



INFORMATION

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# Amphibians and reptiles in a changing climate HOW LONG CAN THEY HANG ON?

*Glass frogs—such as the species *Hyalinobatrachium bergeri* shown here—live in the rainforest of the Andes Mountains. The species of this family typically lay their eggs on the underside of leaves. Once the tadpoles emerge, they fall into the stream below. Eggs and tadpoles have less chance of survival when humidity is low or streams are drying out, making the species very sensitive to climate change. Photo: Ignacio De La Riva*

No one can escape the effects of climate change – not even animals and plants. Particularly affected are those animal species whose body temperature depends directly on ambient temperature known as cold-blooded animals: amphibians and reptiles. Approximately one in every three amphibian and reptile species is currently threatened according to the International Red List. How will climate change affect these two endangered vertebrate groups? Do the impacts of climate change vary from region to region?



*Both the tree frog (*Isthmohyla calypso*) and the Panamanian Golden Frog (*Atelopus zeteki*) are critically endangered. They live in the cloud forests of Costa Rica and Panama. Changes in humidity and higher temperatures foster the spread of a fungal disease that is probably responsible for the decline and even the extinction of many other amphibians in tropical Central and South America. Photo Ignacio De La Riva*

These and other issues were analysed in an overview study conducted by international researchers, including WWF Germany (Winter et al. 2016). The scientists looked at the results of 104 articles that were published in peer-reviewed journals between 2005 and 2015. The effects of climate change on a total of 195 amphibian and 118 reptilian species from around the world were examined in the study. Even though only a small percentage of all known amphibians and reptiles were included in the study, it gives an initial overview of the impacts of climate change on these vulnerable animals. And the impacts are quite severe.

### **Reptiles and amphibians throughout the world are heavily impacted by climate change already today**

Two out of three of the articles analysed found that amphibians and reptiles are affected by climate change today. In total, the impact of climate change on reptiles and amphibians is negative in more than 50% of the cases analysed. Negative means: Populations decline, distribution ranges shrink, and the rate of reproduction may decrease (see case studies in the column on the side). In some cases it is difficult to determine



*A study on the Tokyo salamander in Japan shows that today this species lays its eggs about 20 days earlier than in 1975. Photo: Tamotsu Kusano*



*The European common frog also lays its eggs several days earlier. Photo: Richard Bartz. Wikimedia*



*The body size of the North American Yonahlossee salamander decreased by 18% over a period of 55 years. The likely cause: rising temperatures. Photo: Brian Gratwicke. Wikimedia Common*



*Currently, the Malagasy carpet chameleon is not regarded as threatened by the International Red List. However, increased air temperatures could endanger its future survival because the lizard will have less time to hunt for food. Photo: Ignacio de la Riva*

whether the changing climate has a positive or negative impact on species populations. This is especially true for changes in the timing of behaviour such as mating or egg laying.

According to the articles reviewed, there is one clearly negative effect of climate change: when a habitat is changed to such an extent that a species has to move to another area to survive, but suitable areas are not available or not reachable. Adaptation to climate change is aggravated by habitat fragmentation, wetland drainage and dryland destruction. These kinds of changes in habitats are especially common in densely populated regions such as Germany.

Climate change currently has positive effects on some species in northern Europe, North America and in mountainous areas. Early ice and snow melt enables amphibians to lay eggs earlier in the season. Warmer bodies of water accelerate the pace at which eggs and larvae develop, which reduces exposure to predators. And a smaller snowpack may make it possible for amphibians and reptiles to expand their distributional range. However, only a small portion of all amphibian and reptile species live in these northern areas. The majority of species is found in the tropics where the impact of climate change is much greater.

To date, no study has provided clear evidence that an amphibian or reptile species has become extinct exclusively as a result of climate change. There are many indications that the fungal disease known as chytridiomycosis, which is often lethal for amphibians, thrives at higher temperatures and humidity – conditions that occur with increasing frequency in the tropics due to climate change. However, these studies do not arrive at clear-cut conclusions. It is not disputed, on the other hand, that many amphibian and reptile species will become extinct if climate change continues unabated (“business as usual”) and if the international community fails to reach the Paris Agreement climate goal of keeping global temperature increases to well below two degrees Celsius (3.6 degrees Fahrenheit).

### **Climate change is changing species traits**

Climate change affects species in many ways: from changes in population size, distribution, and timing of behaviour (phenology) to changes in appearance and physiology. In reptiles, changes in temperature can lead to changes in the sex ratio of a given reptile population because sex determination is temperature-dependent in many reptile species.

### **The impacts of climate change outweigh the impacts of other factors**

About half of the studies analysed focused solely on the impact of climate change, while the other half also took other factors into account (such as habitat destruction, vegetation, food supply). One might think that the impact of climate change would decrease when other factors are included in the analysis. However, this is not the case. The effects of climate change therefore outweigh the effects of the other factors analysed.



*The range of the rhinoceros viper in Africa will become much smaller due to climate change. Photo: Luca Luiselli*



*El Niño poses a threat to the marine iguanas of the Galapagos Islands because higher water temperatures have driven away their natural food source. In the 80s, 70% of the population died off during a particularly strong El Niño cycle. Photo: Ignacio de la Riva*



*Greek tortoises are being threatened by increases in drought, heat and fire; the species is already listed as vulnerable on the International Red List. Photo: Shai Meiri*

### The impacts of climate change vary between continents and species

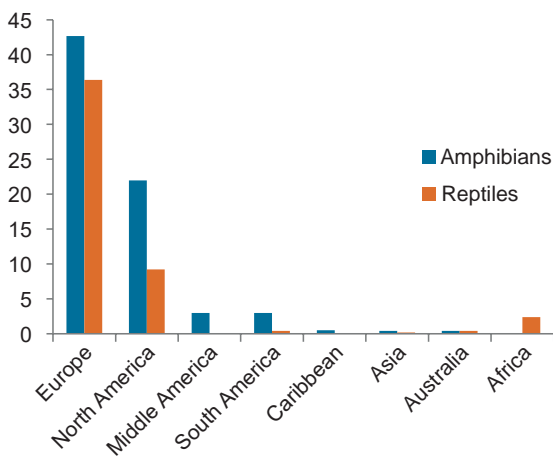
In Europe, amphibians are more frequently affected by climate change than reptiles. Nine out of ten amphibian species and one in two species of reptiles are affected by changing climates in Europe. This pattern is reversed in North America where nine out of ten reptile species are affected by climate change but only every second amphibian. In all other regions of the world, the number of studies published was not sufficient to arrive at a clear and reliable conclusion about the effects of climate change. We do know, however, that amphibians and reptiles are particularly species-rich in the tropics of South America, Africa and Asia. At the same time, they are likely to be particularly vulnerable to climate change because they can only adapt to a relatively narrow range of temperatures. More research is needed in these regions to better understand the dangers facing amphibians and reptiles and to be able to protect them more effectively in the future.

### Most studies look at changes in distribution and population size

Most studies address the question of how species distribution and population size are changing or will change due to climate change. Very few studies investigate changes in reproductive success, even though research of this kind is needed to better understand the causes of changes in populations. Many studies use existing data on the current distribution of a species as a basis for models that estimate the area where the species will occur in the future. Although these kinds of models provide interesting results, it remains to be seen how realistic they are because the models do not include potential behavioural changes in species.

### Studies focus on European and North American species

Most of the species that were described in the studies analysed (70%) are found in Europe and North America (see Figure 1). The studies therefore looked at a large number of North American and European species and very few species from other continents (see Figure 2). As a result, the impact of climate change remains largely unknown for many species and in many regions. Future studies should be dedicated to regions of high biodiversity. The tropics in particular are home to a large range of amphibian and reptilian species, many of which likely suffer from climate change. Species in these regions need more research to improve their protection.



*Fig. 1 (right): Location of studies that were included in the analysis.*

*Fig. 2 (left): Percentage of the species analysed relative to the total number of species in a region.*

It is difficult to draw clear conclusions about the effects of climate change on species because 1) species are affected by several factors at the same time - such as habitat destruction and disease; 2) species differ in their ability to adapt to changing climate conditions; and 3) the impacts of climate change are both direct (heat, drought) and indirect (changes in vegetation and the availability of food). An overview study like ours which summarises the results of many individual studies can therefore reach much more definitive conclusions about the impact of climate change than a single study.



Wetlands—such as this peat bog in Germany's Hohes Venn—are essential for the conservation of many Amphibian species. Drainage, over-fertilization and climate change form an increasing threat to these habitats. Photo: Getty Images

#### More information

on climate change and the impacts of climate change can be found at [panda.org](http://panda.org)

#### What you can do.

You can get involved in protecting amphibians and reptiles. Reduce your own greenhouse gas emissions and demand carbon emission pricing! There are also many other ways to support WWF! Every contribution helps us continue our work towards a living planet and preserving biodiversity.

#### Become a member.

WWF members are committed to climate protection—in Germany and worldwide. With a membership you can significantly contribute to achieving global climate protection targets. In return you receive the WWF magazine four times a year and you can participate in excursions to project areas. [wwf.de/spenden-helfen/wwf-mitglied](http://wwf.de/spenden-helfen/wwf-mitglied)

#### Donations instead of gifts.

Are you celebrating a birthday soon, getting married or organising a party for a friend? Are you looking for a gift that won't collect dust in a dark closet? Then ask your friends to donate to conservation. This meaningful gift will support our conservation work and help preserve biodiversity. [wwf.de/spenden-schenken](http://wwf.de/spenden-schenken)

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#### Why we are here

To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

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