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Citizen scientists help reveal effects of roads on frogs and toads

Roads reduce the species diversity and distribution of frogs and toads, a new US study reports. The large-scale study used data from a national citizen science programme in which members of the public help monitor amphibian populations.

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Landscape change is one of the biggest drivers of amphibian decline around the world. Large-scale conservation is therefore needed to protect these species. However, due to practical constraints, previous studies which assess landscape and road effects on amphibians have often been conducted at a local scale, or are only relevant to a single species.

In contrast, this study assessed 40 species, across 13 states of eastern and central US. It was made possible by data from the North American Amphibian Monitoring Program (NAAMP), a national citizen science initiative. In addition, it involved 200 biology and environmental science students from nine universities who examined and built upon the data.

NAAMP is run by the United States Geological Survey, a government agency, and trains volunteers to recognise the auditory calls of amphibians. The volunteers then conduct surveys at roadside locations where they record any amphibian species heard over a 5-minute period. They also count the number of cars that pass.

The students compiled the volunteer data, and mapped the landscape within a 1 km radius of each of the survey sites. They then modelled the landscape's effects on the species. A total of 937 sites were mapped.

Species richness (i.e. total number of species present) dropped in the presence of dense road networks (defined by the total length of road in the study area) and higher traffic levels. Species richness also fell where wetlands were separated from upland forest by a barrier, e.g. a road or agricultural field. This is likely to be because semi-aquatic amphibians need to migrate from wetlands to upland habitat to complete their lifecycle.

Richness increased with wetland area and, perhaps surprisingly, developed land, which may be beneficial because it provides breeding sites, such as garden or farm ponds. However, nearly all land surveyed had just little or moderate development and highly developed land would probably have negative impacts on species richness of amphibians. The authors also point out that the positive relationship between developed land and richness only occurred when they statistically controlled for the effects of roads.

Only nine of the 40 species met the study's criteria for assessing distribution, that is, they had been recorded at 20-80% of sites within their range, in at least three states. Distribution was measured as the probability of detecting a species at least once across all the surveys, at sites in parts of the US where they are known to occur. For six of the nine species, this probability was reduced by one or more of the following factors: road density, traffic, development and traffic noise. Wetland area increased the probability.

Roads, in particular, negatively affected six species of amphibian assessed, both in terms of richness and distribution. These effects could be the result of traffic collisions, blocked movement and de-icing salt running off onto wetlands. Examples of amphibian conservation actions recommended by the study therefore include: building tunnels for safe crossing, fences to prevent animals from going onto roads and reduced road salt use near wetlands.

The researchers note that the roadside location of all the surveys could affect the results. However, it also points out that the NAAMP sites are fairly representative of the eastern and central US, where 40-80% of all land is within 400 metres of a road.