Tortoise populations can withstand fires every 30 years

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The fire killed 100 percent of the spur-thighed tortoises (*Testudo graeca*) aged under four. Credit: Andrés Giménez

Populations of spur-thighed tortoises (*Testudo graeca*), a species classified as vulnerable and at risk of extinction, can withstand fires if outbreaks occur once every three decades or more. However, the youngest tortoises are more vulnerable, and disappear after each fire. These are the results of a study by Spanish researchers, who analysed the impact of a 2004 forest fire in the Sierra de la Carrasquilla mountains in Murcia (Spain) on these reptiles.

"Tortoises can withstand high temperatures, but this does not mean their shells are completely fire proof", Ana Sanz-Aguilar, lead author of the study, tells SINC. Currently a postdoctoral scholar at the Centre for

Functional and Evolutionary Ecology in Montpellier, France, she collaborated with the Miguel Hernández University (UMH) and the Mediterranean Institute for Advanced Studies (IMEDEA-CSIC) for this research.

One such forest fire occurred on 1 August 2004 in the Sierra de la Carrasquilla mountains in Murcia, Spain, which incinerated a 250-hectare area that was home to a large population of these reptiles. The researchers have been studying the behaviour of more than 1,000 of the animals over the past decade.

The study, published in the journal *Biological Conservation*, shows that the tortoises' response to fire varied greatly according to their age, with the fire killing 100% of the animals aged under four and causing increased mortality rates of 62% in sub-adults (aged from 4 to 8) and 12% in adults (over 8 years of age).

"For the dynamics of this species, a 12% increased mortality rate among adults is more serious than the disappearance of all the young tortoises", says Sanz-Aguilar.

According to the study, the viability of populations of these animals depends on low mortality rates and longevity among adult individuals. Any factor that causes an increase in adult mortality, such as greater vulnerability to forest fires in rocky environments, "increases the likelihood of a population becoming extinct", the authors explain.

However, when fires occur every 30 years (a frequency similar to the natural cycle in Mediterranean environments), medium-large populations of spur-thighed tortoises will not become extinct, according to models designed by the researchers. "Above this limit, the likelihood of extinction increases exponentially", the experts warn.

None of the youngest tortoises were able to survive the passage of fire in any kind of terrain, because of the type of shelter they choose – below vegetation or in very shallow holes. They are also less able to withstand high temperatures, since their shells are not yet ossified.

Danger increases in spring

Although the fire reduced dozens of animals to ashes, the scientists found live individuals surviving in shelters they dig for themselves to sit out the periods of greatest temperature stress, in winter and summer.

The animals' behaviour changes in other seasons, however, and their activity levels increase. "In spring, the tortoises hide under bushes, meaning that, if a fire occurred at that time, they would all be wiped out", says Sanz-Aguilar.

The spur-thighed tortoise is found throughout Europe, Africa and Asia. In the European Union, the most numerous populations are found in the south east of Spain, between Murcia and Almeria, where they range over an area of 2,600 km2. "This is a typically Mediterranean species, and the natural landscapes of this zone suffer from certain kinds of fire, which recur infrequently", the researcher explains.

The International Union for the Conservation of Nature (IUCN) has classified this tortoise as 'vulnerable', and at risk of extinction over the medium term. In Spain, it is classified as 'endangered' on the Red Book of the Amphibians and Reptiles of Spain.

More information: Ana Sanz-Aguilar, Jose Daniel Anadón, Andrés Giménez, Rubén Ballestar, Eva Graciá, Daniel Oro. "Coexisting with fire: The case of the terrestrial tortoise Testudo graeca in mediterranean shrublands". Biological Conservation 144: 1040-1049, 2011. DOI: 10.1016/j.biocon.2010.12.023

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