Urbanization:
Amphibians Worst Nightmare

Don Chance

What is Urbanization

- The change of land use from agricultural or natural to industrial or residential*
- One of the main drivers to amphibian decline globally**

www.thestar.com

*Caness, et al 2013

**Scheffers, et al. 2013.

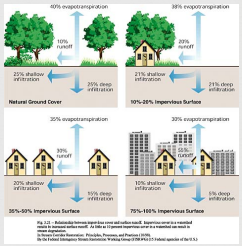
How Does it Affect Amphibians

- Changes the hydrology of the stream or pond
- Increases pollution
- Destroys critical habitat

Canessa et al. 2013

Changes in Hydrology

- Higher levels of impervious surfaces
- Leads to increases in frequency and flashiness of floods
- Especially detrimental to aquatic stages or species



http://www.brookercreek.org/urbanization.htm

How Does it Kill Them?

- Washes away egg masses
- Washes away plant material that could harbor eggs, protecting them from predation
- Interferes with breeding activities, especially for male anurans that call from the water

Canessa, S, and K.M. Parris. 2013. Multi-scale, direct and indirect effects of the urban stream syndrome on amphibian communities in streams. PLOS ONE 8: e70262.

Increased Pollution

American Society of Landscape Architects

Sources of Pollution

- Nonpoint source pollution
  - Runoff from roadways
  - Litter from people
- Point source pollution
  - Pollution from factories
  - Sewage overflow (Third creek)

Heavy Metal Pollution

- Automobiles and roadways are now a major source*
- Strongly affects amphibians due to their permeable skin
- Relevant levels are known to kill in all stages
- Lower levels are known to have other detrimental effects
  - Reduced growth rates
  - Delayed metamorphosis
- Reduce species richness

Fairfax County Virginia

Species Richness

Table 1. Concentrations (mg kg^{-1} dry weight) in sediment of eight metals measured at 35 study sites along the Merri Creek corridor

Metal	Minimum	Maximum	Mean ± SE	Low	Severe
Arsenic	1.44	13.04	6.64 ± 0.48	<6	>33
Cadmium	0.80	7.68	3.56 ± 0.30	<0.6	>10
Chromium	12.08	114.90	66.79 ± 3.49	<26	>110
Copper	9.92	161.30	50.69 ± 7.24	<16	>110
Nickel	11.1	68.92	42.79 ± 2.88	<16	>75
Lead	11.17	631.15	80.46 ± 22.90	<31	>250
Zinc	24.47	1817.08	450.79 ± 89.44	<120	>820
Mercury	0.00	0.91	0.23 ± 0.03	<0.2	>2

Table 4. Heavy metal pollution index scores at study sites where species were present or absent

	Present				Absent			
Species	Minimum	Maximum	Mean	SE	Minimum	Maximum	Mean	SE
Crinia signifera	1	24	9.6	1.1	11	28	17.2	1.5
Crinia parinsignifera	7	11	8.0	1.0	1	28	13.2	1.3
Limnodynastes dumerilii	1	21	8.9	1.8	3	28	13.9	1.4
Limnodynastes tasmaniensis	5	11	8.5	1.4	1	28	15.3	1.4
Litoria ewingii	5	11	8.4	0.7	1	28	14.3	1.5
Litoria raniformis	3	24	7.4	1.4	1	28	13.5	1.3

Values represent minimum, maximum and mean ± standard error (SE) index scores across 35 sites.

Ficken, K.L.G., and P.G. Byrne. 2013. Heavy metal pollution negatively correlates with anuran species richness and distribution in south-eastern Australia. Austral Ecology 38: 523-533.

Destruction of Critical Habitat

- Filling in wetlands
- Removal of necessary vegetation
- Destruction of movement corridors
  - Destroys metapopulations*

http://quokka.wikispaces.com/Causes+of+Endangerment

*Johnson, P.T.J., J.T. Hoverman, V.J. McKenzie, A.R. Blaustein, and K.L.D. Richgels. 2013. Urbanization and wetland communities: applying metacommunity theory to understand the local and landscape effects. Journal of Applied Ecology 50: 34-42.

Why is Urbanization the Biggest Issue?

http://www.worldometers.info/world-population/

References

- Canessa, S, and K.M. Parris. 2013. Multi-scale, direct and indirect effects of the urban stream syndrome on amphibian communities in streams. PLOS ONE 8: e70262.
- Fairfax County Virginia. 2013. Heavy metal pollution is more common than you think. <http://joomla.wildlife.org/documents/JWMguidelines2011.pdf#page=46>. Accessed 14 April 2014.
- Ficken, K.L.G., and P.G. Byrne. 2013. Heavy metal pollution negatively correlates with anuran species richness and distribution in south-eastern Australia. Austral Ecology 38: 523-533.
- Scheffers, B.R., and C.A. Paszkowski. 2013. Amphibian use of urban stormwater wetlands: the role of natural habitat features. Landscape and Urban Planning 113: 139-149.
- Johnson, P.T.J., J.T. Hoverman, V.J. McKenzie, A.R. Blaustein, and K.L.D. Richgels. 2013. Urbanization and wetland communities: applying metacommunity theory to understand the local and landscape effects. Journal of Applied Ecology 50: 34-42.

Questions??

http://www.birdsandblooms.com/blog/toad-in-the-window/