The Three C’s of Amphibian Decline: Chytrid, Conservation, and Climate
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Dr. Maureen “Mo” Donnelly has been at Florida International University since 1994, and the Associate Dean of Graduate Studies since 2008. A self-described tropical ecologist turned conservation biologist, Dr. Donnelly and her lab study the effects of climate change, habitat loss, and infectious disease on frog populations in the Central American lowlands. The tropical rainforests hold 50% of the world’s biodiversity, yet Dr. Donnelly pointed out that only about 5% of the rainforests are protected, and could result in a massive loss of biodiversity.

The Graduate Students of the Biological Sciences at Duquesne University have the ability to invite a seminar speaker each semester, and are encouraged to have lunch and get to know our guest. We chose to invite Dr. Donnelly for our Spring 2019 speaker, and it was a delight to have lunch with her. She was full of advice for those of us just beginning in our careers, and her personality kept everyone captivated. Despite my interests lying more in the molecular and microbiology side of the spectrum, I couldn’t wait to hear her talk.

Dr. Donnelly opened with a description of the biodiversity in the tropics and a reminder of what we stand to lose. *Incilius periglenes*, the Golden Toad and “poster child” for biodiversity loss, completely disappeared from a protected site. While many species slip away quietly over several years, the golden toad disappeared rapidly. This gained widespread attention and drove questions of what was killing off the amphibian
populations in these protected forests. For those of us not as well versed in conservation biology, Dr. Donnelly pointed out that while the end result is population decline and extinction, there is no single driving factor. Every individual threat to a species has effects on others that can mitigate or compound effects. She then revealed a grim truth: Interconnected conservation threats are not always enough to explain population decline. Many species are in decline with no clear reason why.

Efforts to explain this enigmatic decline were based in either diseases spreading as a result of climate change or disease spreading independently. Fungal infection has been wreaking ecological havoc, and not just in the amphibian scene. Between white nose syndrome in bats, or snakes dying from fungal infections in their mouths, fungi have been posing a biodiversity threat for decades. *Batrachochytrium dendrobatidis* (Bd) is an infective water fungus that has been affecting European and North American frog populations for years. Bd was thought to be a relatively new arrival to North America, but examination of museum specimens revealed it has been present for over 100 years. It causes chytrid disease, where fungal spores form in amphibian skin, and when full, the sites burst open and lead to the spread of spores and death of hosts. Dr. Jason Rohr, a colleague of Dr. Donnelly, evaluated the strength of both arguments. There was weak support for the climate change argument, with correlations being merely that. The idea of chytrid spreading on its own gained more support, but not enough to completely denote causation.

Some of Dr. Donnelly’s recent students have tackled the questions of leaf litter and matrix quality on species richness. Many small amphibians use leaf litter for shelter, and it provides the moisture to keep their eggs from drying out. Gradual warming temperatures from the 1970s to the early 2000s led to faster decomposition, and drier leaf litter. The effects of these changes in leaf litter were not the same for all species present, but
they are thought to impact the quantity of amphibians found. Changing land use has led to habitat fragmentation, where areas of remaining habitat are surrounded by a matrix of modified vegetation. Higher species richness was associated with higher quality matrix, since the matrix did not impede animals from venturing to different habitat patches. It effectively made the sizes of the habitats greater, and allowed for more resource sharing. However, if surrounded by low quality matrix, there were higher species-area relationships. The animals did not want to venture into the low-quality matrix, resulting in habitat patches becoming more isolated, similar to islands.

Although a distressing topic, Dr. Donnelly still presented the subject of conservation biology and amphibian decline with grace and humor. She was clearly passionate about the topic, but communicated everything in a way that left nonexperts feeling confident in their understanding. While there are still many unanswered questions about why amphibian populations are declining so rapidly, it’s reassuring to know that the Donnelly lab and her colleagues are working on unravelling this crisis.
References:

