Young Formas Researchers in the spotlight

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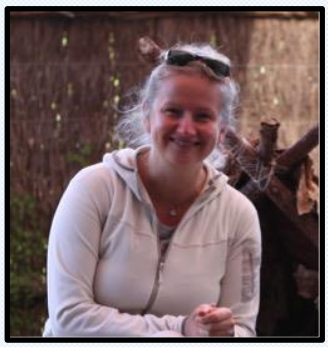
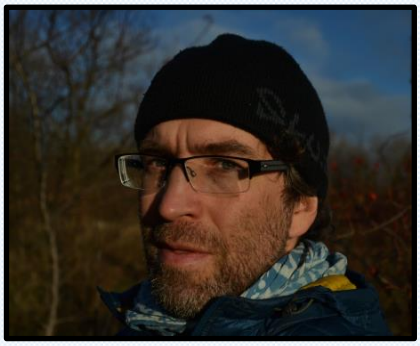
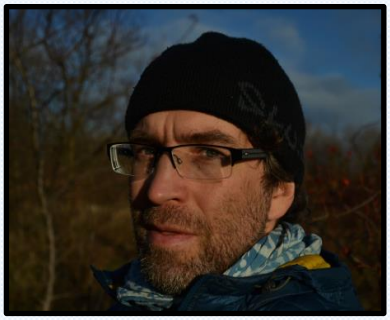
December 2015

This month, we turn the spotlight not only to one researcher, but to five, young talented researchers who all received a Formas grant for plant-related research this year's open call.





Paul Becher, Department of Plant Protection Biology, SLU



Already during my undergrad studies I got especially interested in insects, microbes and ecology. My research then focused on ecophysiology and chemical ecology with studies on food quality of microalgae, chemical defence by cyanobacteria, and insect behaviour. At SLU Alnarp I mainly studied odour-attraction behaviour of insects towards microbial, plant and social signals. My studies on *Drosophila*-yeast interactions led to the specific project on *Drosophila suzukii*.

-Can you quickly describe what you received a Formas grant for?

My project focuses on the spotted wing drosophila, *Drosophila suzukii,* which is a disastrous pest insect attacking cultivated and wild soft fruit and berries. We urgently need a better understanding of the fly's ecology and behaviour to develop sustainable control tools. As any organism, *D. suzukii* encounters beneficial and harmful microbes during life. Several of these microbes emit chemical signals that *D. suzukii* is able to detect. The project aims at understanding the signals and behavioural responses within microbe-insect interactions for the development of new control methods based on behavioural manipulation of the fly.

-What would the dream outcome of your Formas grant be?

The best would be to identify microbial signals that disrupt essential behaviours of *D. suzukii* like the fly's attraction to fruit, fly mating behaviour and egg-laying on the fruit. The findings would convince growers, industry and authorities and lead to fast implementation and control of *D. suzukii*.

-What are the implications of your research for the society?

The project addresses control of one of the currently economically most important pests on fruit. The fly is a threat for commercial soft-fruit production as well as for wild berries in Sweden. We want to contribute to the development of sustainable, semiochemical-based strategies to control *D. suzukii* and other pests in the future.

-When you close your laptop and walk out of the lab, what do you like to do?

There are many things. I love being outdoors with the family. Spending a weekend picking blueberries in the forests is a nice activity during summer. But berries should be free of *Drosophila* maggots.

Michelle Cleary, Southern Swedish Forest Research Centre, SLU

I am a forest pathologist working with fungal and oomycete forest pathogens affecting important tree species. Forest Pathology is a discipline I became enthused about even prior to pursuing my undergraduate forestry education as it entails much more than studying the biotic and abiotic

maladies affecting the health of forest ecosystems. The science also has biological, ecological, social, political and managerial elements.

My research interests are multi-faceted which probably explains the diversity of forest pathosystems I work with here in Sweden and abroad with several ongoing international collaborations. Though I have a particular interest in invasive forest pathogens. In particular, I am interested in the intricacies underlying invasiveness and the ways trees defend themselves (at the cellular, biochemical and molecular level). Understanding the interactions between pathogens, host trees, and the environment is critical to managing forest diseases and maintaining healthy, sustainable, and resilient forests in a changing environment. Working with such 'practical' issues means that the research will have applied value to various stakeholders groups.

-Can you quickly describe what you received a Formas grant for?

Recently, Phytophthora-pathogens have emerged as a new forest health problem in Sweden causing major damages and in worst case mortality on number of important broadleaved tree species. New introductions and expansion of established populations serves as a potential profound threat to Swedish forestry and forest ecosystems. In this project we will employ a unique "genes-to-landscape" approach that will reveal the patterns of species distribution, and genetic diversity of invasive Phytophthora species populations associated with forests, parks, amenity plantings and nurseries in Southern Sweden. In this project, together with my colleague Dr. Johanna Witzell, we will harness the interest of the stakeholders and citizens by involving them into the science through voluntary partnerships ("Citizen Science") that aim at systematic collection of samples and interactive dissemination of results and which will ensure the continuous and reciprocal flow of information between our research group and stakeholders and other end-users.

-What are the implications of your research for the society?

Invasive Phytophthora species have increasingly been reported worldwide due to an increase in the global trade of nursery plants for planting, and in some cases have resulted in significant ecological and economic impacts to forest ecosystems. Our research has broad relevance for society: the establishment and expansion of Phytophthora-populations in southern Sweden can build inoculum potential that may affect not only other broadleaved trees but also conifers, such as Norway spruce. Moreover, the enrichment of Phytophthora-spp. in our environment will increase the stochastic possibility for new hybrids between different Phytophthora-spp. which can be more aggressive than their parents and/or have a broader host range. This kind of event could destabilize our forests and seriously threaten the provisioning of ecosystem services (e.g. clean water). The Phytophthora species we have so far identified in our studies have a broad host range which suggests their establishments in nature pose a serious risk to Swedish forestry. This research will enable the development of new scientific information regarding the extent and risk of the newly established Phytophthora populations by integrating genetic, environmental and landscape data, which should

facilitate employment of durable management strategies for dealing with invasive Phytophthora pathogens

-When you close your laptop and walk out of the lab, what do you like to do?

When I am away from the lab, I relish in family life with my husband, 2-year-old son, and two dogs. We take all chances to enjoy and learn from all that nature has to offer. Having moved to Sweden from western Canada, I still though long to be in the mountains and relish in any opportunities for rockhounding and mountain views from the top – which usually requires some travels outside of Skåne!

Laura Grenville-Briggs, Department of Plant Protection Biology, SLU

My mum was a botanist and biology teacher, so plant science formed a major part of my early education. I am fascinated by the war in our fields: the molecular interactions between plant and microbe that lead to disease or defence. Oomycetes are fascinating Eukaryotic microbes that highly adaptive and have developed ingenious ways to evade or overcome plant defences to cause disease.

-Can you quickly describe what you received a Formas grant for?

Plant pathogens, such as fungi and oomycetes secrete an array of effector molecules to promote disease. Translation of this knowledge to aid sustainable disease control is still largely lacking. Crop diseases in the field may arise in an environment in which pathogens are competing or cooperating for host plant resources. Our agricultural fields are complex microcosms of multiple organisms To transition our knowledge from lab to field it is necessary to understand effector expression in such a competitive environment. My formas grant will study this in both potato and pea crops.

-What are the implications of your research for society?

We hope that by understanding how the interactions of multiple pathogenic Eukaryotes promote disease in plants, we will be able to develop more durable resistance to these pests. Potato is the most highly sprayed crop in Sweden, largely due to attempts to control both early and late blight diseases caused by the fungus Alternaria solani and the oomycete Phytophthora infestans respectively. Our long-term goals are to reduce our dependence on fungicides and develop sustainable integrated disease management strategies for potato.
-Tell us about your latest publication?

-When you close your laptop and walk out of the lab, what do you like to do?
When not in the lab, you will most often find me working in my garden at home, or ice-skating with my two children.

Jacob Johansson, Department of Biology, Lund University

My research currently focuses on how climate change influences the timing of biological events (phenology) such as bird spring migration or flowering, and how these changes in turn may disrupt ecological interactions. As a theoretical ecologist, I analyze mathematical models based on game theory and life history optimization to make predictions about ecological and evolutionary responses to different types of environmental change.

-Can you quickly describe what you received a Formas grant for?

I will study how bumblebees are affected by the temporal distribution of floral resources over the season. Bumblebees rely on a continuous supply of pollen and nectar for their survival and ability to reproduce. However, in modern agricultural landscapes, the distribution of floral resources over the season can be very uneven, with overabundance during the blooming periods of mass-flowering crops such as rapeseed or strawberries and periods of floral dearth and thus food scarcity. In my project I will construct mathematical models to study how resource variation affects bumblebee population dynamics and how it may influence natural selection of life history traits such as timing of colony establishment or timing of reproduction. An overarching goal is to understand the role of phenology for declines in the abundance and diversity of insect pollinators - a world wide phenomenon with far-reaching consequences for food production and conservation of plant species.

-What are the implications of your research for the society?

Provisioning of additional floral resources, for example in the form of wild flower strips alongside cultivated fields, is increasingly used to counteract decreasing populations of pollinators. For conservation projects, the theory developed here can be used to design flowering schedules to maximize the potential pollinator diversity. For agricultural production, the research will inform us how crop flowering times, along with potential food supplementation, best should be distributed over the season to maintain pollination services.

-Tell us about your latest publication?

We recently put together a special issue about phenological change for the Oikos journal and this served as a great inspiration for planning the awarded project. While phenological data continues to accumulate in ongoing, large-scale monitoring programs, we still know relatively little about the

ecological consequences of these changes. The thematic showcases novel research about how phenology impacts ecological interactions such as pollination, predation or herbivory and how it can be understood from the perspective of life-history evolution.

Ramune Kuktaite, Department of Plant Breeding, SLU

A necessity to find “green” alternatives for the petroleum-based plastics and more efficient and sustainable use of bio-resources are the driving forces of my research. Plants contain interesting compounds such as protein and starch, which with the help of the latest techniques can become our future clothes, furniture and packaging material. Understanding the architecture of protein and starch in new products is a key element in designing those products for specific functionality.

-Can you quickly describe what you received a Formas grant for?

To develop “fibre” like materials from the unique potato starch and wheat gluten protein, as well as to understand how we can tune the macromolecular structure of the materials with their functionality.

-What would the dream outcome of your Formas grant be?

Novel woven textile-like materials with properties suitable for example, wound dressing etc.

-What are the implications of your research for the society?

Contributing positively in lowering carbon footprint, “greener” environment and whole eco-system, and creating novel bio-based products (instead of petroleum based ones).

-Tell us about your latest publication?

It is about the possibility to create “spaghetti” type material from the wheat protein and potato starch, and its interesting “breathing” properties suitable to be used as packaging film.

-Let´s say you got unlimited research funds; where would your research be five years from now?

Few research projects going on hand-in-hand with several industrial partners and creating together innovative plant protein-rich food and non-food products.

-When you close your laptop and walk out of the lab, what do you like to do?

Be with my family, enjoy walking in nature and take care of my garden.