INSTITUT FÜR UMWELTWISSENSCHAFTEN LANDAU

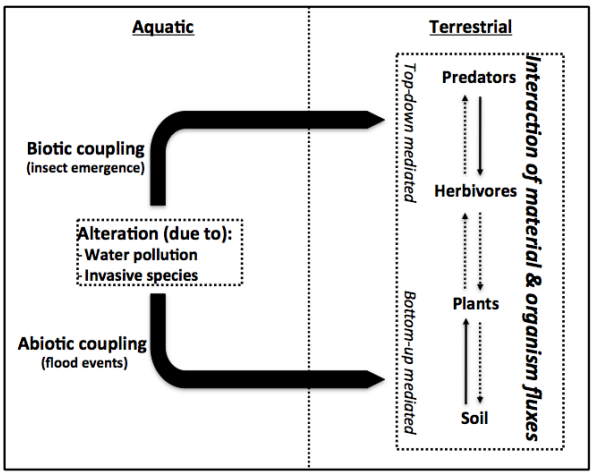
SystemLink

Funded by: DFG Deutsche Forschungsgemeinschaft

SystemLink

12 Doctoral researcher positions (PhD students) announced:

Please find below a more detailed description of each PhD project and the respective contact persons. Please send your applications (1 pdf file, max 10 MB), specifying for which PhD position you apply, with a 1-page letter of motivation, a reference letter from a mentor, degree certificates, a CV and a list of publications/presentations **until 17 May 2019** via email to **bewerbung@uni-koblenz-landau.de.** Please make sure to mention your **name and the reference number 49/2019** in the subject line of the email. Potential candidates shall be prepared to participate in a three-day workshop in Landau between 9 and 11 July 2019.



SystemLink website

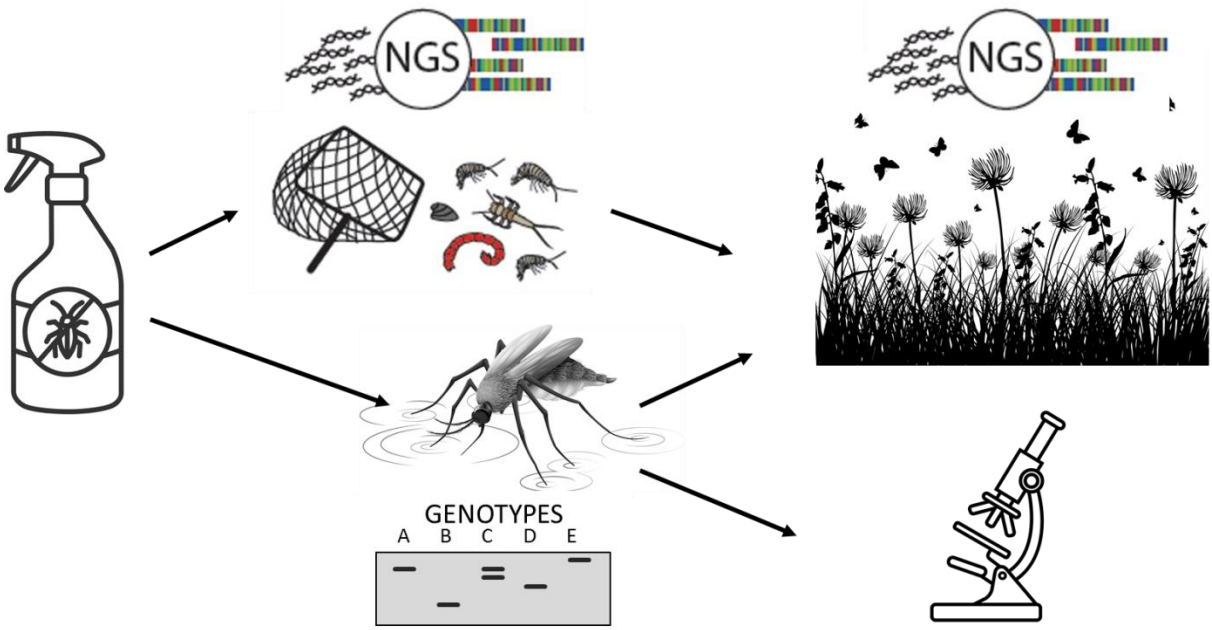
Important abbreviations:

FPM	Floodplain Mesocosms (see Facilities for details)
joint FS_{stream}	joint field study streams (see Facilities for details)
joint PE	joint pot experiment (see Facilities for details)
PUFA	polyunsaturated fatty acids
RSM	Riparian Stream Mesocosms (see Facilities for details)
SIA	stable isotope analysis

PhD project: Stress transfer across communities
Working title: Transfer of environmental stress across ecosystems: community and species response to aquatic fungicide or insecticide load

Supervising scientists: Klaus Schwenk, Kathrin Theissinger and Lorenz Fahse

Approach: We will conduct studies at the **SystemLink** site-scale (RSM) accompanied by laboratory batch-scale studies to determine the impact of fungicides or insecticides on the aquatic and the terrestrial community including DNA-metabarcoding approach and DNA barcoding approaches. In a pilot study, using laboratory experiments, various fungicides or insecticides will be tested for their effects on aquatic communities and in particular the model organism *Chironomus riparius*. During the second project phase, we plan to expose *C. riparius* populations (with and without several generations exposition to environmental stress) in common garden experiments to environmental stressors to test for potential adaptation or genetic drift.
In general, this project provides the necessary information to document the association of aquatic and terrestrial community structure and its vulnerability to environmental stress. In addition, we will assess potential top-down directed effects in terrestrial systems via joint analyses of species composition, ecological traits and fitness across both ecosystems in cooperation with the PhD projects *Biological pollutant transfer, Subsidy dynamics*, and *Bottom-up effects*.



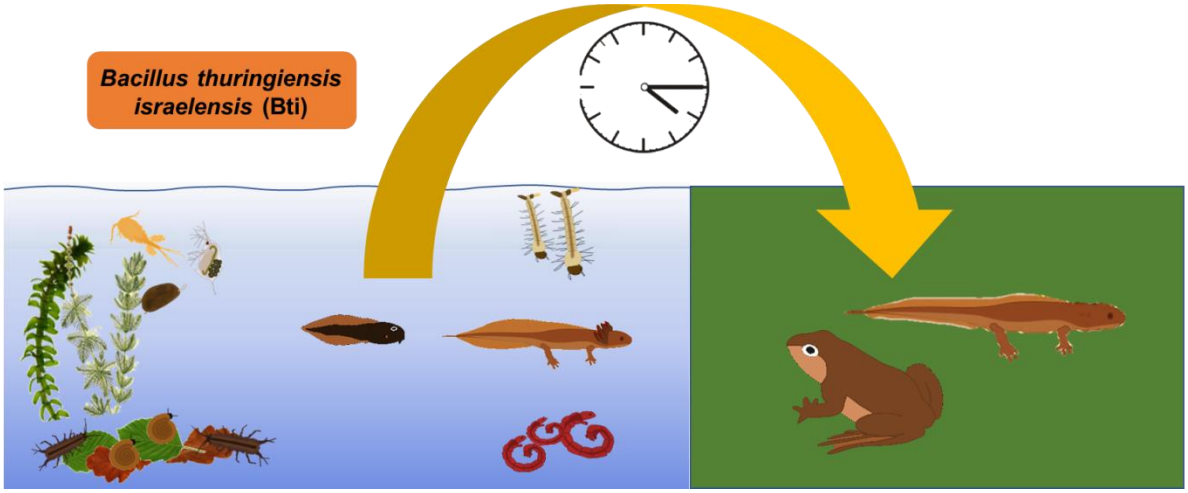
Interested? You are the right person for this project if you are interested in molecular genetics and have a background in experimental ecology. Ideally, you should have experience in arthropod ecology, DNA barcoding and DNA-metabarcoding.
You would have normally acquired these skills during a Bachelor and Master in Biology or similar course programs.

Contact: Klaus Schwenk, Molecular Ecology

PhD project: Amphibian ecology
Working title: The mosquito control biocide *Bacillus thuringiensis israelensis* (Bti) directly and indirectly affects amphibians and their role in terrestrial ecosystems

Supervising scientists: Carsten A. Brühl, Martin H. Entling, Kathrin Theissinger

Approach: We will focus on the European common frog for direct and the palmate newt for indirect effects of Bti. Both species are relevant representative amphibians of wetlands in Southern Palatinate.
As part of the **SystemLink** joint Floodplain Mesocosm (FPM) experiment, we will assess the impact of multiple Bti applications on temporal emergence patterns (phenology) of both amphibians. We address a quantitative (biomass, body condition) but also qualitative (stoichiometry, amino and fatty acids) perspective. We use stable isotope analysis and DNA-metabarcoding to follow the dietary composition over their life cycle in the aquatic and also the terrestrial phase. The project closely cooperates with two other PhD projects using the Floodplain Mesocosms: *Subsidy dynamics* for food web analysis and *Biogeochemical fluxes* for bio-geochemical processes. During the FPM experiment, the effects of Bti will be assessed for waterborne and diet mediated effects on the physiological fitness and behaviour (activity) of both species. The latter will be investigated involving an established camera system. We additionally will address the role of juvenile amphibians as prey in terrestrial systems and the consequences of temporal emergence shifts on their potential predators.



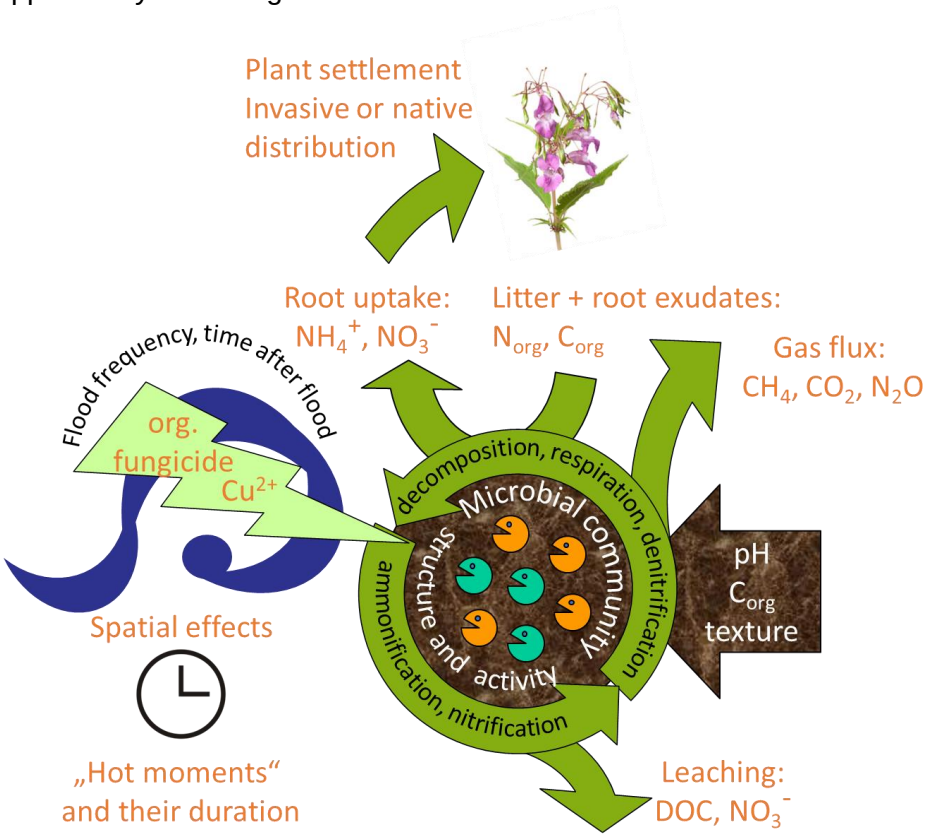
Interested? You are the right person for this project if you are interested in amphibian ecology, experimental ecology and have a background in molecular genetics. Ideally, you should have experience in terrestrial community ecology, ecotoxicology and DNA-metabarcoding.
You would have normally acquired these skills during a Bachelor and Master in Biology, Environmental Sciences or similar course programs.

Contact: Carsten A. Brühl, Community Ecology and Ecotoxicology

PhD project: Rhizosphere biogeochemistry
Working title: Joint FS_{stream} biogeochemistry (HJ): The impact of anthropogenic stressors on biogeochemical cycling at the root-microorganism-soil interface

Supervising scientists: Hermann Jungkunst, Katherine Muñoz, Melanie Brunn

Approach: This project will combine then **SystemLikn** *batch-scale* (joint PE) and the *landscape-scale* (joint $FS_{streams}$) to identify impacts of micropollutants and invasive species at the plant-microorganism-soil interface via their role for N- and C-cycling. Within **SystemLink**, we will analyse soils in the joint $FS_{streams}$ and joint PE (with PhD project *Soil C-N dynamics* and in close cooperation with the PhD project *Bottom-up effects*. We will focus on biological parameters and on soil chemical parameters such as water-soluble carbon and nitrogen species, plant available nutrients and total elemental composition (CHNS). At selected sites we will additionally test weather natural and invasive plants differ in their belowground patterns of hot and cold spots or if spatiotemporal patterns of stressors determine invasive or native plant distribution. Therefore, field-measurements of gas emissions during predicted hot moments will be used to detect possible effects of micropollutants on biogeochemical fluxes and plant distribution. Labeling approaches will contribute to quantify and qualify biogeochemical cycling. Some results will be combined with the information on the pore system, hydraulic conductivity and water retention obtained by NMR relaxometry and water transport assessments. We will define abiotic patterns linked to the contaminant patterns in the field supported by modelling.



Interested? You are the right person for this project if you are interested in soil biogeochemistry and you have knowledge and background in soil-plant-microbe-interaction. Normally, people would acquire such knowledge during a Bachelor / Master in Soil Science, Environmental Sciences, Biogeosciences or similar course programs.

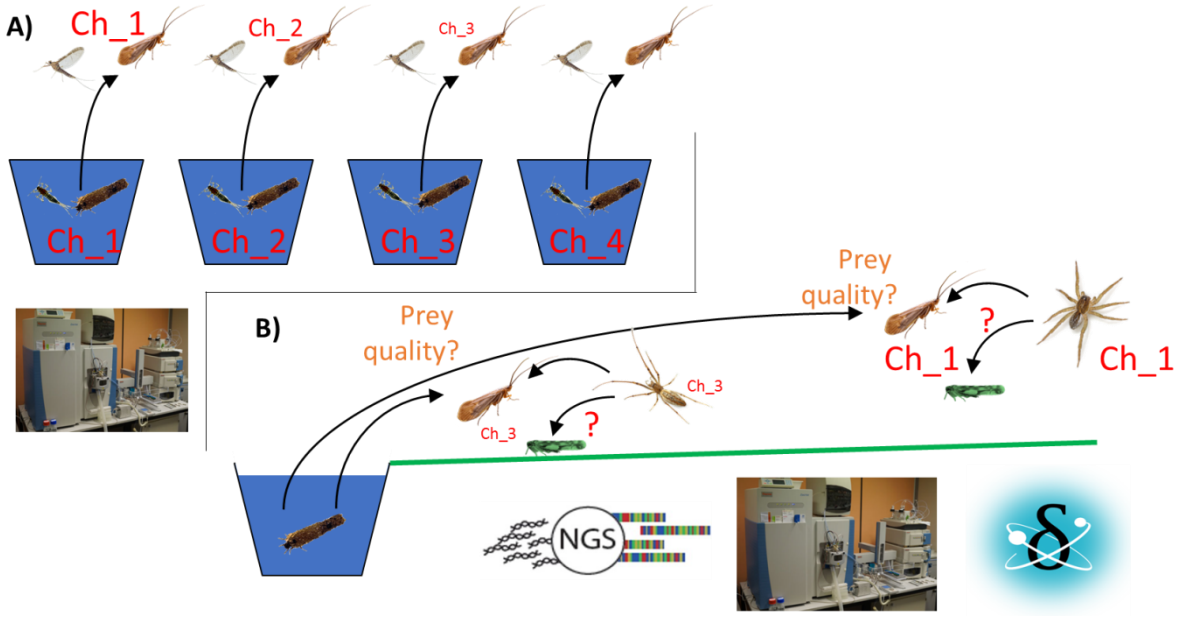
Contact: Hermann Jungkunst, Geoecology

PhD project: Biological pollutant transfer

Working title: Implications of physicochemical properties of micropollutants for their emergence-mediated transport to terrestrial ecosystem

Supervising scientists: Ralf Schulz, Gabriele E. Schaumann and NN Post-doc

Approach: Micropollutants differing in their tendency to be transported with emerging adult insects from the aquatic to the terrestrial ecosystem will be used in this PhD project in order (i) to understand the processes of micropollutant transport during insect emergence, (ii) to quantify the resulting effects on spatial micropollutant export into terrestrial recipient systems, and (iii) to study whether emergence-quality related parameters affect the population dynamic of terrestrial predators.
Laboratory batch or stream microcosm experiments will be conducted applying a variety of micropollutants and merolimnic insect groups in order to quantify, using trace chemical analytics, the potential transfer of micropollutants with the emerging adults.
The RSM (**SystemLink** *site-scale*) will be used to apply micropollutants expected to lead to a different spatial extent of micropollutant export into terrestrial predators, i.e. spiders (cooperation with PhD project *Food web ecology*). SIA in combination with DNA-metabarcoding will be applied in order to quantify food composition of spiders (cooperation with PhD project *Stress transfer across communities*), whose population parameters will also be assessed in cooperation with the PhD project *Subsidy quality*.



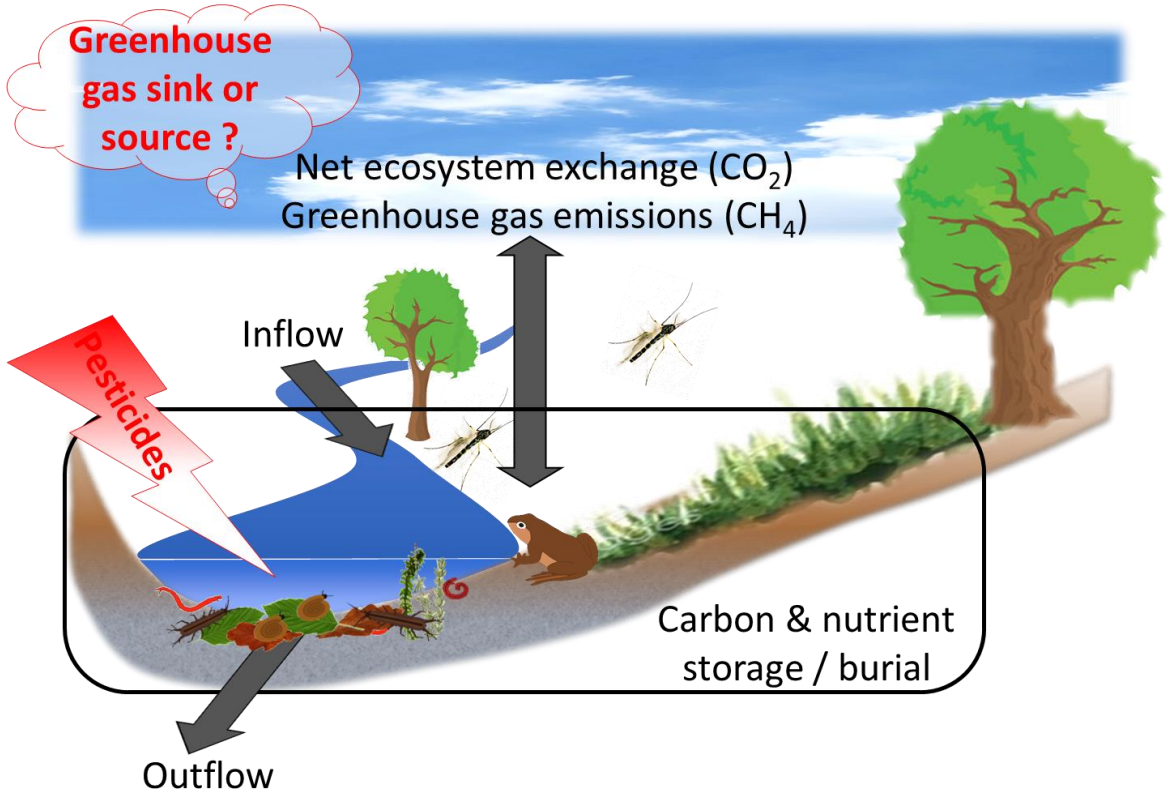
Interested? You are the right person for this project if you are interested in food webs and have a background in ecotoxicology and environmental chemistry. Ideally, you should have experience in experimental ecology and trace chemical analytics.
You would have normally acquired these skills during a Bachelor and Master in Environmental Sciences, Ecotoxicology or Environmental Chemistry or similar course programs.

Contact: Ralf Schulz, Ecotoxicology & Environment

PhD project:
Working title: Effects of chemical stressors on biogeochemical processes and fluxes in water to land transition zones.

Supervising scientists: Andreas Lorke, N.N., Jochen Zubrod

Approach: We will use an ecosystem-scale mass balance approach as part of a joint mesocosm experiment (Floodplain Mesocosms FPM). Carbon (C) and main nutrient (N, P) budgets will be estimated for replicated treatments by quantifying all relevant material fluxes and pools. In addition to these physically controlled flux paths, we will include mass fluxes of C, N and P associated with motile organisms, including insect emergence and amphibians. Observed differences in the biogeochemical cycling at the land-water interface among the treatments will be related to application of the biological mosquito control agent Bti (*Bacillus thuringiensis israelensis*) in selected treatments. The project will take advantage of the process understanding on ecological interactions obtained in two concurrent studies during the **SystemLink** joint FPM experiment (cooperation with PhD project *Subsidy dynamics* and *Amphibian ecology*).
We expect microbial methane production and oxidation as important ecosystem functions that are affected by the application of biological mosquito control agents. We quantify methane oxidation rates in water and soil using stable isotopes and by conducting additional smaller-scale experiments.



Interested? You are the right person for this project if you are interested in physical transport processes, and have knowledge and background in biogeochemistry.
Normally, people would acquire such knowledge during a Bachelor / Master in Environmental Physics, Engineering, Environmental Sciences, Biogeosciences or similar course programs.

Contact: Andreas Lorke, Environmental Physics

PhD project: Soil C-N dynamics

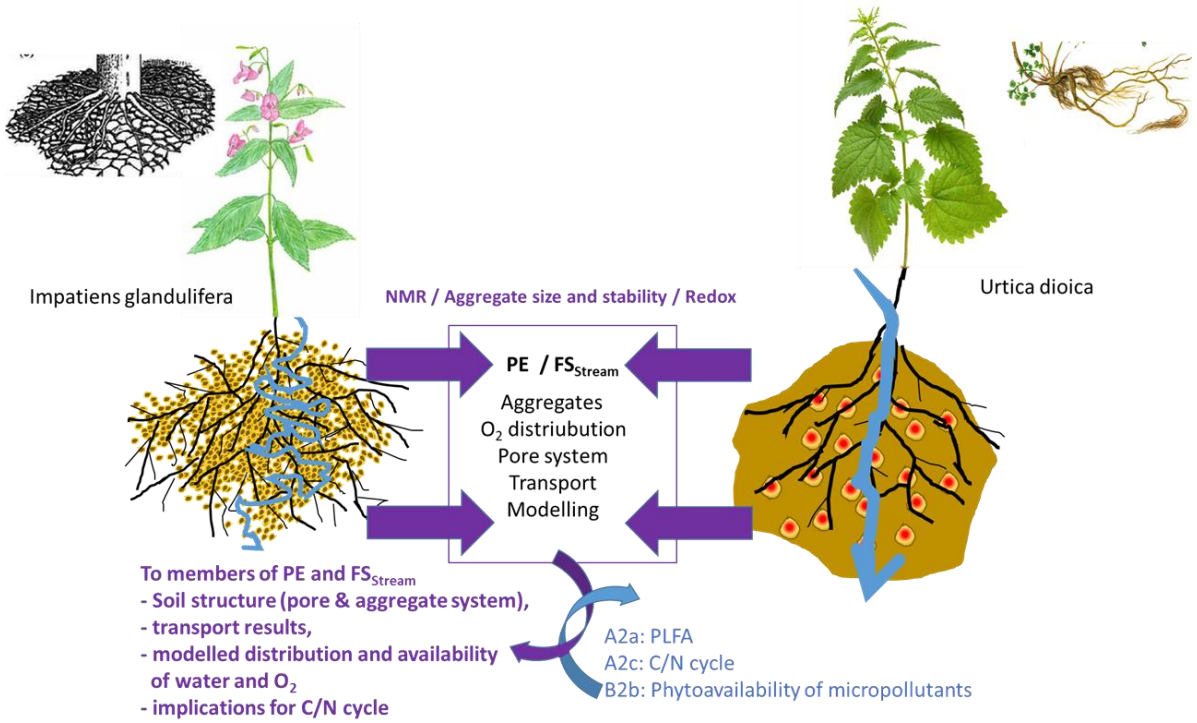
Working title: Implications of the interplay between invasive plant colonization and soil structure for the biogeochemical carbon and nitrogen cycle

Supervising scientists: Gabriele E. Schaumann, Eva Kröner, Verena Rösch

*Approach: N*ative (*U. dioica*) and invasive plants (*I. glandulifera*) have different root systems. These will strongly alter soil structure, carbon turnover and its thermodynamics. We will investigate these interplays on lab-, batch- and landscape scale. For this, we participate in two joint experiments: the **SystemLink** joint pot experiment (joint PE) and the **SystemLink** FS_{stream} (PhD project *Bottom-up effects*).

During and after the growing season we will assess root structure and soil hydraulic properties. Micro-respiration experiments with a long incubation time and thermodynamic measurements will help to roughly estimate the effect of water and oxygen distribution on carbon conversion efficiency and carbon turnover thermodynamics. Furthermore, we will select suitable biomolecules to characterize the carbon conversion efficiency by compound-specific isotope analysis. Here we will collaborate with the PhD project *Rhizosphere biogeochemistry*.

Water retention and soil pore size distribution in the rhizosphere will be characterized via 1D- and 2D nuclear magnetic resonance (NMR) relaxometry. With this, we will monitor pore size distribution, swelling-shrinking processes, rheological properties and soil microstructural stability. With this, we will collaborate with PhD project *Rhizosphere biogeochemistry* (link with gas emissions) and *Soil-plant modelling* (link with water transport).



Interested? You are the right person for this project if you are interested in soil biogeochemistry, you like thinking logically and you have some knowledge and background in soil physics or physical chemistry.

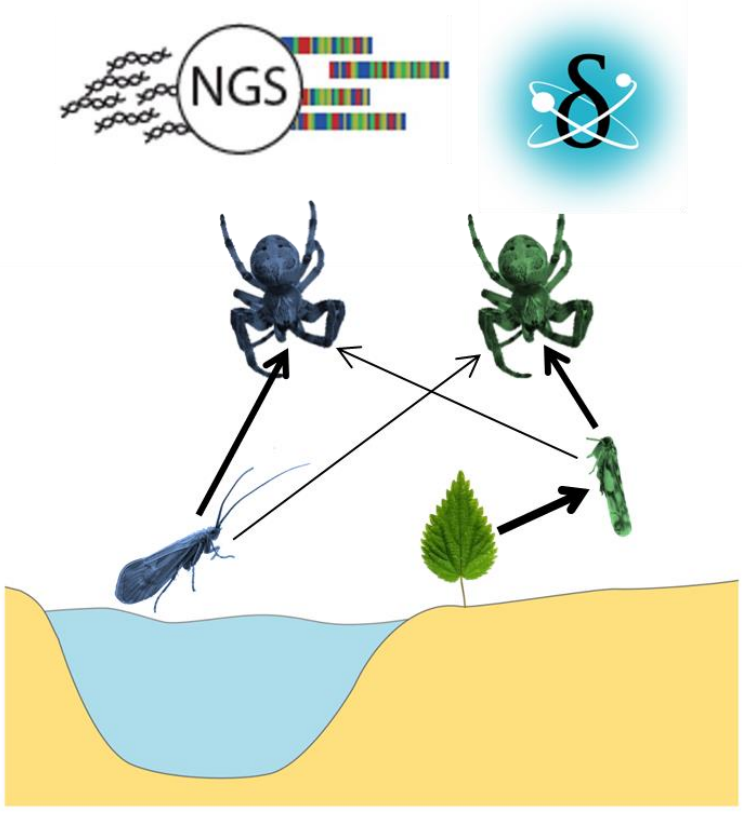
Normally, people would acquire such knowledge during a Bachelor / Master in Soil Science, Chemistry, Environmental Sciences, Biogeosciences or similar course programs.

Contact: Gabi Schaumann, Soil & Environmental Chemistry

PhD project: Food web ecology
Working title: Pollution and invasive plants reduce the impact of aquatic subsidies on riparian food webs

Supervising scientists; Martin Entling, Nanki Sidhu, Klaus Schwenk

Approach: We will investigate a set of 12 stream sections (**SystemLink** *landscape scale*) with similar runoff, but contrasting pollution levels and riparian vegetation composition in order to be able to compare the independent contribution of stream pollution and invasive riparian plants on the degradation of riparian food webs (in collaboration with the PhD project *Rhizosphere biogeochemistry*).
Emerging aquatic insects will be sampled, terrestrial productivity and terrestrial food webs will be assessed (cooperation with *Bottom-up effects*). We will determine the diet composition of terrestrial predators with a combination of SIA and molecular gut content analysis (metabarcoding). In a subset of sites, we will sample terrestrial predators along transects from the stream into the terrestrial habitat to determine the transversal decline in aquatic subsidy contribution to terrestrial predator diets.
As predators, we will study pairs of related spider species that are common along streams, and that consist of one riparian specialist and one habitat generalist each. We expect that the aquatic contribution is generally higher in riparian specialists than in the respective generalist species, but that generalists transfer nutrients further into terrestrial ecosystems because they are not limited to the riparian zone.



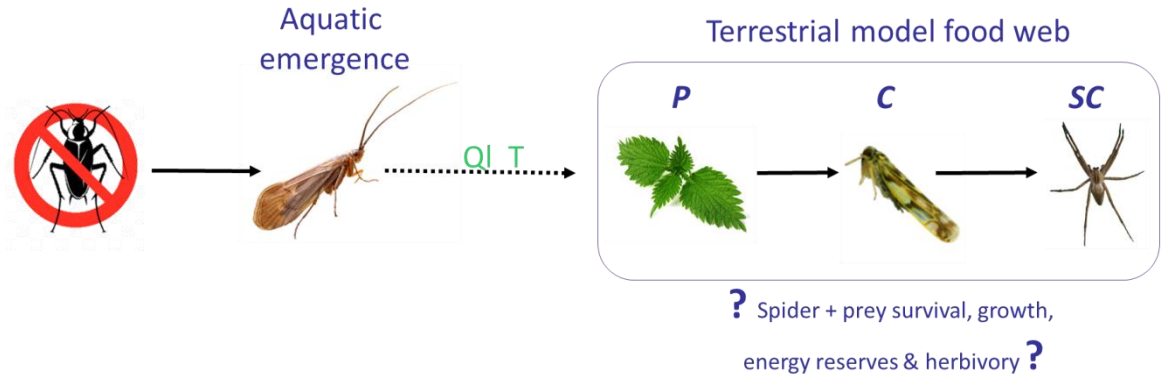
Interested? You are the right person for this project if you are interested in food webs and have a background in ecology and genetics. Ideally, you should have experience in arthropod biodiversity, ecological field work and in DNA sequencing techniques.
You would have normally acquired these skills during a Bachelor and Master in Biology or similar course programs.

Contact: Martin Entling, Ecosystem Analysis

PhD project: Subsidy quality
Working title: Terrestrial food webs are affected by the selective impacts of aquatic micropollutants on insect emergence

Supervising scientists: Jochen P. Zubrod, Ralf B. Schäfer, Mirco Bundschuh

Approach: The effects of three treatment levels of the selected micropollutants on the emergence of a typical lowland stream aquatic invertebrate community will be examined in the **SystemLink** RSM (cooperation with PhD projects *Stress transfer across communities* and *Biological pollutant transfer*). We will monitor the biomass and quality of emerging organisms. Subsequently, a full factorial experiment using microcosms inside the RSM, as meta-ecosystems, will be conducted featuring a simplified food web consisting of a terrestrial predator, terrestrial herbivorous prey, a plant, and aquatic prey (cooperation with PhD project *Ecological stress response modelling*). We will monitor the effects of the different treatments on spider survival, growth, energy reserves, and usage of prey items (via stable isotope analysis) as well as on terrestrial prey abundance and herbivory.
Furthermore, we will focus on micropollutants' effects on the physiology and pollutant burden of aquatic emergence and in turn the response of terrestrial spiders to changes in prey quality. Merolimnic insects will be exposed to micropollutants in the laboratory and kept until pupation (cooperation with PhD projects *Subsidy dynamics* and *Biological pollutant transfer*). After emergence, these insects will be introduced into the RSM and effects of the different micropollutant-induced qualities on the simplified meta ecosystems will be assessed.



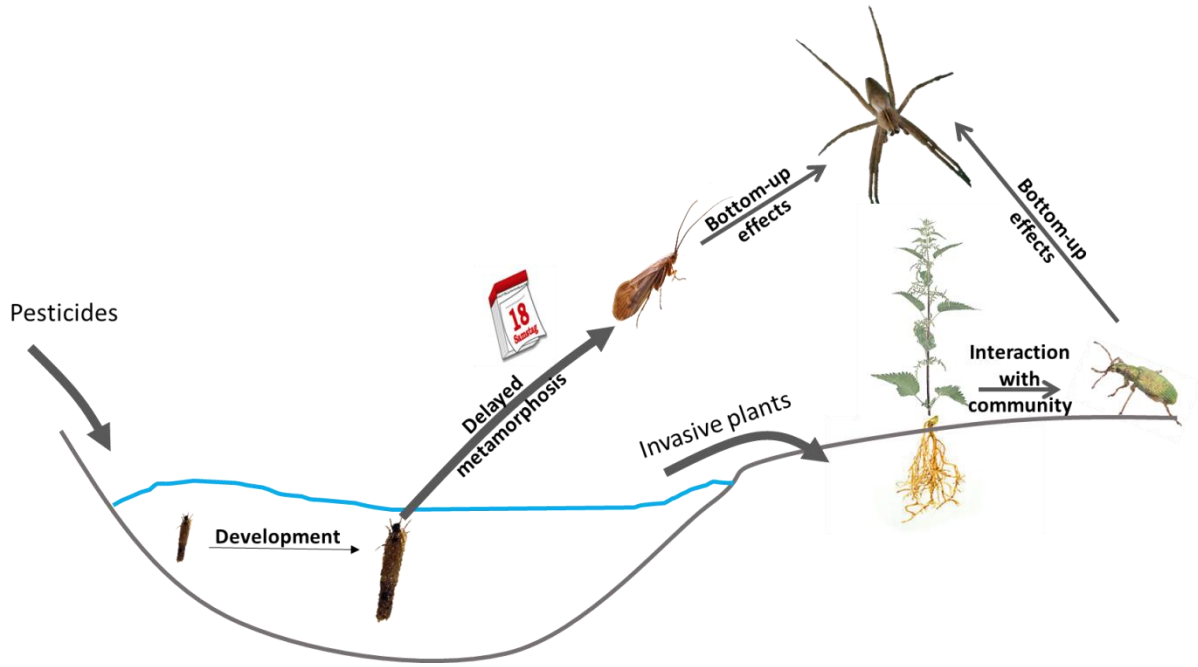
Interested? You are the right person for this project if you are interested in food webs and have a background in ecotoxicology or stress ecology. Ideally, you should have experience in experimental ecology and stable isotope analysis.
You would have normally acquired these skills during a Bachelor and Master in Environmental Sciences or Ecotoxicology or similar course programs.

Contact: Jochen Zubrod, Aquatic Stress Ecology

PhD project: Subsidy dynamics
Working title: Anthropogenic changes in the water-to-land transition zones modify the quality and temporal availability of aquatic subsidy for terrestrial predators

Supervising scientists: Mirco Bundschuh, Carsten A. Brühl, Mira Kattwinkel

Approach: We hypothesize that pesticides, such as Bti or fungicides, alter the temporal emergence pattern of the aquatic insect communities in terms of quantity and quality. This will be assessed at the site-scale involving the **SystemLink** floodplain mesocosms (FPM) in collaboration with the PhD projects *Biogeochemical fluxes* and *Amphibian ecology*. In addition to emergence patterns, the implications on the terrestrial predator will be covered. In a follow-up batch-scale experiments, we will determine the impact of selected pesticides and their mixtures on the quantitative and qualitative aquatic subsidy.
To address the impact of the second set of stressors, namely invasive species, it is planned to team up with the PhD projects *Bottom-up effects* and *Food web ecology*. By sampling terrestrial invertebrate communities in riparian zones dominated by invasive and native species, we quantify potential bottom-up directed consequences for riparian predators. Under laboratory conditions, the physiological responses of terrestrial spiders to the shifts in the temporal availability and quality of prey will be determined following procedure developed jointly with the PhD project *Subsidy quality.*



Interested? You are the right person for this project if you are interested in food webs and have a background in ecotoxicology and functional ecology. Ideally, you should have experience in experimental ecology and biomarker studies.
You would have normally acquired these skills during a Bachelor and Master in Environmental Sciences or Ecotoxicology or similar course programs.

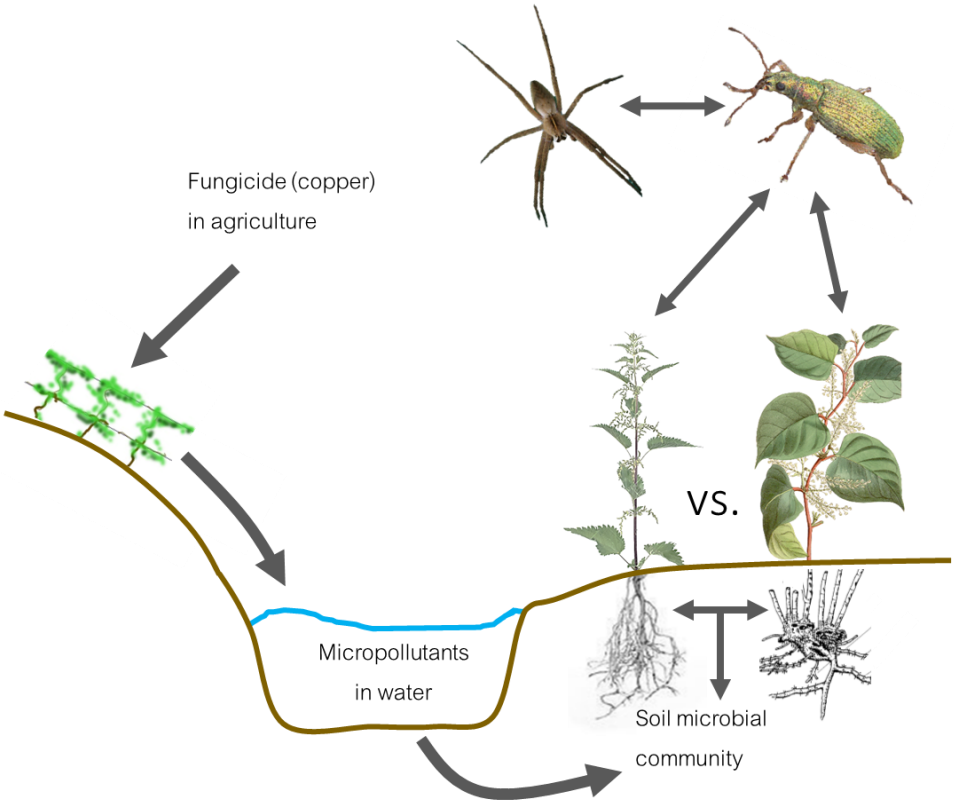
Contact: Mirco Bundschuh, Functional Aquatic Ecotoxicology

PhD project: Bottom-up effects

Working title: Bottom up effects of aquatic micropollutants and invasive riparian plants on terrestrial food chain and community composition

Supervising scientists: Jens Schirmel, Mirco Bundschuh, Kai Riess

Approach: An observational field study at streams (**SystemLink** joint FS_{stream}) will be combined with a laboratory experiment (joint PE) involving different riparian plant species and copper.
In the field study (*landscape scale*), we will investigate 12 stream sections with varying pollution levels to compare the independent contribution of stream pollution and invasive riparian plants on riparian soil microbial (DNA-metabarcoding) and invertebrate community structure including plant physiological fitness (cooperation with the PhD projects *Rhizosphere biogeochemistry*, *Food web ecology*, *Subsidy quality*, and *Ecological stress response modelling*. In a controlled laboratory experiment, joint PE, we will test the causal effects of micropollutants on the soil microbial community and subsequent effects on the focal riparian plant species (native/invasive) and focal herbivores and optionally predators that were found as associated in the field. We will use microcosms filled with a representative riparian soil and its native soil microbial community. A fully-crossed factorial design will be used. After the experiment, the fungal community will be characterised, and the morphological and physiological fitness of the focal plants and of higher trophic levels will be measured (collaboration with the PhD projects *Rhizosphere biogeochemistry* and *Soil C-N dynamics)*.



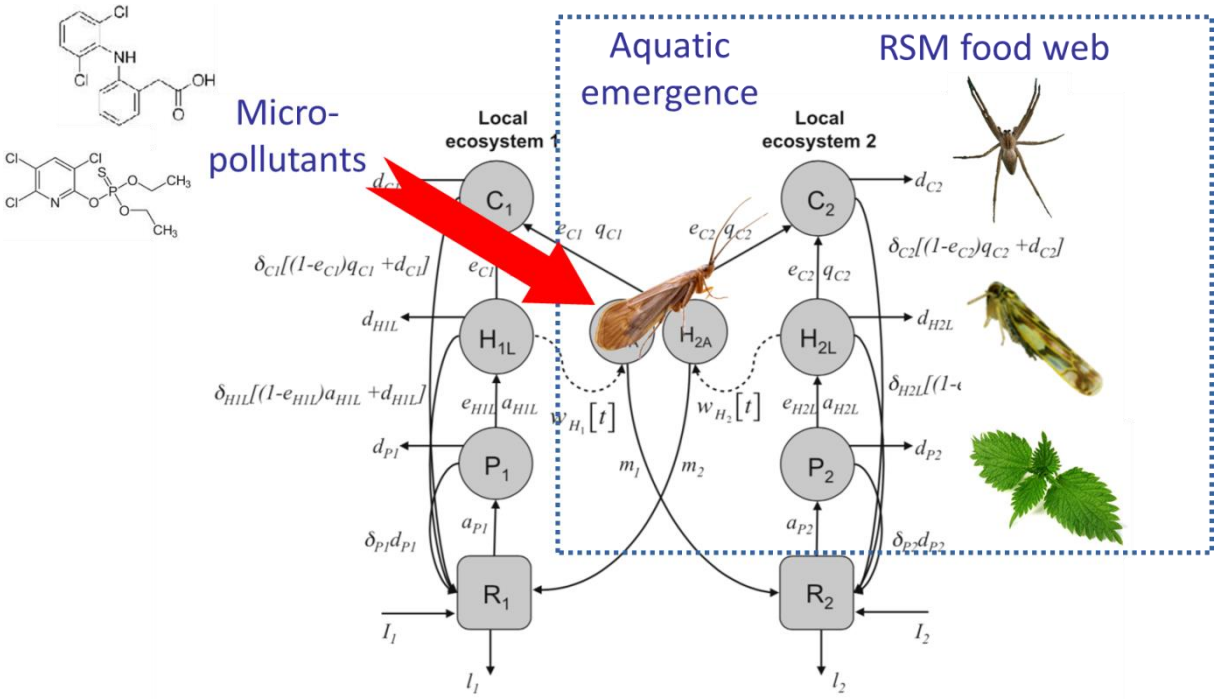
Interested? You are the right person for this project if you are interested in food webs and have a background in ecology and physiology. Ideally, you should have experience in arthropod biodiversity, ecological field work and in bioassay techniques.
You would have normally acquired these skills during a Bachelor and Master in Biology or similar course programs.

Contact: Jens Schirmel, Ecosystem Analysis

PhD project: Ecological stress response modelling
Working title: Modelling the response of a terrestrial food web to a change in aquatic subsidies through environmental stress

Supervising scientists: Ralf B. Schäfer, Mira Kattwinkel, Jens Schirmel

Approach: In the first part of the project, we will review the models that have been used for cross-ecosystem studies including meta-community and meta-ecosystem models as well as food web models. Based on the review, a conceptual model will be developed and research gaps will be identified, with a particular emphasis on which data would be needed to create simple cross-ecosystem models for spatially explicit and spatially non-explicit tri-trophic riparian systems consisting of a predator, herbivore prey and a plant. In the second stage of the project we will implement a quantitative model of the tri-trophic system and integrate a toxic effects sub-model. The model will include potential links to biogeochemical cycles and ecosystem functions such as primary production. Prior to the availability of empirical data from the different **SystemLink** PhD projects, realistic ranges of parameters will be used to evaluate the potential effects of toxicants on the stability of the tri-trophic system. Once empirical data is available, the model will be used to test the hypothesis that toxicants destabilize the dynamics of the tri-trophic riparian system.
This PhD project will closely cooperate with the PhD project Soil-plant modelling. In addition, the PhD study will closely interact with all other projects that include the tri-trophic system (e.g. Subsidy quality and Bottom-up effects).



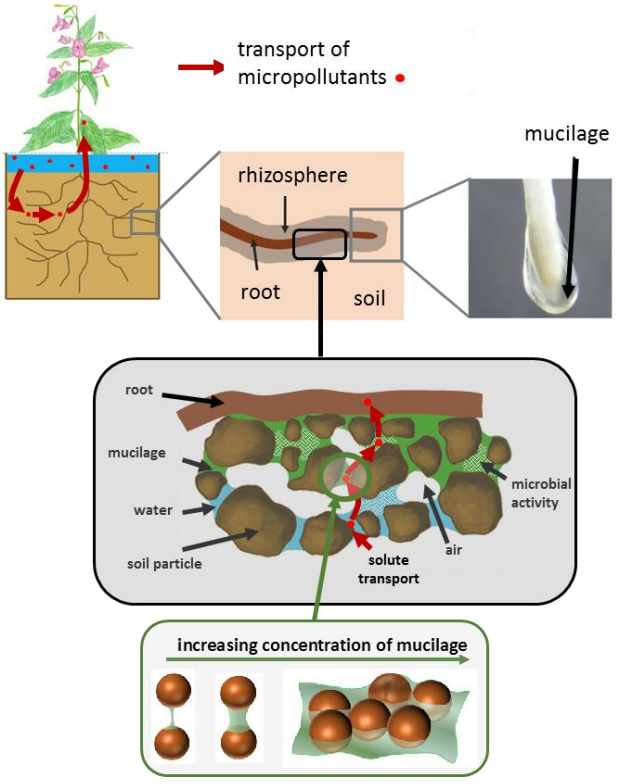
Interested? You are the right person for this project if you are interested in ecological modelling and/or quantitative ecology and you have knowledge and background in food web ecology, modelling, applied mathematics or data analysis.
Normally, people would acquire such knowledge during a Bachelor / Master in Environmental Sciences, Theoretical Ecology, Biology, Mathematics, Physics or similar course programs.

Contact: Ralf Schäfer, Quantitative Landscape Ecology

PhD project: Soil-plant modelling

Working title: Interplay between plant roots, root exudates and soil structure and their effect on bioavailability of micropollutants and nutrient cycle – a modelling approach
Supervising scientists: Eva Kröner, Lorenz Fahse, Andreas Lorke

Approach: We will use a model that is based on the Lattice Boltzmann Method (LBM) to better understand how physical properties, such as surface tension, visco-elastic behavior and hydrophobicity, may control the spatial arrangement of the liquid phase within pore space and to derive the corresponding connectivity of the liquid and the gaseous phase. We will combine these results with common models of solute transport in polymers and in soil to, at first, describe the diffusion process of solutes in pure mucilage and, secondly, extend this to the diffusion within pore space where we also account for the specific spatial arrangement of the liquid phase. In this way, we finally want to improve our understanding of the effect of root exudates on the bioavailability of micropollutants.
Information about root length density and radius distribution that is measured destructively in samples of the **SystemLink** joint PE (cooperation with PhD project *Soil C-N dynamics*), will be used as input parameters for a simulation. In this simulation, we will numerically solve the Young-Laplace-Equation and Stokes Equation to estimate how water retention and saturated hydraulic conductivity of soil are altered by a distribution of macropores that are occupied by roots of varying radii. We will finally combine our simulations of the spatial distribution of the liquid phase with a pore network model. Modelling approaches will be done in cooperation with PhD project *Ecological stress response modelling*.



Interested? You are the right person for this project if you are interested in soil physical dynamics and/or soil biogeochemistry, you like thinking logically and you have some knowledge and background in modelling and/or soil physics and/or physical chemistry.
Normally, people would acquire such knowledge during a Bachelor / Master in Soil Science, Physics, Environmental Sciences, Biogeosciences or similar course programs.

Contact: Eva Kröner, Geophysics