

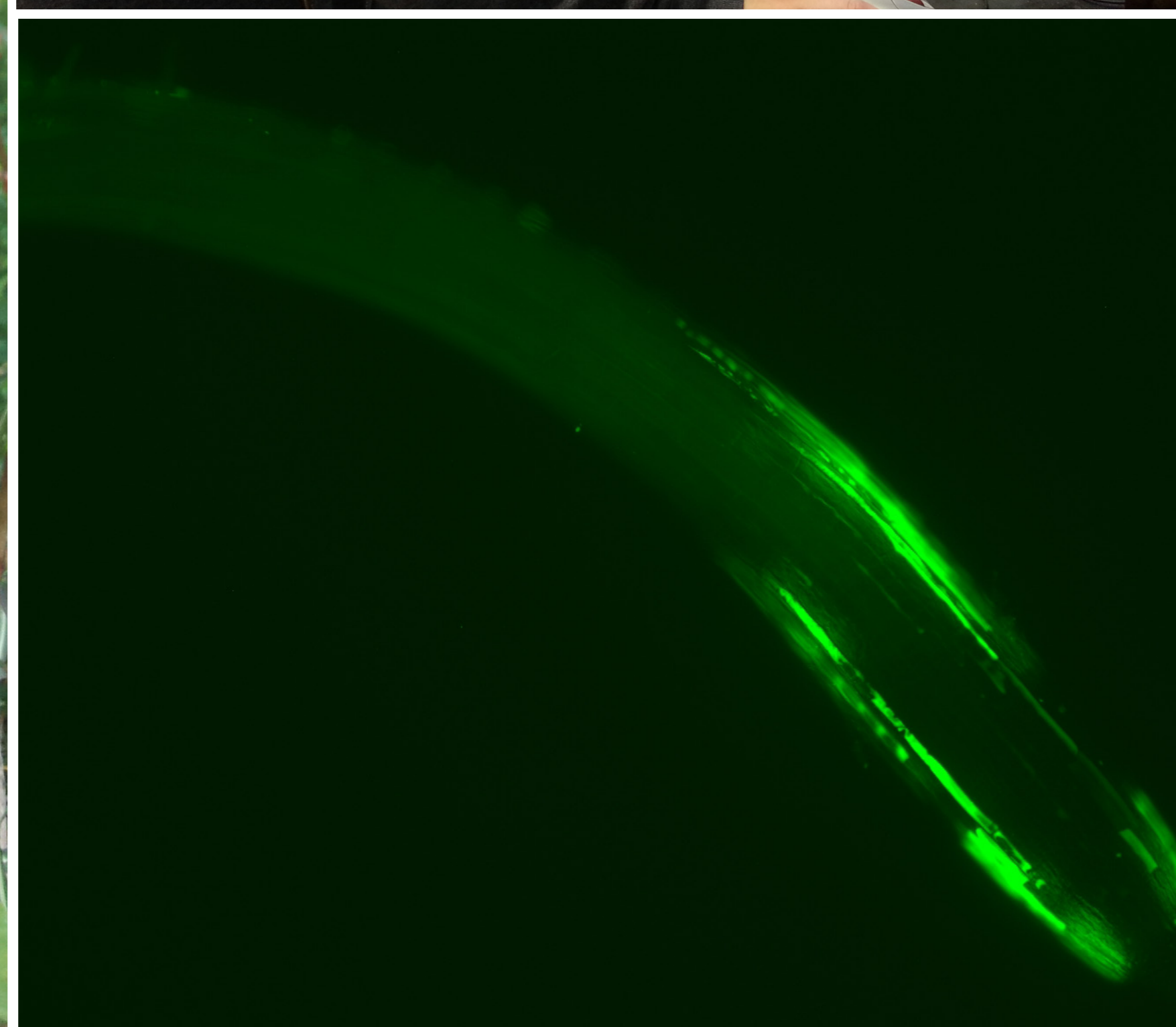
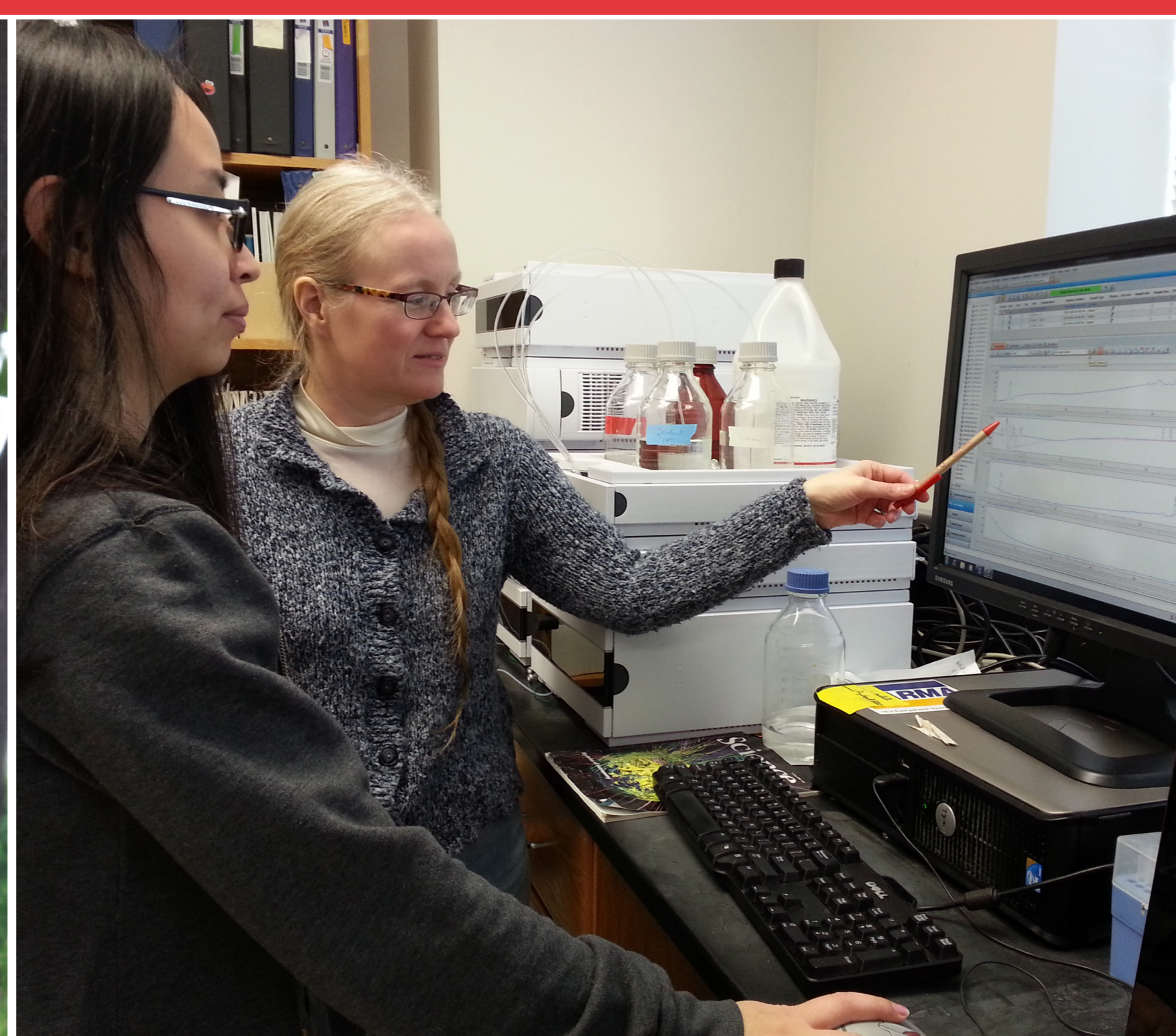


Undergraduate Program

Ecological Technology Design
Ecosystem Health
Soil and Watershed Science
Natural Resources Management

Graduate Program

Soil and Watershed Sciences
Ecological Technology Design
Wetland Science
Ecosystem Health & Natural Resource Management



Using Plants to Monitor the Health of the Environment

As the climate is changing with warmer winters, cooler summers, and more springtime ozone levels, the amount of stress experienced by organisms increases. This stress leads to reactive oxygen species (ROS) which can cause cell damage and disease. ROS can also induce normal signalling pathways to stimulate defense responses. Monitoring for increased ROS, markers associated with ROS, and growth, development and fitness will help understand the impacts of our changing climate on organisms in the environment.

Seedling Establishment

Seedling establishment is a critical stage in growth and development that occurs after the seed reserves are exhausted and the seedling can assimilate nutrients on its own. M1 and M24 metalloprotease activities peak during this growth stage and play essential roles in growth and development and nutritional homeostasis across phyla. However, the endogenous substrate(s) for these classes of enzymes have been poorly defined. For example, M1 metalloproteases have been shown to play a role in the cell cycle and cell division in animals and plants although the direct targets of the enzymatic activity in these processes have not been identified. Identifying substrates of the enzyme is a priority to understanding function so that the research can be translated into environmental restoration, crop improvement, and weed repression.

Evolution of Herbicide Resistance

Multi-herbicide resistant weeds, or superweeds *Amaranthus* spp., *Ambrosia* spp., and *Conyza* spp., are a major threat to food and commodity crop production. These superweeds also present a threat to the environment as herbicide use increases to try to control them. Understanding the mechanisms that allow for the rapid evolution of traits that confer fitness under selective pressure, whether it is herbicide resistance or tolerance to climate or ozone changes, is essential to meet the challenges of food and environmental security. These so-called superweeds, pigweed, ragweed and horseweed, all natives to the lower 48 states, are ideal model systems to study the rapid evolution of fitness under selective pressure.

Herbicide Targets and Metabolism

The mechanism(s) of action of most herbicides are unknown, and where a specific target of the herbicide may be known, the herbicide is likely to have additional targets. For example, the pre-emergent herbicide naphthylphthalamic acid (NPA) is used as an auxin transport inhibitor, but it also targets the activity APM1, an M1 metalloprotease. Plant growth regulators (PGRs) are important for production of crops and natural PGRs are an alternative to herbicide use. Natural PGRs can be used alone or in conjunction with conventional PGRs to increase the consistency of PGR activity. Developmental formulations and application methods are required to demonstrate efficacy of natural PGRs for commercial use. Natural PGRs are a sustainable and ecologically friendly alternative to optimize production of crops and may be useful in ecosystem restoration.