



## Global Warming

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### What is Global Warming?

- Global Changes (Vitousek, 1994)
  - Increased concentrations of atmospheric CO<sub>2</sub>
  - Alterations in global nitrogen cycle
    - Eutrophication
  - Increased land use/land cover change
  - Decrease in ice coverage
  - Depletion of ozone
- Results in ecosystems (Root et al., 2003)
  - Increase in temperature
  - Habitat destruction
  - Increased UV radiation

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### Effect on Amphibians

- Reduces reproduction and survivability
- Increases disease transmission/mortality
- Alters habitat
- Alters chemistry of ecosystem (Eutrophication)




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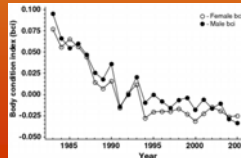
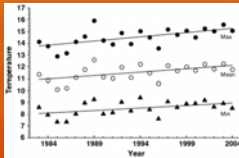
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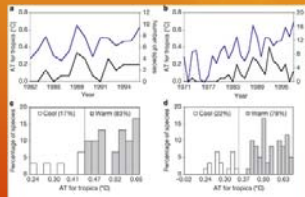
## Inhibiting Reproduction

- C. J. Reading, 2006 published in *Oecologia*
- Studied *Bufo bufo*
- Increased average annual temperatures
  - Lower body condition index
  - Lower survivability
  - Smaller clutch sizes



## Increased Disease Transmission/Susceptibility

- Pounds et al. 2007
- Monteverde harlequin frog (*Atelopus sp.*) and Golden toad (*Bufo periglensis*)
- Caused by pathogenic chytrid fungus
- Concluded with 99% confidence that disease spread correlated with temperature rise



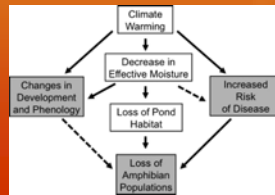
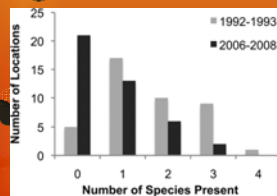
## Habitat loss due to warming



- Araujo et al., 2006
- Objective was to project amphibian and reptile dispersal patterns based on anticipated habitat loss
- Warmer temperatures actually favor increased amphibian dispersal
- Biggest concern is drying related to global climate change rather than warming
- Amphibians have little ability to mass-migrate North

## Dessication and Warming in Yellowstone

- McMenamin et al., 2008
- One of the most actively conserved amphibian habitat locations
- Uncontrollable decrease in pond habitat



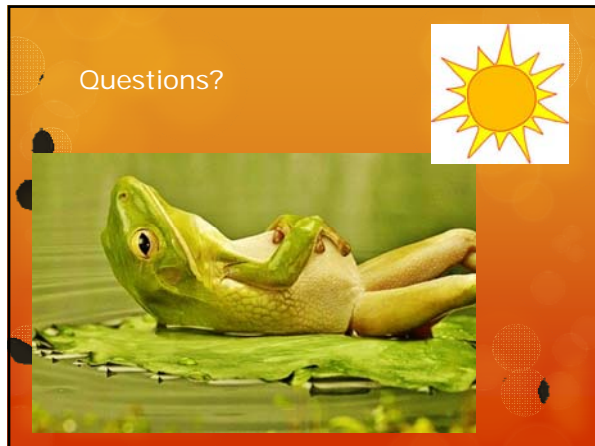
## Why is Global Warming so important?

- Global problem – affects all species in every environment
- Amplifies existing problems – increased UV-radiation, increased environmental nitrogen levels, disease, etc.
- Undocumented results – natural disasters, erosion, etc.
- Caused by humans



## References

- Araujo, M. B., et al. "Climate warming and the decline of amphibians and reptiles in Europe." *Journal of Biogeography*, 2006: 1111.
- McMenamin, Sarah, et al. "Climatic change and wetland desiccation cause amphibian decline in Yellowstone National Park." *PNAS*, 2008: 16988-16993.
- Pounds, J Alan, et al. "Widespread amphibian extinctions from epidemic disease driven by global warming." *Nature*, 2007: 161-167.
- Reading, C. J. "Linking global warming to amphibian declines through its effects on female body condition and survivorship." *Oecologia*, 2006: 1007.
- Root, Terry, et al. "Fingerprints of global warming on wild animals and plants." *Nature*, 2003: 57-60.
- Vitousek, Peter. "Beyond Global Warming: Ecology and Global Change." *Ecology*, 1994: 1861-1876.



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