

## Urbanization and Amphibian Declines



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## Introduction

"Urbanisation currently threatens over one-third of the world's known amphibian species."  
-Hammer et. al 2008

- Urbanization- shifting from rural to urban areas
- Why is urbanization occurring?
  - Economic changes
  - Technological advances
  - Modernization and industrialization



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## The Dangers of Urbanization\*

Why are amphibians so susceptible to urbanization?

- Small home range (low/poor dispersers)
- Semi-permeable skin (susceptible to changes)
- Breeding activity (migrate to ponds)
- Many use vernal ponds (rely on visual cues)



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## The Dangers of Urbanization

How does urbanization threaten and kill amphibians?

- 1) Increase in roads and traffic
- 2) Decrease in water quality
- 3) Potential increase in disease transmission
- 4) Decrease in habitat availability and quality
- 5) Increase in light pollution




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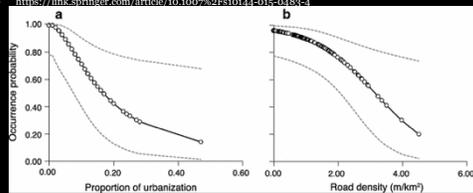
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### (1) Roads and Traffic



- Amphibians killed trying to cross busy roads
- The proportion of urbanization and road network density decreased yellow-bellied toad occurrence
- Noise pollution

<https://link.springer.com/article/10.1007%2F978-94-017-0483-1>




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### (2) Water Quality

- Urbanization increases pollution and chemical runoff, which is being dumped into amphibian breeding habitat

Gill fouling	F	Increase in total suspended solids from point-source pollution and increased overland flow negatively influences salamanders	13.16	<0.05
In-stream cover	G	Urbanization increases spate frequency, which flushes in-stream cover from the channel, which negatively influences salamanders	18.51	<0.05

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### (3) Disease

- No studies have supported that disease is correlated with urbanization
- Not many studies have been done (hard to quantify)
- Stressed animals = more susceptible to diseases
- Not equipped to fight off infection




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### (4) Habitat Availability

- Habitat disappearing because of increases in roads, houses, and other general construction related to increase in human population
- 54 year study in Ontario observing Anuran abundance following construction of a residential neighborhood
- Linear decline in Spring Peepers, Green Frogs, American Toads, and Gray Treefrogs

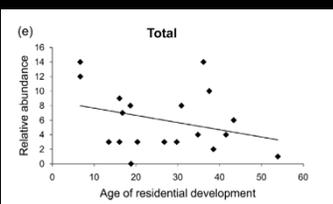


Figure 2 The relationships between (a) spring peeper *Pseudacris crucifer*, (b) American toad, *Anaxyrus americanus*, (c) gray treefrog *Hyla versicolor*, (d) green frog *Lithobates clamitans* and (e) total anuran relative abundance at 19 focal ponds and the mean age of residential development in surrounding landscapes. A linear trend line is shown for each relationship except in the case of the gray treefrog, for which a second-order polynomial line of best fit is shown.

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### (4) Habitat Quality

- Reduction in stream salamander populations due to increase in runoff, altered stream hydrology, geomorphology, chemical composition, and heavily dependent on stream microhabitats
- Before-after control-impact (BACI) study design to estimate changes in abundances of larval and adult salamanders in streams affected by urbanisation
- Two-lined salamanders (*Eurycea cirrigera*) and dusky salamander (*Desmognathus fuscus*)

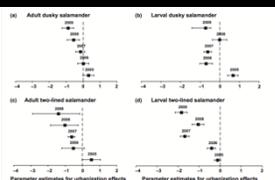


Fig. 2 Estimates of  $\beta$  (effect of urbanisation) on abundances of (a) adult northern dusky salamanders (*Desmognathus fuscus*), (b) larval northern dusky salamanders (*D. fuscus*), (c) adult southern two-lined salamanders (*Eurycea cirrigera*) and (d) larval southern two-lined salamanders (*E. cirrigera*) detected in 30 streams in the Charlotte-metropolitan area, North Carolina, U.S.A. Error bars indicate 95% credible intervals. Species and/or stages with parameter estimates (including 95% credible intervals) below zero declined after urbanisation.

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## Lessening the Effects of Urbanization

- Improving stormwater management
- Maintain forested buffer zones
- Stormwater ponds to collect runoff should be adjacent to streams to prevent chemical contamination, sedimentation, and to reduce the variability of water flow (Tsihrintzis and Hamid 1997, Behera et al. 1999, Harrell and Ranjithan 2003)
- Educating the public




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## Questions?




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## Sources

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