

# Bugged

MSU DEPARTMENT  
OF ENTOMOLOGY



Kelsey Graham, MSU Entomology

MICHIGAN STATE  
UNIVERSITY

## FROM THE CHAIR

Today there's a lot of talk about the campus climate resulting from some tragic and criminal actions of a few individuals. Many were injured and the university community in general will be impacted well into the future. Our support and thoughts go with the individuals and their families directly affected. This situation has generated a lot of discussion about how we interact with each other, and what we can do to insure safety, transparency, diversity, equity and inclusion. These are topics that should be out in the open all the time and more recently, I believe we're on a healthy path.

The Department of Entomology is flourishing. We welcome Marianna

Szűcs as a newly minted assistant professor in the area of biological control. Rufus Isaacs was honored with the William J. Beal Outstanding Faculty award. Peter White received the Entomological Society of America (ESA), North Central Branch's Distinguished Achievement Award in Teaching. Jaquelyn Albert, Holly Hooper and Margie Lund received Michigan State University Horticulture Society scholarships. Jay and Jean McPherson created an endowment to help students become more active with the ESA. More achievements come to light daily as evidenced by the stories in this issue of *Bugged*.

We are venturing into new territory as well. Jen Pechal and Eric

Benbow formed a team searching for sustainable food security in Malawi using insects. David Mota-Sanchez and colleagues secured a \$600,000 USDA grant to help Latino farmers and their families succeed in farming. Also, Amanda Lorenz-Reaves is feeding the entomology pipeline through the Bug Club and actively recruiting majors and minors into the Department.

Behind the scenes, easily, we have the best staff in the university! They insure grant proposals get submitted, the business of the department flows, field studies get implemented and labs run smoothly. Related to this, we wish Julia Perrone all the best in the next phase of her career as she moves from Landis lab technician "extraordinaire" to a Master of Library and Information Science program at Kent State University.

We're doing very well!

All the best,



Bill Ravlin,  
Chairperson



Fire pit gathering at the send-off celebration for lab manager Julia Perrone.

## RESEARCH & PROJECTS

### Wayne Jiang's IR-4 work has contributed to a 17-country agreement to improve global pesticide residue regulations.

Jiang is part of a team that has successfully structured an international agreement that will better align regulatory pesticide residue levels (MRLs). Non-scientific regulatory barriers in some countries have made it difficult for farmers worldwide to use tools and technologies that enhance productivity. A joint statement on MRLs was signed in December 2017 at the 11th World Trade Organization (WTO) Ministerial Conference in Buenos Aires. The statement was requested by delegations from Kenya, Uganda and the United States and was signed by Brazil, Canada, Uruguay, Costa Rica, Madagascar, Colombia, Panama, Dominican Republic, Peru, Chile, Kenya, Uganda, Argentina, Japan, Guatemala, Paraguay and the United States of America.

### Marianna Szűcs, a new assistant professor of entomology, arrived on campus this winter, ready to build off work published recently in the “[Proceedings of the National Academy of Science](#).”

Szűcs is a co-first author for studies that occurred in Ruth Hufbauer's lab at Colorado State University.

Biologists are increasingly recognizing that evolutionary change can occur in much shorter time scales than previously thought. In fact, changes may be fast enough to be observed in real time, affecting ecological processes, such as population dispersal or demography. Szűcs and Hufbauer's team explored whether evolutionary change could occur within a few generations when a species arrives in a new habitat and how it might influence population size and range expansion. They used a model



Wayne Jiang (back row, far right) at a capacity building event for African Union countries held in Accra, Ghana, during March 2017.

beetle system, red flour beetles (*Tribolium castaneum*), to test their theories about colonizing populations. Red flour beetles can complete a generation within just five weeks, making it possible to follow them over multiple generations as they adapt and spread in a new environment. To measure the strength of rapid evolution, the researchers compared populations that were allowed to adapt and spread unconstrained to populations where they prevented evolution.

Within six generations, populations allowed to evolve grew three times larger and spread 46 percent faster than non-evolving populations. Evidently, rapid evolution drives both increases in population size and expansion speed from the outset, acting as an architect of successful colonization and range expansion. These results imply that adaptation and other rapid evolutionary processes are likely critical in determining how large the colonizing population becomes and how widely it expands in its new environment. These can be unintentionally introduced invasive species or intentionally released biological control agents or endangered

species being relocated or reintroduced into new habitats.

Szűcs said, “For those of us working with biological control, these findings mean in working with planned releases, we should promote genetic and demographic processes that increase evolutionary potential while trying to prevent these in invasive species.”

**Chairperson Emeritus Mark Scriber was part of a team publishing in the Proceedings of the National Academy of Science**

this spring with “[Climate-mediated hybrid zone movement revealed with genomics, museum collection, and simulation modeling](#).” The work is a continuing National Science Foundation research commitment to Scriber, initially made 40 years ago with tiger swallowtail butterflies. Findings have enabled assessments of changing species distribution limits and impacts of climate-mediated hybridization and genetic divergence. Genetic



## OUTSTANDING ISAACS AWARDED MSU'S PRESTIGIOUS BEAL AWARD

Each year, Michigan State University honors 10 faculty members for their outstanding contributions to education and research with William J. Beal Outstanding Faculty Awards. In February 2018, **Rufus Isaacs** was awarded a Beal Outstanding Faculty Award. He joins 551 professors who have been honored since the award's establishment in 1952. Recipients are chosen based on continued excellence throughout their appointment at MSU.



The award citation commends Isaacs as follows: Rufus Isaacs is an exceptional scholar, who seamlessly merges fundamental and applied research to solve critical problems with insect pests while simultaneously transmitting knowledge to stakeholders and mentoring the next-generation of scientists. He is internationally recognized for his research on berry crop pollination and insect pest management, which has saved fruit producers millions of dollars in lost revenue and led to effective means for controlling devastating invasive insect pests of grapes, blueberries and other berry crops.

Specifically, the award acknowledged Isaacs's research and extension on managing the spotted wing *Drosophila*, which has allowed growers to produce berry crops and meet market expectations while minimizing pesticide inputs. His research on pollination services has demonstrated that enhancing native pollinators can be a cost-effective means of sustaining production. He has also significantly changed the science community's understanding of the current pollinator crisis by leading a national project on integrated crop pollination. As a result, this understanding now includes not only managed honey bees, but also native bees as critical components of fruit crop production systems.

Isaacs is an outstanding teacher and mentor, effectively training the next generation of entomologists in classroom and lab settings and providing examples of how scientists can train others and positively affect society. His comprehensive mentoring has resulted in former students occupying positions of influence in academia, government and NGOs worldwide.

and phenotypic changes in two species of Papilionid butterflies (*P. glaucus* and *P. canadensis*, and their hybrids) were examined across a well-known hybrid zone using genomics and morphological traits from older museum specimens and recent collections across the Great Lakes region of North America. Genetic introgression and reproductive isolation involved intrinsic and extrinsic factors, including the primary driving selection of recent

thermally-changing landscapes. Computer-simulated future scenarios illustrate the likely differences in local selection pressures in and around the hybrid zone areas across the geographically diverse Great Lakes and eastern US landscapes.

"It is especially satisfying to see a research project started in the 1970s continued through the present time with significant recognition," Scriber said.



**David Mota-Sanchez is leading a project to increase sustainability of Michigan's Latino farmers.** His team has secured \$600,000 to work with beginning Latino farmers and encourage children to consider a future in farming. Latino farmers are changing the face of specialty fruit production by transitioning from employment in industrial and farm labor to becoming farm-owners. These new farmers face challenges including a lack of agriculture experience, stricter food safety and worker protection regulations, and devastating fruit pests. In addition, cultural isolation, language barriers, lack of business skills and reduced access to markets hinder their longevity as farm-owners.

The funding is part of USDA NIFA's Beginning Farmers program. The team will be working with Latino blueberry growers in southwest Michigan. Blueberry production is mostly concentrated in southwest Michigan and the team estimates that a third of blueberry farmers in Michigan are Latino. "Along with the training to help the farmers succeed in growing blueberries," said Mota-Sanchez, "the project will highlight crop diversification options so that the growers can diversify their farms to increase their sustainability."

Mota-Sanchez has brought together partners prepared to train these new farmers as well as address an issue found throughout farming communities—an aging farmer population with fewer young people prepared to farm.

## ALUMNI GIVE BACK MCPHERSON GRADUATE STUDENT TRAVEL AWARD

Thank you to Jay and Jean McPherson for establishing a new travel award with a gift of \$200,000. The J. E. and Jean M. McPherson Graduate Student Travel Award was created by the McPhersons to celebrate their long-term association with MSU and the importance they place on students actively participating in professional meetings.

Both Jay and Jean earned degrees from MSU. Like many young people, they met at MSU and were married in the Alumni Chapel. Upon receiving his PhD, Jay became a professor of entomology in the Department of Zoology at Southern Illinois University. He also was a leader with the Entomological Society of America (ESA) including being an ESA Fellow, an Honorary Member and President.

This award was established to encourage student involve-



Students take a break at the 2018 North Central ESA branch meeting to enjoy the local frozen custard. From left to right: Margie Lund, Gabriela Quinlan, JP Kole, Andrew Myers, Colin O'Neil, Carissa Blackledge, Emilie Cole, Holly Hooper.

ment in the national and regional branch ESA meetings and to celebrate the critical role entomologists play in science and society. Support includes travel, lodging and registration fees.

The McPherson Award was awarded for the first time at the March 2018 NCB-ESA meeting in Madison, Wisconsin. The recipient is **Gabriela Quinlan**, a doctoral student advised by Rufus Isaacs.

**Richard J. Snider's list of spider species found in Michigan has been updated** and is available for download. Snider published his first list in 1991 including 557 species of spiders found in Michigan. The new list is available at [bit.ly/MichiganSpiders](http://bit.ly/MichiganSpiders) and includes a section listing any new Michigan species (with county records) that have been added to the MSU Entomology Department spider collection since 1991.

### PEOPLE

**Rich Merritt** and **Ken Cummins** were honored as Inaugural Fellows of the Society for Freshwater Science when the society launched the honors program with 27 scientists in 2017. Merritt reports the society has collected

letters for the next generation of fresh water scientists from the fellows that will be compiled into a publication. Read about the contributions of Merritt, Cummins and the other fellows at: <http://bit.ly/FreshWaterFellows>



MSU Entomology Chairperson **Bill Ravlin** is the 2018-19 president of NCB-ESA and began leadership at the March branch meeting.



**MSU's Linnaean team** made it to the second round this year. Team members were: Margie Lund, Andrew Myers, Colin O'Neil and JP Kole. Undergrad Kole was a team stand-out, shown above at the competition.



Collaborators met at MSU in January 2018, offering many of the Malawian partners their first opportunity to experience snow. Left to right: Eric Benbow, Kingsley Masamba (LUANAR), Andy Safalaoh (LUANAR), Jennifer Pechal, Jeremiah Kang'ombe (LUANAR) and Arox Kamng'ona (UM-COM).

## Farming insects for feed, food and health

Jennifer Pechal and Eric Benbow have formed a team searching for sustainable food security in Malawi. This challenge has additional complexities in Sub-Saharan Africa, where diets are nutritionally weak and protein is limited. Solutions will require new ways to provide high-quality diets that are safe, sustainable, scalable, affordable and widely available.

Pechal and Benbow are part of a grant awarded in 2017 by MSU's Alliance for African Partnership (AAP). The funding supports "inception stage" partnerships with real-world impact that improve African lives and livelihoods. Insects are part of the solution for this collaborative partnership between Michigan State University, Lilongwe University of Agriculture and Natural Resources in Malawi (LUANAR), and the University of Malawi, College of Medicine (UM-COM). The project aims to improve food security in Malawi by increasing protein production through a novel feedstock – insects.

The research team is exploring the use, optimization and safety of farming insects for protein-rich livestock feed and human food. Specifically, identifying beneficial

insect recyclers, the black soldier fly [*Hermetia illucens* L. (Diptera: Stratiomyidae)] to effectively convert organic waste biomass into insect biomass for nutritious feed or food. Black soldier fly larvae are voracious consumers of decomposing organic material and use the nutrients found in common waste to complete their lifecycle. Larvae feeding on decomposing organic matter (e.g., pre- or post-consumer waste or agricultural waste) result in insects that are high in protein and lipids. Once larvae leave their food resource to pupate, they can be harvested, dried and milled for use as a feedstock for livestock, poultry and aquaculture. The scientists are also examining the role and perception of using native insects (e.g., mopane worms) as food for humans.

Progress has been made towards developing long-term partnerships with African, European and US institutions, local stakeholders and marginalized individuals such as youth and women in a community. Overall, there is tremendous potential to improve food security, increase agricultural sustainability and enhance progress for nations to achieve a zero-waste status through the use of insects.

## AWARD-WINNING

**George Bird** was named the Michigan Vegetable Council's 2017 Master Farmer Associate recipient. In presenting the award to Bird, the Council noted that he has served on the MSU faculty since 1973 basing his work on nematode diseases of vegetables, fruit and agronomic crops. Much of his research and outreach has occurred on-farm with close association with multiple generations of farm families. His students have become well-known nematologists based on his training. The Council joined with Michigan Farm Bureau to produce this video highlighting Bird's work and impact on Michigan farmers: <http://bit.ly/GeorgeBird>.

## The International Integrated Pest Management (IPM) Symposium was held in Baltimore, Maryland, in March.

This event is held every three years and is attended by those working in IPM from around the globe. This year, organizers placed an emphasis on encouraging more students to attend the symposium. Funding for student travel and a mentoring luncheon was provided by the North Central IPM Center under the leadership of Sue Ratcliffe and MSU's **Lynnae Jess**. Entomology students receiving travel awards included **Jaquelyn Albert** and **Heather Leach**. Both were leading authors of posters receiving honorable mentions:

- Jacquelyn Albert and Julianna Wilson for "Field-level fungicide exposure to honey bees (*Apis mellifera*) during orchard bloom in Michigan."
- Heather Leach, James Hagler and Rufus Isaacs for "Invasive honeysuckle increases populations of the invasive vinegar fly, spotted wing *Drosophila*."

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[ent.msu.edu](http://ent.msu.edu)

**Three entomology graduate students were honored by the Michigan State Horticultural Society** with scholarships in 2017: **Jacquelyn Albert** (MS, Julianna Wilson) is interested in integrated pest and pollinator management for fruit growers and plans to pursue a position as an extension educator after completing her degree.

**Holly Hooper** (MS, Matt Grieshop) has worked on several farms around the world, learning a variety of different management programs. She hopes to work with farmers to learn the best IPM practices to preserve profit and the environment.

**Margaret Lund** (PhD, Zsofia Szendrei) is researching the cabbage white butterfly and its biological control agents with greenhouse tests and field experiments. After graduation, she would like to work as an extension educator linking university researchers and growers.

*Continues on page 8.*

## MARKETING ENTOMOLOGY

**Joy Landis**  
and  
**Mallory Fournier**

won a silver marketing award from the Association for Communication Excellence (ACE) for the insert about graduate studies in entomology included in our fall issue of *Bugged*. Have you shared it with someone who should consider becoming a graduate student with MSU Entomology? Download to share it by email or print at: [bit.ly/EntoGradStudies](http://bit.ly/EntoGradStudies).



## WINNING STUDENTS BECOME SCIENTISTS IN WHITE'S CLASSROOM

**Peter White** is the 2018 recipient of the Entomological Society of America (ESA) North Central Branch Distinguished Achievement Award in Teaching.

White has a dual appointment in the Department of Entomology and Lyman Briggs College, which focuses on science, technology, engineering and math education. He has used this unique appointment to bring together these two disciplines: illustrating general concepts in his biology course for non-majors through some insect-based examples, and bringing cutting-edge teaching methodologies into his entomology course.

White models his teaching on the three principles of modern pedagogy: an interactive learner-centered environment, a backward design curriculum development process, and student-driven engagement with authentic scientific investigation.

His learner-centered undergraduate teaching uses a "flipped-class" approach. In class, students participate in peer discussions, hands-on activities, problem-solving and debate. Outside of class, students watch an instructional video by White and complete the related homework ([view one of the videos](#)).

The backward design means he develops a set of learning outcomes that drive the interactive interventions of his flipped classroom. His assessments for



determining student learning are based on the intended outcomes. His goal is to turn the classroom and lab-room into dynamic learning spaces where students learn how to think like biologists rather

than simply assimilate information about biology. Students generate hypotheses, apply knowledge and investigate scientific questions.

White encourages the students to engage in the scientific process of discovery and hypothesis testing when they conduct lab work. He presents a general theme at the beginning of each semester and encourages them to work in teams to pose scientific questions around this theme for exploring throughout the semester.

Similarly, in graduate-level teaching, White's course on insect genetics requires students to design and execute their own research projects. Entomology graduate students come from a broad background, so White's course helps those with ecology or macro-biology backgrounds become proficient and familiar with standard and modern genetic techniques, from PCR and primer design to NextGen sequencing. The students isolate DNA from an insect species of their choosing. They then amplify and sequence a gene of interest to them. This lab work is paired with seminar-style classes where students take turns presenting relevant papers in the field of insect genetics.

## FEATURED STUDENTS

**Hometown:** Okemos, Michigan

**Future plans:** I want to get my masters in entomology. From there, I might go on for a PhD or find work related to entomology.



**CAITLIN PEFFERS**  
UNDERGRAD STUDENT

**Tell us about your experiences working in labs.** I volunteered in a lab for Michigan Natural Features Inventory when I was in high school. I sorted through samples from vernal pools for arthropods. I got to see a lot of aquatic insects and was amazed at how many were dependent on temporary ponds at some stage in their life cycle. This was one experience that cemented my desire to become an entomologist.

Once I came to MSU, I became the first member to join Dr. Henry Chung's insect physiology lab. I get to study pheromone synthesis genes in spotted winged *Drosophila*. Working in Dr. Chung's lab has taught me valuable methods in molecular biology that I hope to build on and use in my future studies.

**What is the best selling point about an entomology major?** The learning is great fun! All the entomology

**Home state:** Michigan  
**Previous education:** University of Michigan  
**Major professor:** Dave Smitley

**What are you researching?** Pollinator attractiveness of popular annuals and perennials.

**Why study entomology?** I took an insect diversity class during my undergrad, and it completely changed my life. I was studying mycology at the time, but I've never looked back. More people should study entomology because it would help them better understand the importance of biodiversity and how it relates to food security.



**COLIN O'NEIL**  
GRADUATE STUDENT

courses I have taken have been the highlight of every semester. They have been interactive and engaging and often include outdoor excursions.

**What or who inspired your interest in entomology?** My parents recognized early on that I had a particularly keen interest in insects and were all about allowing me to follow my interest to see where it might lead. It led to endless explorations for insects, nature camps, bug camps, stream sampling, etc. It must have been around my early middle school years when I learned from my mom that entomology was an actual field of study.

**What has been your best experience with entomology?** Hard to choose. Attending the Entomological Society of America conference, working in Dr. Chung's lab, interacting with peers. I have to say, learning to pin and spread specimens for my insect collection was fun. It makes the specimen look pretty and dramatic.

**How do you spend your time outside of studies?** I draw and paint things, often people, arthropods or natural scenes. I also play the cello, crochet, knit, listen to audio books and read mystery novels.

**Do you have advice for anyone interested in an entomology major?** Take ENT 404 Fundamentals of Entomology. You will learn so much about insects, and it is a good course to take if you are wondering if entomology is for you. Also, the department has great faculty advisors and mentors. Definitely find time to talk with them!

**What or who inspired your interest in entomology?** Brian Scholtens, the professor of the aforementioned life-changing insect course, and Matt McGuffie, a classmate and eventual best friend.

**What is your favorite activity or responsibility as part of your graduate studies?** Words can't express how much I love teaching. Every semester, my students were interested in the class material, and they treated me with respect.

**What is your favorite insect?** Parasitoid wasps, because they are incredibly successful at fulfilling a rather niche reproductive strategy. They parasitize every life stage of other insects, they parasitize non-insects and they even parasitize each other.

**What is your favorite activity/way to spend your time outside of your studies?** Catching and pinning insects, or spending time with my significant other, sometimes both!

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## ALUMNI NEWS

**Vianney Willot** (MS, Mike Brewer) reports after working within the pest control industry, he decided to change careers and enroll in a computer coding “boot camp.” He spent a couple years as a software developer for Menlo Innovations in Ann Arbor and in January 2018 became a software developer for the Ford Motor Company. Willot writes, “It is very interesting to work on what Ford calls ‘Smart Mobility.’ The automobile industry is in the middle of its biggest revolution with the emergence of self-driving cars. In the future, Ford sees itself as a tech company. It is pretty exciting to be a part of it.”

**Becky Blasius** (MS, Rich Merritt) is an adaptive management specialist, with the Lower Colorado Multi-Species Conservation Program, Bureau of Reclamation in Henderson, Nevada.



Amanda Lorenz-Reaves, MSU Entomology

**Entomology’s new outreach specialist, Amanda Lorenz-Reaves, reports Bug Club is back!** Bug Club met in the MSU Bug House in January 2018 and is planning activities to build community for undergraduate students interested in entomology.

**Rob Morrison** (PhD, Zsofia Szendrei) received the International Organization for Biological Control – Nearctic Region Section’s 2017 Early Career Outstanding Scientist Award,

which acknowledges scientists within 10 years of earning their doctorate degree who have made significant contributions to the field of biological control.

## Taking a winter break with Grafius and Parsons

For many winters, **Gary Parsons** and **Chairperson Emeritus Ed Grafius** have gone fishing in the Florida Keys. Gary shared a bit about the latest trip offering an interesting view of the aftermath of Hurricane Irma and fun with an emeritus chairperson.

In January, the two headed to Lower Matecumbe Key to fish in warm, sunny Florida. Ed and his wife keep a boat there and were glad it and the places where they normally stay survived. However, Gary and Ed were not sure what to expect for the rest of the community. Despite TV coverage and dire reports that the Keys were wiped out, Islamorada didn’t fair too badly. A few buildings showed signs of significant damage. Trees, shrubs and understory plants didn’t fare as well due to the winds

and storm surge. Although the landscape didn’t look so lush and tropical, at least much of the vegetation was still there. Birds and bugs remained, too.

People were still cleaning up and repairing, but there were quite a few going-out-of-business signs or closed-up stores. The hurricane didn’t appear to cause much damage, but three to four months of little or no tourist income was

more than they could take. Overall, that area of the Keys seems to be recovering nicely.

So how was the fishing? Ed and Gary caught 615 fish (32 species) over two weeks. Believe it or not, that was their second worst year fishing there! The best year was 1,149 fish and 42 species in 2014. They mostly catch and release fish, but this trip they actually had a hard time catching enough of the right sizes and species to eat for dinner, so they contributed to the local economy by eating out more often. Although Ed and Gary consider catching any fish exciting, the best catch of the trip was a 5-foot blacktip shark caught by Gary (see photos). Like most vacations, it seemed to end way too soon, and it was back to the cold and snow.





## ALUMNI PROFILES: NEIL KAGAN

### Why did you study entomology at MSU?

My career path really began in 1970 on the first Earth Day, when I was 16 years old. That day, my high school held a big assembly about the environment with several speakers. What I heard kindled a passion for protecting the environment that has motivated me ever since. In my senior year, I took an advanced biology class that included ecological field studies. We assessed water quality and biodiversity in streams by studying benthic organisms, especially insects. I was amazed when I saw a rock plucked from the bottom of a stream crawling with mayflies and caddisflies. Here was a whole world I hadn't known to exist. I was fascinated and chose to study biology at Penn State University.

During my freshman year, my advisor suggested a double major. When I suggested law, he endorsed the choice, saying there would soon be a need for attorneys to enforce newly adopted federal environmental laws. As I was completing my bachelor's degree, I decided I would be more informed and effective with a better grounding in biology and ecology. So, I chose to get a master's prior to law school. Michigan State University's Entomology Department had the best reputation and they offered me a graduate assistantship with a new professor, Rich Merritt. Rich knew from the start that my intention was to go to law school, but he took me on as one of his first graduate students.

### How did MSU prepare you for what you do today?

Studying at MSU gave me solid education in science. My thesis involved studying insect populations in four sewage treatment lagoons on campus. Working with

Rich, I learned how science works, to think logically and critically, to be objective and write clearly. This was wonderful preparation for law school because many of the same principles apply.

After law school at the University of Oregon, I worked as a solo practitioner. Among other things, I represented a nonprofit environmental group to protect roadless areas in National Forests in Oregon that would qualify as wilderness under the Wilderness Act. Then I worked for 1000 Friends of Oregon enforcing Oregon's land use planning laws. Eventually, I became a senior counsel for the National Wildlife Federation in the Great Lakes region, based in Ann Arbor, Michigan. My primary duty was to protect the Great Lakes from toxic substances, nutrient pollution and invasive species. This past year, I returned to Oregon and I am now the legal director of WildEarth Guardians.

Looking back, I can see that my studies and research made me more comfortable working with scientists—hydrologists, geologists and other experts—to win lawsuits. I am grounded enough in science to understand how scientists think and work. Together, we can better advocate for protecting the environment.

### What do you regard as your most significant litigation?

In the late 1970s, an impasse had developed nationally over the allocation of roadless areas in National Forests, whether to wilderness or non-wilderness uses. The industry wanted as much forest land as possible to be available for timber harvesting. The environmentalists wanted as much as possible preserved as wilderness. I brought two lawsuits in 1983 that forced the Forest Service to stop timber



Neil Kagan, legal director of WildEarth Guardians.

sales and road building in most of Oregon's roadless areas, which totaled about three million acres. The lawsuits pressured Oregon's senior Senator, Mark Hatfield, to accept a compromise that would protect about one-third of Oregon's roadless areas as wilderness—nearly one million acres. Based on that compromise, Congress enacted the Oregon Wilderness Act of 1984. Congress then used the Oregon compromise as a model in passing wilderness acts for 17 other states. Altogether, Congress preserved more than 8.2 million acres of roadless areas as wilderness in 1984. Ever since, these public lands have been permanently protected from logging, mining, road building and other destructive development. My involvement was exhilarating, as I was right in the middle of all the controversy.

### Thoughts for current students?

One thing I have learned is that one person working alone rarely achieves success. People can be much more effective if they work together and learn from each other.

### Anything else you wanted to share?

Insects are still one of my favorite forms of wildlife—I think they are beautiful!



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### ARE YOU SOCIAL?

## #SPARTANINSECTS

Are you a social media user? The Department, labs and, of course, many entomologists can be found on Twitter, Instagram, Facebook and much more. Common hashtags to locate us are #SpartanInsects, #FieldDayFriday, #MSUEntomology. See you there?

