated knowledge gaps that research can address. In a human-dominated world, how much habitat is needed to keep lizard populations sustainable? How resilient are they to our changing world? Are other threats looming, such as disease? Emerging concerns such as climate change need greater attention. More knowledge of this diverse and colorful fauna will assist us in making management decisions in the future.

[www.yearofthelizard.org](http://www.yearofthelizard.org)

PARC is dedicated to herpetofaunal conservation. You can become involved in PARC to help address lizard conservation needs in your area. For more information about PARC and the Regional Working Group in your area, please go to:  
[www.parcplace.org!](http://www.parcplace.org)

## Seven Small Ways YOU Can Help Lizards

1. Provide lizard-friendly habitats in your backyard or elsewhere to help keep common species common
2. Focus special attention on rare species
3. Lizards are watchable wildlife, watch them!
4. Do not take wild lizards as pets, or release pets into the wild
5. Consider adopting a lizard from a shelter or wildlife rehabilitation center rather than buying a new one
6. Keep pet cats indoors, or if you let them out, try not to let them eat lizards
7. Tell others about lizard conservation needs



Long-nosed Leopard Lizard (*Gambelia wislizenii*) basking in the sun. Photo © LLC Jones.

### Make lizard conservation happen!

*“At noon in the desert a panting lizard waited for history, its elbows tense, watching the curve of a particular road as if something might happen.”— William Stafford*

### For More Information

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**Author:** Deanna H. Olson, US Forest Service, Pacific Northwest Research Station, Corvallis, OR; dedeolson@fs.fed.us

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Page 1 banner photos, clockwise from lower left – Southern Alligator Lizard, *Elgaria multicarinata*, © B McCreary; Juvenile Eastern Collared Lizard, *Crotaphytus collaris*, © LJ Vitt; Juvenile Giant Spotted Whiptail, *Aspidoscelis stictogramma*, © LLC Jones; courting Broad-headed Skinks, *Plestiodon laticeps*, © LJ Vitt; Texas Banded Gecko, *Coleonyx brevis*, © LJ Vitt.

Page 12 photos, top to bottom: Male Five-lined Skink (*Plestiodon fasciatus*) in breeding color, © LJ Vitt; Common Chuckwalla (*Sauromalus ater*), © LLC Jones; Round-tailed Horned Lizard (*Phrynosoma modestum*), © LJ Vitt. Year of the Lizard logo by Todd Long.



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