

What is the most important cause of amphibian decline?

---

---

---

---

---

---

---

---

**WRONG!!!!!!!!!!!!!!!!!!!!**

---

---

---

---

---

---

---

---

**Insecticides**  
Ryan Mutchnick

---

---

---

---

---

---

---

---

## What are Insecticides?

- A type of pesticide that is used to specifically target and kill insects.



---

---

---

---

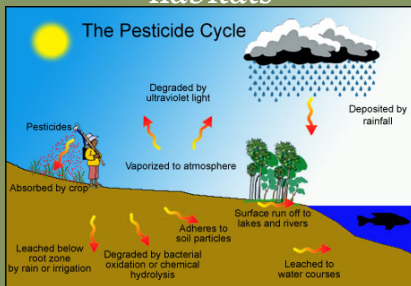
---

---

---

---

## How insecticide are transmitted to amphibian habitats



---

---

---

---

---

---

---

---

## Population Decline

- 200 million pounds of pesticides are applied each year in California alone.
- Two billion pounds throughout the USA annually.
- Populations of the critically endangered mountain yellow-legged frog (*Rana muscosa*) disappeared at a significantly higher rate than other populations. Verge of extinction.



---

---

---

---

---

---

---

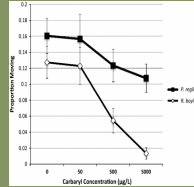
---

## Carbaryl Study

- (Kerby and Shi, 2014)
- Higher concentrations of carbaryl caused Pacific tree frog (*Pseudacris regilla*) and foothill (*Rana boylei*)



*Pseudacris regilla*




---

---

---

---

---

---

---

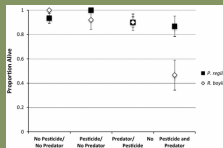
---

---

---

## Survival

- No significant change in survival rate when only carbaryl or predators were introduced.
- When both carbaryl and predators are introduced survival rates decrease.



Foothill Yellow-legged Frog (*Rana boylei*)  
Photo: Oregon Department of Fish and Wildlife

---

---

---

---

---

---

---

---

---

---

- Relyea and Mills, 2001
- Experimented with gray treefrog tadpoles (*Hyla versicolor*)
- The presence of Carbaryl caused survival rate to drop to 40% within 8 days with low concentrations and no predators.
- With the presence of Carbaryl and predators survival rate dropped to 8% within 8 days.



© John P. Clare

---

---

---

---

---

---

---

---

---

---



- <http://www.southwest.com/florida-forest-frogs/>

---

---

---

---

---

---

---

---

### References

- Relyea, R. A., and N. Mills. 2001. Predator-induced stress makes the pesticide carbaryl more deadly to grey treefrog tadpoles (*Hyla versicolor*). PNAS 98:2491-2496.
- Kerby, J. L., and A. Sih. 2014. Effects of carbaryl on species interactions of the foothill yellow legged frog (*Rana boylei*) and the Pacific treefrog (*Pseudacris regilla*). *Hydrobiologia* 746: 255-269
- Bruhl, C. A., T. Schmidt, S. Pieoer, and A. Alscher. 2013. Terrestrial pesticide exposure of amphibians: An underestimated cause of global decline? Scientific Reports 1135 doi:10.1038

---

---

---

---

---

---

---

---

### Questions



---

---

---

---

---

---

---

---