



UNIVERSITY OF TORONTO

FACULTY OF FORESTRY

Prof. Sandy M. Smith's Invasive Species Lab

Contact

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Number of Positions available

1-2 MScF or PhD, with preference for the latter

Research Focus

My research aims to increase our ability to manage forest pest insects and plants through improved understanding of factors that affect those natural enemies regulating them. Specifically, I explore questions related to population mortality and community diversity of insect natural enemies, with focus on understanding and manipulating native parasitoids and predators either through introduction or shifts in vegetation and stand structure. Recent introductions into Canada of several major forest pests has enabled us to compare the complexes of native and exotic natural enemies, and to explore mechanisms by which these communities affect host mortality and pest invasion. My current work tests hypotheses about mechanisms of displacement following the introduction of exotic species to better understand invasion processes in forest systems. Results will add to our current understanding of invasion dynamics, and at the applied level, help to direct management strategies for invasive alien forest insect species.

Project Descriptions

I have funding to support research in the general area of ecological impacts and management of invasive forest insects (emerald ash borer, pine shoot beetle, *Sirex* woodwasp, earthworms) and plants (dog-strangling vine, garlic mustard), both in urban/regional forests of southern Ontario and temperate/boreal forests in northern Ontario. My work is nationally and internationally collaborative, thus students have additional opportunities to carry out research projects in Canada (Toronto, Ottawa, Alberta) and at international agencies USDA (Montpellier, France) and CABI (Delemont, Switzerland).

Currently funded and planned projects include:

1) **Enemy Release and Biotic Resistance Hypotheses.** My lab examines predictions of these two hypotheses using an indigenous (*Ips*) and exotic (*Tomicus*) bark beetle system, in conjunction with the associated *Sirex* woodwasp system to explain patterns of enemy attack and host productivity. Biogeographic and ontogenic data are collected across a gradient of host densities in North America and Europe to quantify the degree to which enemies are present and account for host mortality and productivity.

2) **Biological Control of the Emerald Ash Borer in Ontario.** Experiments involve population and community measurements of natural enemies as they discover this recent invasive; in particular, their arrival with the borer or movement from native wood-boring species on to the invasive. Studies assess the potential for augmenting select natural enemies (those that have shown a rapid response to this beetle) in order to reduce its invasiveness in North America.

3) **Invasive alien plants**, such as dog-strangling vine (DSV) (*Vincetoxicum rossicum* & *V. nigrum*) and garlic mustard (GM) (*Alliaria petiolata*), prevent regeneration of native forest communities and cause significant losses in natural biodiversity. Their potential to destabilize North American forests will be accelerated under climatic change and disruption by other invasives such as emerald ash borer. As part of a larger collaborative effort in eastern NA, we are examining herbivory as a potential tool to manage these invasives, with emphasis on fitness impacts and host range specificity both in the countries of origin and countries of introduction.

4) **Impact of Invasive Earthworms.** Almost all earthworm species are invasive in Canada and have recently been shown to have severe negative impacts on northern temperate forests. Our current study examines species composition and patterns of spread (either naturally or by humans in recreational areas) across a range of forest types to measure their effects and provide an assessment of their ecological impact. Ecosystem variables of relevance to forest resource management and sustainability include physical structure of the forest floor, phosphorus cycling, seedling recruitment, and plant growth.