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INVITATION PUBLIC DEFENSE

Amphibians in anthropogenic landscapes: threats and opportunities

Leni Lammens
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PROMOTORS

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Curriculum Vitae

Leni Lammens was born in Jette on the 2nd of May 1996. After finishing secondary school, she started a bachelor's degree in bio-engineering at the Vrije Universiteit Brussel (VUB), but then switched to her primary passion, biology, after finishing the first year. She performed her bachelor's thesis at the Wetenschappelijk Instituut Volksgezondheid – nowadays known as Sciensano – on pathogenic fungi. She then continued with the master in biology at the VUB, specializing in herpetology, but performed her master's thesis on chytrid pathogens at Wildlife Health Ghent. She secured an internship at the Smithsonian Tropical Research Institute in collaboration with Washington National Zoo in the Panama Amphibian Rescue Centre in Gamboa, Panama, aimed at improving husbandry and captive breeding of critically endangered frog species – notably of the genus *Atelopus*. She subsequently started this PhD at Wildlife Health Ghent, Ghent University.

During her PhD, Leni published two papers as first author and coauthored in one other paper. She gave two presentations, of which one on an international conference.

Where?

The defense will take place on Tuesday 18 November 2025 at 17.00h

Auditorium B

Faculty of Veterinary Medicine
Ghent University, Campus Merelbeke
Salisburylaan 133, Merelbeke

A reception will follow after the defense.

How to attend?

If you would like to attend the reception, please register before the 10th of November 2025, by email with topic "Attendance reception PhD" to leni.lammens@ugent.be.

Members of the Jury

Prof. dr. S. Gabriël
Faculty of Veterinary Medicine, UGent
Chair

Dr. F. Batsleer
Faculty of Bioscience engineering, UGent

Dr. W. Beukema
Reptielen Amfibieën Vissen Onderzoek Nederland
(RAVON)

Prof. dr. Apr. S. Croubels
Faculty of Veterinary Medicine, UGent

Dr. J. Speybroeck
Instituut Natuur- en Bosonderzoek (INBO)

Summary

As amphibians are increasingly threatened by anthropogenic influences and disease, it is essential to study the effect of existing management efforts and develop efficient, novel conservation measures.

In Chapter 1, we aimed to investigate whether differential sylvicultural management practices influence the population viability of fire salamanders (*Salamandra salamandra*), a forest specialist species with conservation priority in Belgium. According to the IUCN, fire salamander populations are in decline and threatened by habitat loss, exploitation for the pet trade, pollution and most notably, *Batrachochytrium salamandrivorans* (Bsal) induced chytridiomycosis. Increasing population viability and avoiding Bsal introduction is essential to the survival of these remarkable amphibians, but whether fire salamanders benefit from increasingly popular sylvicultural practices meant to increase structural complexity and overall biodiversity is unknown. We investigated an array of metrics, from population demography and genetics to the health of individuals, of ten Flemish fire salamander populations. This allowed us to robustly assess population viability. We also determined the forest area, presence of breeding habitat and the structural complexity index (SCI) of the forests containing these populations and investigated whether those environmental parameters could be linked with population viability. Overall, we can conclude that fire salamanders generally benefit from management practices meant to increase structural complexity and biodiversity. The knowledge about the influence of management techniques on the health of fire salamanders gained in this chapter can be used to safeguard the health of vulnerable populations.

In Chapter 2, we aimed to study how the direct environment as well as the landscape affects the health of a species that is considered to be a generalist, the semi-aquatic alpine newt (*Ichthyosaura alpestris*). In contrast with fire salamanders, alpine newts are relatively common and occur in a variety of landscapes, making them an excellent model species for studying landscape level effects. Alpine newts are not at immediate risk of extinction. However, the IUCN reports population declines due to habitat loss, pollution, exploitation and invasive fish in breeding habitats. They are also intermediately susceptible to chytridiomycosis, but clear evidence of disease-driven population decline is lacking. We studied newt body condition, *Batrachochytrium dendrobatidis* (Bd) infection status and fluctuating asymmetry (FA) in ten breeding populations at sites with varying landscape compositions and structural complexity of habitat patches. Alpine newt health was not significantly affected by the structural complexity of habitat elements, but a higher proportion of forest surrounding the breeding habitat was beneficial for newt body condition and FA. Conservation of existing forest patches and increasing forest area in the vicinity of alpine newt breeding ponds may help sustain individual health of adults and, as a consequence, population viability of a common semi-aquatic amphibian.

Proper habitat management and protection alone might however not always suffice to safeguard amphibian populations. As pathogen introduction can lead to devastating effects, we need to develop efficient management strategies directed at eliminating pathogenic chytrids from natural environments. In Chapter 3, six alternative disinfectants were screened for their efficacy against Bd. Of these six, peracetic acid (PAA) seemed very promising, not only because of its efficacy against the pathogen, but also because of its rapid degradation, ultimately yielding only water, oxygen and carbon dioxide. Next, we investigated the toxicity of PAA on three invertebrate species and on painted frog (*Discoglossus pictus*) tadpoles.

Almost all invertebrates (93%) survived 5 minutes exposure to a PAA concentration lethal for Bd cultures, but this dose was toxic for tadpoles. We continued by setting up a microcosm experiment to study the effects of PAA on semi-natural systems. As expected, PAA degradation occurred very rapidly. Initially, adding PAA caused a drop in pH and an increase in dissolved oxygen (DO). PAA degradation stabilized pH, but caused a massive drop in DO. This undesirable effect could be remediated by adding aeration to the microcosms. Aerated microcosms could sustain survival of tadpoles as soon as 48h after treatment with PAA. We conclude that PAA can be used to disinfect simple breeding habitats, provided that aeration is possible and tadpoles can temporarily be removed. Further increasing our knowledge on the effects of disinfectants on pond ecosystems could help improve conservation strategies and protocols for elimination of Bd in nature.

In the General Discussion, I shortly review the costs and benefits of environmental disinfection, how habitat improvements for amphibians might impact other taxa, whether habitat connectivity is desirable or not in light of Bsal outbreaks, and a practical approach directed at enhancing fire salamander population viability in Flanders. On top of that, I had the opportunity to work with an array of different metrics aimed at assessing population viability throughout this thesis. In the discussion, I evaluated the metrics we've used based on their practicality, informativeness (how well did it help us estimate population viability in the end?) and main limitations. A robust assessment of population viability cannot be based on a single metric; instead, I recommend including at least one population genetics metric, one demographic metric – if feasible – and two individual metrics.

This thesis highlights the importance of evaluating and refining conservation strategies to better support amphibian populations. The experiments and fieldwork described here have led to the development of a new protocol to help mitigate amphibian disease, as well as the identification of key habitat requirements of amphibians. Together with the evaluation of metrics used to assess population viability, I hope this work contributes to the toolbox for conserving populations of these remarkable animals.