

Department of Entomology



2014-2019 Strategic Plan

College of Agriculture and Life Sciences

Virginia Tech



Mission

The primary focus of the Department of Entomology in Virginia Tech is to develop innovative solutions and provide expertise in addressing the impact that insects have on the State, nation and the world. It is our responsibility to educate and train the future generations of entomologists to improve the quality of life in the USA. In alignment with Virginia Tech's and the College of Agriculture & Life Sciences' "strategic themes", as described in the university and CALS strategic plans, our emphasis is on Food Security, Resilience, Health, and Sustainability. By building on our strength in areas where we have the expertise, we are able to fulfill our three missions of teaching and learning, research and discovery, and outreach and engagement.

Vision

Our vision is to be an academic center of excellence in the insect sciences, accumulating a repository of knowledge about insects for the purpose of providing solutions to a variety of complicated environmental, societal and economic problems. Our vision is accomplished through world-class research, teaching, and extension activities that benefit society and build value for our stakeholders.

Overall

Challenges: Despite our success as a Department, we have identified some areas where we can improve, as well as some areas of potential growth. As a Department, we lack a proactive system for digital content management and distribution throughout our electronic media. As a result, digital content production and management has fallen on individual faculty and programs, with variable success. Information Technology cuts across all of our missions, and represents a major hurdle to increasing the prestige of the Department and associated fund-raising activities. Likewise, while we have many successful and proud alumni, our electronic media and presence does not significantly feature their accomplishments or otherwise provide incentives for donations. Finally, a vast collection of more than 800,000 insect specimens, vital for many research, teaching and outreach activities, currently sits in a sub-standard facility at a remote location off campus (due to insufficient space on the main campus), limiting its use.

Goals:

1. Increase the visibility of the Department within the University, the Commonwealth of Virginia, as well as throughout the region.
2. Increase visibility of alumni.
3. Relocate the Department Insect Collection to an appropriate space on campus to be incorporated into research, teaching and outreach activities.

Strategies:

1. Increase visibility of the Department
 - a. Increase Departmental resources dedicated for IT, in particular the development of an improved living, active website and social media presence.
 - b. Continue to grow and support the Hokie Bugfest.
 - c. Develop a fee-for-service center capable of interfacing with industry and obtaining contract work for larger scale projects involving insect identification or other activities.

Benchmarks

1. *Develop and maintain an active, dynamic website by the end of the 2015-2016 academic year.*
2. *Attendance at Hokie Bugfest should increase and remain above 5000 individuals by 2015.*
3. *Establish a fee-for-service center for larger scale insect identification projects in a way that minimizes impacts to clientele involved in current small scale ID work.*

2. Increase visibility of alumni
 - a. Develop an alumni database
 - b. Feature alumni profiles and testimonials on the website
 - c. Increase participation in alumni awards

Benchmarks

1. *Alumni database to be developed by 2015, and annually updated thereafter.*
2. *Develop at least 10 alumni profiles/testimonials in 2015, 30 by 2016.*
3. *Coordinate alumni awards with other activities such as Hokie Bugfest or invited seminars to encourage alumni participation*

3. Insect Collection
 - a. Relocate the Insect Collection to the main campus
 - b. Use additional IT resources to develop a searchable database for the collection

Benchmarks

1. *Identify space that can be used and renovate any space as needed in 2014-2015.*
2. *Insect Collection successfully moved and available for teaching/research/outreach activities by the 2016-2017 academic year.*
3. *Database operational by 2016, with a secure and consolidated on-campus collection by the end of the planning period.*

Research and Scholarship

Biomedical research (Primary funding sources-NIH). Vector-borne pathogens are the cause of diseases such as malaria, yellow fever, West Nile encephalitis, and dengue hemorrhagic fever, with hundreds of millions of people affected worldwide each year. In the past decade, VT had made the strategic decision to build a diverse group of faculty whose research programs address, in whole or in part, the burden of vector-borne infectious disease (VBID). Faculty research in this area also emphasizes insect genomics, biodiversity, ecology and urban/public health.

The worldwide burden of vector-borne diseases such as malaria and dengue remains substantial. Results from vaccine trials for the causative agents of these diseases remain disappointing, and resistance to the most recent antimalarial compounds is developing. Thus, there is much remaining to be done in this area. Members of our Department will continue to address basic questions of vector-pathogen interactions, vector genetics and vector/pathogen evolution. In particular, we have developed and will continue to strengthen our use of high-throughput sequencing technologies, gene editing/transgenesis technologies and chromosomal mapping to address critical biological questions.

Natural/Agro Ecosystems Research (Primary funding sources-USDA/VDACS/Industry/Commodity groups). Faculty are engaged in research based in the fundamental study of insect pests and their associates in systems ranging from the unmanaged or managed forests, to large-scale or high-input agronomic systems, as well as urban landscapes and human environments. In many cases, we are dealing with non-native species or emerging new problems where there are presently few or inadequate options for management. Concurrent with these studies are efforts to develop improved monitoring systems, sustained management approaches, or treat directly the numerous pests that impact us, with emphasis on Integrated Pest Management/Biological Control of pest problems, and environmental monitoring and protection. This also includes: IPM/biological control of commodity pests such as horticultural, field and forage crops, forest and Christmas tree, household and structural pests monitoring and protection of the environment.

Many of our new emerging issues are related to non-native invasive pests that have direct economic impacts on commodities of importance but also environmental consequences. While economics was clearly a driving force for research in the past, minimizing environmental impacts by these pests has also become a suitable justification for working on a problem. A number of new invasive species have recently

entered Virginia and others threaten the Commonwealth. We will be responding to any new invasions deemed to have potentially significant impacts. For all pests, we will continue to strive to develop tactics and overall strategies that are safe and sustainable both economically and environmentally. The use of molecular techniques to identify insect species and to characterize pesticide resistance in critical species of interest is becoming a common tool for traditional entomologists. Understanding the fate of pesticides in the environment will be an emerging strength.

Challenges: Our faculty have been highly productive, and as a Department our research expenditures per tenure-track faculty have consistently ranked us in the top 3 in the college since 2008. However, recent and anticipated retirements have left some obvious gaps in our research portfolio. There are also some funding agencies where our Department has not sought or obtained significant funds, even though we would be competitive. Many of our faculty have reached a point in their career trajectories where they are ready to assume leadership roles on large, interdisciplinary projects, but in many cases the burden of administering these and other tasks is a barrier to such submissions. While Entomology faculty have published research articles with colleagues in other departments, most of these are in closely aligned fields such as Biochemistry, Crop and Soil Environmental Sciences, Biological Sciences, Chemistry and Statistics. Finally, our rate of publications has lagged behind our highly successful funding rate.

Goals:

1. Increase the diversity of our sponsored research activities by acquiring or building on expertise in critical priority areas to the Commonwealth that are currently underserved or rapidly emerging.
2. Incentivize the submission of large collaborative projects with Department faculty as PI or co-PI.
3. Build relationships with new Departments on campus in order to stimulate novel research directions.
4. Increase the ability of graduate students to submit and publish their research findings.

Strategies and Benchmarks:

1. Increase diversity of sponsored research
 - a. Promote and develop research in emerging or underserved areas such as pollination biology, invasive species biology, turf/corn pests, biodiversity and sustainability, biomimicry, insect pathology and genomics.
 - b. Develop incentives for submitting significant research proposals to agencies poorly represented in our Departmental portfolio, such as the NSF, DOD, and NIFA.

Benchmarks

1. *Incentive plans will be developed and set in place by mid-2014.*
2. *The number of large (>\$400,000) research proposals submitted to non-traditional federal agencies (NIH, USDA) should increase to 2 (2015) to 4 (2016) to 5 or more (2017) per year while maintaining our other funding sources.*

2. Increase incentives for leading large collaborative projects
 - a. Re-evaluate the current administrative burden on Departmental faculty and transfer responsibilities where appropriate to departmental staff.
 - b. Develop incentives for faculty who submit large scale interdisciplinary proposals in coordination with the CALS incentive system.

Benchmarks

1. *Survey of current staff responsibilities and faculty time spent on administrative tasks complete by the end of the 2015 academic year.*
2. *Plan for reduction of faculty effort on administrative tasks implemented by 2016.*
3. *Submission of at least 1 multi-institution large scale project (>\$2,000,000) per year starting in 2017 with an Entomology faculty member as PI.*

3. Build collaborations with new Departments both within and between Colleges

- a. Increase communication with other CALS and non-CALS departments to identify potential cross-disciplinary projects.
- b. Develop incentives for submitting research proposals with faculty in other Departments that are not current or frequent collaborators, such as engineering (biomimicry), sociology (impact assessment), or horticulture (IPM).

Benchmarks

1. *The number of interdepartmental collaborations should increase each year, with at least 2 new proposals submitted per year starting in 2016.*
4. Increase student publications
- a. Recognize and showcase student publications
 - b. Increase student participation in the Scientific Writing class offered through our Department.
 - c. Identify opportunities for students to write review articles while they generate their research data.

Benchmarks

1. *Increase the number of press releases associated with newly published articles, ensuring at least one per month by 2015.*
2. *Links to all newly published articles to be featured prominently on the revised Department website.*
3. *We will establish 5-year rolling averages for GRE-verbal and writing scores for all incoming students. All students in the lower half in one of these categories (compared to other incoming students) will be required to enroll in Scientific Writing as part of their Plan of Study, beginning with students admitted in 2014-2015.*

Teaching

Background:

The goal of our teaching program is to motivate and encourage life-long learning and to provide students with a knowledge and understanding of entomology. We recognize the need to help students develop skills for the real world. These skills may involve a number of educational processes that will provide an interactive learning experience, as well as imparting technical knowledge. These include: Active learning, critical thinking, problem solving both individually and collaboratively in groups, and laboratory classes. Most courses taught in the Entomology Department are lecture-based, but computer-based technologies have revolutionized and enhanced teaching in the classroom. Undergraduate students are now given the opportunity to participate in research, and faculty members are encouraged to offer independent study courses and involve students in their research programs.

Although only M.S. and Ph.D. degree programs are offered by the department, **our teaching program** involves instruction at both the undergraduate and graduate level. The department does not offer an undergraduate degree but provides consumer and public interest courses for the university, and participates in courses for the Agricultural Technology Program. We also offer an undergraduate minor in Entomology. The undergraduate courses are directed at basic and applied entomology and serve the needs of students in many disciplines. Faculty members also teach courses in biology, forestry, and agricultural life sciences. Several of our faculty members are involved in an online Master's of Agriculture and Life Sciences distance curriculum.

Challenges: Despite our success in maintaining significant graduate enrollment, the number of applicants each year is highly variable and is typically skewed towards M.S. applicants and foreign nationals. Rarely are there sufficient applications to be able to enforce highly competitive admissions standards, and applications typically arrive too late to be considered for competitive fellowships offered by the Graduate School and the college. The rapid increase in genomic information for non-model organisms and the great potential these data hold has gone beyond a single course or faculty member. It is now apparent that our students will need to understand the concepts and utility of the genomic revolution in

order to be competitive, regardless of their individual research focus area. Finally, while we have established a minor in Entomology for a number of years, undergraduate students enrolled in this minor are not well incorporated into Departmental activities.

Goals:

- 1 Develop and implement a more structured recruiting plan in order to increase the number and quality of applicants into the graduate program.
- 2 Modernize both the undergraduate and graduate curriculum offered by the Department to incorporate the explosion of genomic information available for insects of agricultural and medical importance, taking advantage of the current drive to sequence 5000 insect genomes (i5K).
- 3 Increase participation in the Entomology minor as well as the involvement of undergraduates enrolled in the minor in Departmental activities.

Strategies and Benchmarks:

1. Student recruiting

- a Establish a graduate recruiting open house event in coordination with the Hokie Bugfest, held each year in October.
- b Establish a major table display for meetings such as the Annual Meeting of the Entomological Society of America, held in Nov/Dec each year, to be staffed throughout the meeting by both students and faculty members.
- c. Establish a priority application deadline substantially earlier in the year for admission in the Fall semester (Dec-Jan instead of May-June).
- d. Establish career-specific tracks to better inform potential students of the diversity of professional opportunities available.
- e. Develop and analyze statistics of job placement after graduation amongst alumni, featuring this information along with alumni testimonials on our website and social media.

Benchmarks:

1. *The number of potential applicants who participate in the Bugfest open house or who visit the ESA Table display will be tracked over a five year period. Our hope is to grow to 10-20 students participating in the open house per year, with an additional 60-80 identified during the ESA event. Of these, we hope to have 50% of those that express interest submit completed applications before the priority deadline, representing a target of 35-50 additional applicants per year. Correspondingly, we expect our acceptance rate to drop from 80-90% down to ~25%, as we could focus our resources on the most competitive students.*
2. *The quality of student applicants will be assessed through several standard metrics, such as average GPA and average GRE of incoming students. Our expectation is that these metrics will increase each year over the course of the next five years.*

2. Modernization of curriculum

- a. Identify areas of overlap between current courses to avoid unnecessary duplication of material; identify any gaps (Pollination Biology, Invasive Species Ecology, Chemical Ecology, Insect Pathology, Genomics)
- b. Re-evaluate the timing of biannual courses to ensure adequate course offerings each semester.
- c. Course instructors will identify one or more Research faculty with expertise in molecular biology and genomics to assist them in incorporating this information into the course curriculum where appropriate.

Benchmarks:

- 1 *Complete audit of current curriculum and alter the timing of any courses by the end of the 2015 academic year.*
- 2 *Submit amended course proposals for at least 30% of our currently offered courses by the end of 2015, adding at least one learning objective relating to molecular biology and*

genomics. Additional course amendments submitted by 2016 so that 75% of courses have incorporated molecular biology/genomics.

3. Grow participation in the ENT minor
 - a. Develop a new required 1-credit hour course for the ENT minor concerning career opportunities in the field of Entomology
 - b. Increase participation of students enrolled in the ENT minor in the Hokie Bugfest.
 - c. Increase participation of ENT minors in the Alwood Society (currently a graduate student organization only).
 - d. Increase participation of ENT minors in undergraduate research.

Benchmarks

1. *Submit new course proposal during the 2014-2015 academic year, so that the new course "Career Opportunities in Entomology" can be taught starting in the 2015-2016 academic year.*
2. *Submit amended requirements for the ENT minor to incorporate this new course in the 2014-2015 academic year.*
3. *Document the number of ENT minors participating in Alwood Society activities, Hokie Bugfest and undergraduate research. This number should increase each year, with a target of at least 50% of ENT minors participating in at least one of these activities by 2016, and a final target of 75% by the end of the planning period (2019).*

Extension/Outreach

Mission Statement: To increase public knowledge of pest management, arthropods, and the science of entomology by providing educational opportunities and outputs to the public through Cooperative Extension and outreach. Outcomes include the protection of human health, animal health, our environment, and food supply, plus and the enhancement of livelihood, and quality of life among the citizens of the nation.

Overall Summary: Entomology Extension is a cohesive group of specialists that reflects the overall working relationship of the department. We are inclusive in our collaboration and work towards success in enhancing the overall departmental and college Extension/outreach program goals. Among our many roles, one is to provide the scientific expertise to address insect pest problems across the state—to determine the most important pest issues facing growers/non-growers alike, to develop new or improve pest management alternatives, and to fully participate in the clientele education process. The impacts of what we do include: increased and improved pesticide applicator safety and environmental protection; increased pest management efficacy; protection of human and animal health; improvement of human living conditions; increased youth science education; and improved public attitudes toward science education and entomology in general. These impacts are achieved through delivery of information regarding the safe use of effective pesticides; the value of protecting beneficial arthropods; the importance of protecting food sources; and how pest management improves our quality of life through the adoption of integrated pest management (IPM).

Our signature programs include: agricultural and specialty crop IPM, urban IPM, apiculture, pesticide safety education (PSE), regulatory assessment and stewardship in IPM and IR-4, 4-H youth education, and international Extension and outreach.

Our three major extension programs are:

(i) Agricultural and Specialty Crop Entomology, an extension/outreach program with emphasis on IPM in fruit, vegetables, field crops, forest and urban trees, ornamentals and turf, and livestock, including apiculture.

(ii) Urban Entomology, an extension/outreach program with special emphasis on IPM in public housing, commercial facilities, and Virginia schools.

(iii) Pesticide Safety Education, protecting human health and the environment through pesticide safety education, and working with stakeholders to maintain viable and balanced IPM practices through pesticide regulatory compliance and assessment.

Challenges: We anticipate that Extension and outreach programs will become ever more dependent on mass communication technologies. At present, webpages and Facebook have been our primary tools. Use of social media will be explored further. We are entering an era of 3-D expression. 3-D printing technology has emerged to supplement traditional print and photographic media. That technology will soon enhance entomology education and research, as it has with Virginia Tech engineering disciplines. Faster communications will soon enhance our ability to reach more people and more diverse audiences. Youth education is key to changing attitudes on the importance of the science of arthropods to human existence and maintaining our quality of life. Science education and recruiting new entomologists depend on our efforts.

Goals:

1. Increase volume of electronic Extension content available to stakeholders and clientele and county agents.
2. Establish an ongoing Entomology 4-H program involving the annual Hokie Bugfest, ongoing outreach youth activities (tours, visits, etc.) and an annual 4-H summer camp.
3. Increase engagement and service to currently underserved stakeholders.
4. Increase graduate student involvement in Extension career preparation and programming.

Strategies and Benchmarks:

1. Increase volume of electronic Extension content available to stakeholders and clientele.
 - a. Host factsheets, newsletters, and other forms of content directly on the Department's website.
 - b. Utilize Scholar as a means to share this information and collaborate with Extension field faculty.
 - c. Transition printed content where applicable to other media as needs and opportunities arise.

Benchmarks

1. *Establish departmental server resources and IT support by the end of 2015.*
 2. *Create media content as needed – ongoing.*
 3. *By fall of 2015, incorporate content-based factsheets into agent in-service education through face-to-face and online educational offerings.*
2. Establish an ongoing Entomology 4-H program involving the annual Hokie Bugfest, ongoing outreach youth activities (tours, visits, etc.), and an annual 4-H summer camp.
 - a. Work with 4-H to organize and fund a Blacksburg-based “bug” camp for kids, K-12.
 - b. Collaborate with the Alwood Society to offer academic credit to graduate students interested in youth education in entomology.
 - c. Utilize camp and other youth activities to recruit undergraduates as future graduate students and to drive public participation in the annual Hokie Bugfest.

Benchmarks

1. *Coordinate camp and school tour/visit activities with the annual Hokie Bugfest and other public outreach activities by June 2014.*
 2. *Establish an annual summer 4-H “bug” camp in Blacksburg by June 2015.*
 3. *By summer 2017, VT Entomology will have an ongoing Extension 4-H program with a robust enrollment in the bug camp and ongoing youth activities.*
3. Increase engagement and service to currently underserved stakeholders. Priority areas include:
 - a. Insect Pollinators/Beekeepers
 - b. Turfgrass/Corn
 - c. Urban insects of medical importance (mosquitoes, ticks, bed bugs, etc...)

- d. Insects of veterinary importance
- e. Stored grain products
- f. Organic

Benchmarks

1. *Meet among department faculty to strategize ways to handle these priority areas and to explore the means to support an expanded outreach effort. – by December 2014.*
 2. *By December 2015, host a department Extension faculty retreat inviting Extension administration and key stakeholders to share interests and seek support to cover underserved programming areas.*
 3. *Post 2015 – Maintain ongoing stakeholder groups to continue to affect support for expanded engagement of underserved clientele.*
4. Increase involvement of graduate students in Extension career preparation and programming.
- a. Establish and promote summer extension fellowships/internships for graduate students.
 - b. Encourage graduate students to become certified pesticide applicators (category 10).
 - c. Offer advanced topics courses in cooperative Extension and outreach for graduate students in entomology.

Benchmarks

1. *Meet with VCE administration to seek support for summer Extension fellowships/internships for entomology students – by June 2014.*
2. *Train all graduate students in pesticide safety leading to certification as registered technicians or commercial applicators in demonstration and research pest control (cat. 10) (dependent on experience) by the first semester prior to their participation in research or educational activities associated with pest management and pesticide use. Encourage students to take ENT4264 in preparation where they lack knowledge. Certification is a legal requirement for anyone involved with pesticide application and education in the commonwealth.*
3. *By June of each year, offer an advanced topics course in cooperative Extension and outreach for graduate students participating in summer and fall Extension activities and events. This would be used as another building block for those seeking a career in Extension and outreach.*

Facilities

Though the main department office is located in Price Hall, faculty and staff are spread out and located in seven buildings: Price, Agnew, Latham, Fralin, Dodson Urban Entomology Lab, Insectary, and the Quarantine Lab in Prices Fork. Latham Hall, Fralin Center, and the Dodson Urban Entomology Lab are relatively new compared with the other buildings on campus. Some renovation is being undertaken in the Quarantine lab.

Challenges: Though containing more than 800,000 specimens and a repository for current studies and a valuable research and educational resource, the use of the Virginia Tech Insect Collection is curtailed and now faces major challenges to its vitality by an off-site location at the Prices Fork Research Facility, inadequate storage system, and lack of a searchable database online. Other locations such the Dodson Urban Lab and the Prices Fork Research Facility are used for teaching and extension activities in addition to research, but do not have classroom space. With the increase in IT-based activities supporting all missions of the Department, it is in our best interests to streamline and centralize maintenance and housing of servers. Finally, as noted in both the 2007 and 2013 Departmental Reviews, Price Hall is in poor condition, and is not suitable for modern teaching and research activities.

Goals:

1. Identify and renovate space on campus to house the Insect Collection.
2. Establish teaching space at the Price's Fork facility and the Dodson Urban lab.
3. Establish a dedicated space to house and maintain Departmental servers to support anticipated growth in IT across Research, Teaching and Extension missions.

4. In collaboration with CALS administration, develop a long-term plan for the Department's research and teaching space beyond the life of Price Hall.

Strategies and Benchmarks:

1. Identify and renovate space on campus to house the Insect Collection.
 - a. Work with CALS administration and facilities to immediately identify space for the insect collection.

Benchmarks

1. *Renovate any space as needed in 2014-2015.*
 2. *Insect Collection successfully moved and available for teaching/research/outreach activities by the 2016-2017 academic year.*
2. Establish teaching space at the Price's Fork facility and the Dodson Urban lab.
 - a. Determine feasibility for converting the storage space currently housing the insect collection into a small teaching space (20-30 seats) at the Price's Fork campus.
 - b. Determine feasibility for constructing an outdoor pavilion or similar structure at the Dodson lab/Glade Road facility for teaching/extension activities.

Benchmarks

1. *Feasibility study for Price's Fork renovation determined in 2016 after the insect collection is moved, with construction initiated in 2016 and classroom space ready for instruction in 2017.*
 2. *Feasibility for using currently available funds (\$100K) provided by industry to develop a classroom space or outdoor pavilion determined in 2014-2015, with construction initiated in 2016 and space commissioned for the 2016-2017 academic year.*
3. Establish a dedicated space to house and maintain Departmental servers to support anticipated growth in IT across Research, Teaching and Extension missions.

Benchmarks

1. *Departmental space committee will evaluate current space and provide recommendations as to the best available space to use for server storage and maintenance by the end of 2014-2015.*
4. In collaboration with CALS administration, develop a long-term plan for the Department's research and teaching space beyond the life of Price Hall.
 - a. Maintain current Departmental footprint in any new facility.
 - b. Preserve proximity between teaching labs and faculty research space, as there is often little distinction between the two.
 - c. Ensure appropriate containment facilities are present in any new space.

Benchmarks

1. *No specific timeline, but it is anticipated that by the end of the planning period, a long-term solution for housing Department of Entomology faculty will be identified.*

Tenure-Track Faculty Positions:

Year 1

Title: Pollinator Biologist (R/T or R/T/E).

Description: The successful candidate for this position would be expected to develop an extramurally funded research program focused on pollinating insects. Candidates with a Ph.D. in entomology, zoology, or a closely related field and with experience in pollinator biology including but not limited to the ecology, physiology, behavior, genetics, or pathology of the honey bee and/or other pollinating insects will be strongly encouraged to apply. Preference will be given to individuals with extensive post-doctoral experience and a demonstrated ability to secure extramural funding and publish high quality, peer-reviewed journals. It is expected that the incumbent will contribute to innovative undergraduate- and graduate-level curricula in entomology and related disciplines as well as mentor undergraduate and graduate students. The candidate will have access to existing honey bee colonies, apiculture facilities, and land for field research, including agronomic, vegetable, and orchard field plots.

Justification: This position is central to addressing a primary focus of the Department of Entomology to develop innovative solutions and provide expertise in addressing the biology and ecology of insects that provide critical pollination services to support agricultural production. Honey bee and pollinator health are specifically emphasized in FY 2015 USDA budget and these activities will be supported by a substantial increase in resources for research in the coming years. The hiring of a tenure-track faculty member in the area of Pollinator Biology will increase the diversity of sponsored research and will assist in the promotion and development of research in the emerging and underserved areas that focus on the biology and ecology of pollinating insects. This position is in alignment with the strategic themes of the College of Agriculture and Life Sciences and Virginia Tech, which emphasize Food Security, Resilience, Health, and Sustainability.

Title: Invasive Species Biologist/Ecologist (R/T)

Description: A faculty member in this position would be expected to provide unified focus to programs relating to invasive insect pests in the Department of Entomology, to take leadership in planning, implementing and coordinating large international, national and regional multidisciplinary research projects and to integrate these research activities and generate scientific results scalable to national and international research. The successful candidate for this position will focus on the application, implementation and coordination of multidisciplinary research activities linking population biology, adaptation/evolution and biological control with environmental/ climatic modeling approaches to develop innovative methods to improve the effectiveness of invasive pest management. Activities are expected to be conducted in cooperation with other research groups within the Department of Entomology, associated departments in the College and University and in other states. The faculty member would: 1)

produce scientific analyses of invasive populations; 2) contribute toward coherent management of invasive populations; 3) create written communications for scientific and general audiences; 4) participate in the development of comprehensive scientific and public policy; and 5) train graduate students in issues relating to invasive population ecology and management

Justification: Increases in international commerce in recent decades has led to a dramatic increase in invasive pests. In the last few of decades alone, numerous exotic insect species have been accidentally introduced into North America and have had major economic impacts on Virginia agriculture and its natural resources, e.g. brown marmorated stink bug (BMSB), spotted wing drosophila, emerald ash borer, hemlock woolly adelgid, bean plataspid (kudzu bug) and the soybean aphid. Changes in global climate may further accelerate the rate of exotic species introductions in the coming decade; such climate related changes are a major emphasis area of the CALS strategic plan. The international movement of pests is reciprocal, and recent importations of American species are currently causing problems on other continents, e.g. Colorado potato beetle in Ukraine, western flower thrips throughout Europe, grape leafhopper in Italy, and the fall webworm in Asia and Eastern Europe.

Large scale, multi-PI collaborative proposals, an important component of the Departmental Strategic Plan, could be made more effective if united by broader aspects of invasive species theory, relating to international movement of pests, their establishment in new regions, their movement and obstacles to natural controls within such regions--qualities we seek in an Invasive Insect Ecologist. As invasive species are becoming more frequent, it will be advantageous in long term management to develop broader knowledge of issues relating to movement and establishment of introduced species in new habitats. With an increasing global marketplace, problems with invasive species are likely to increase.

Year 2:

Title: Chemical Ecologist (R/T)

Description: The Chemical Ecologist in the Department of Entomology will investigate fundamental aspects of intra- and interspecific, chemically-mediated interactions between insects and between insects and their hosts and will develop an externally funded research program incorporating modern approaches to solve basic and/or applied problems. The faculty member will be responsible for developing a nationally-recognized research program in chemical ecology and for teaching undergraduate and graduate level courses on Insect Chemical Ecology and courses related to her or his area of specialization. Establishment of collaborative programs with departmental faculty will be encouraged, including those working in the areas of fruit and vegetable crops, medical and veterinary, urban pest management, toxicology, forest pest management, and disease vectors.

Justification: Insect behavior and physiology are mediated by a diverse array of endogenous and exogenous chemicals, including semiochemicals (e.g. pheromones, kairomones, allomones) and hormones, many of which can be used to manipulate pest and beneficial

species toward defined goals. Many entomologists at Virginia Tech are engaged in research that includes elements of chemical ecology that relate to pest insect management. A Chemical Ecologist with specialized expertise in the principles and applications of this broadly-applicable discipline would find numerous opportunities to establish multidisciplinary ties with faculty currently working in all of the Entomology Department's major focus areas, including biomedical, natural/agro ecosystems, urban entomology, and pesticide safety education. Such inter- and extra-departmental collaborations are expected to increase the Department's competitiveness for multi-disciplinary grants from the USDA, NSF, NIH, and DOD; a major focus of the Department of Entomology's 2014-2019 strategic plan.

Title: Insect Pathologist (R/T)

Description: This position would be dedicated to developing an extramurally funded research program focused on invertebrate pathology and teaching an introductory and advanced graduate course on the topic. The course would cover among other things the general characteristics and identification of the major pathogen groups, mechanisms of pathogen infection, insect immune responses, and mitigation of disease in beneficial insects.

Justification: This position would help facilitate accomplishing a number of the goals set forth in the 2014-2019 Strategic Plan. Overall Goals: Includes increasing the visibility of the Department through a fee-for-service center capable of interfacing with industry and obtaining contract work for larger scale projects involving insect identification or other activities. Insect pathogens pose a serious threat to the management of beneficial insects (including pollinators), as well as to biological control programs predicated on mass rearing of insects. Therefore, pathogen identification would be a valuable addition to any fee-based-service center. Research Goals: This position would help increase in the diversity of our sponsored research activities and the submission of collaborative projects. The ability to incorporate expertise on insect pathogens would positively impact a diverse range of both applied and fundamental research programs. For example, fundamental programs would benefit from an ability to study the interface between a particular insect and its associated pathogens, while applied programs would benefit from this expertise in the development of sustainable bio-control solutions and in preventing disease in beneficial insects. Teaching Goals: An introductory course(s) covering the general characteristics and identification of the major pathogen groups, mechanisms of pathogen infection, insect immune responses, and mitigation of disease in beneficial insects would address a significant gap in the current undergraduate and graduate curriculum. Outreach/Extension goals: Pathogens affecting invertebrates naturally limit insect populations and represent a foundational group of organisms used in biological control strategies. Several extension programs could potentially benefit from a faculty position in this area. The position could also potentially facilitate expansion into new extension areas, depending on the expertise of the faculty member.

Year 3:

Title: Insect Genomics (R/T)

Description: The successful applicant will conduct research on insect genomes; the emphasis of research will be on the analysis of genome-scale data, development and utilization of tools to improve genome assembly and annotation, characterization of the genomic landscapes, and investigation of genome evolution in diverse groups of insects. The successful applicant is expected to develop a nationally and internationally recognized, externally funded research program, to mentor graduate students, develop and teach a graduate course in the area of her/his expertise and provide advice to the Entomology Department graduate students and faculty. Collaborations involving other on- and off-campus faculty in Entomology, Biochemistry, the Virginia Bioinformatics Institute, Fralin Life Science Institute, and Virginia Tech Carilion School of Medicine and Research Institute are especially encouraged.

Justification: Our 2014-2019 Strategic Plan highlighted specific challenges pertaining to Research and Scholarship. For example, our department has not obtained significant funds from some funding agencies (NSF, USDA) in the areas of research where modern genomics approaches are used. We have been quite successful with NIH funding focusing on basic questions of vector-pathogen interactions, vector genetics and vector/pathogen evolution. As a result, we developed and will continue to strengthen our use of high-throughput sequencing technologies, genome editing/transgenesis technologies and cytogenetic mapping to address critical biological questions. However, our rate of publications has lagged behind our highly successful funding rate. The position in Insect Genomics can help to broaden our funding opportunities and to increase our scholarly activity because genomic approaches can be applied to any insect taxon and to a wide spectrum of research questions. Insects are important to worldwide agriculture, food safety, human health, and energy production. For this reason, insect genomics is receiving increasing attention from researchers around the globe. Ambitious projects to obtain whole-genome sequences for insect and related arthropod species, such as the i5K initiative (<http://arthropodgenomes.org/wiki/i5K>), have been initiated. However, genome assemblies obtained by next-generation sequencing for many insect species are highly fragmented, unfinished and, thus, have limited value. The position in Insect Genomics can help to address the growing need for highly-finished and well-annotated genome assemblies. The position is closely tied to the CALS and the University strategic plans. The CALS 2012-2018 Strategic Plan prioritizes “programs that focus on the genetic and environmental factors that regulate and affect human, animal, plant, and ecosystem health.” The University 2012-2018 Strategic Plan highlighted the importance of analyzing “the complex interactions among genomic, environmental, and behavioral factors using high-performance computing.”

Classified Staff:

Year 1:

Title: Electronic Content Production, Management, Marketing and Promotion Specialist (100%).

Description: This position would be dedicated to promoting the Department's accomplishments, faculty, students and events through electronic media. This individual would proactively obtain, produce and make available electronic content through the website and social media, perform server maintenance, and would necessitate a background in web design, journalism/marketing and scientific writing.

Justification: Many of the goals set forth across all of our missions in the 2014-2019 Strategic Plan depend upon sufficient expertise and effort in electronic media. Overall Goals: includes the development and maintenance of a more dynamic website, the establishment of departmental presence in other social media forms, the development, implementation and maintenance of an alumni database, and the insect collection database. Research Goals: The lack of IT support throughout the Department hinders research progress, as the burden of administering content, performing server maintenance, upgrades, backups and hardware replacements falls to individual faculty. This position will help us accomplish our goal of reducing administrative burden on faculty, freeing up time for pursuing larger scale research grants and projects. Teaching Goals: Our student recruitment goals are heavily tied to our overall goals concerning Departmental visibility, including a dynamic and diverse web presence. Database development for student tracking will also be required. Outreach/Extension goals: This position ties in with our goals of increasing the amount of content available to stakeholders, clients and agents, as well as promoting outreach events such as the Hokie BugFest™ and the 4-H summer camp.

Year 2:

Title: Youth and Community Service Program Coordinator/Apiculturist (50%/50%).

Description: This position will be dedicated to coordinating public events and outreach work currently being conducted by a network of volunteers within the department. This includes acting as liaison with Virginia 4-H and other stakeholders associated with the Hokie BugFest™, summer "bug" camps, tours, school visits, community events, Extension collaboration, and related activities. This individual will also support the apiculture program. This involves maintaining the apiary, providing programs and supporting outreach and teaching activities, and conducting presentations about pollinators and apiculture. Finally, this person will support the department's live arthropod collection. This work involves daily maintenance, care, and showing live arthropods when the need arises for public outreach and teaching purposes. This effort will be coordinated with the people and facilities that now maintain this collection on a volunteer basis. The work may involve supervising wage employees and volunteers.

Justification: Many of the goals established in the 2014-19 Strategic Plan involve community and public outreach activities. Each of the tasks outlined here supports those priorities. The

priorities involve an expanded 4-H youth program, enhanced recruiting, youth camping activities, and additional community and service events. These activities support the department in teaching, research, and Extension/service/outreach. Since 2011, the Hokie BugFest™, has become one of the largest single-day public outreach events hosted by the college or the university, outside of athletics. In 2014, we are likely to exceed 5,000 attendees. The event is supported by donations, both in-kind and monetary, from various sponsors. The success of the Hokie BugFest™ has enhanced public relations for the university, helped recruit students, gained alumni support, and encouraged donors. Community groups, schools, local media, Virginia 4-H, and the pest control industry have partnered with the event. In order to keep this and other outreach activities functioning we need a staff position to coordinate outreach and the facilities associated supporting it. The apiculture program and the live arthropod collection are major contributors to teaching, research, and outreach/service. Without these resources, the department would suffer greatly. This position will coordinate these resources with volunteers, faculty, staff, and students. No other staff or faculty position exists that is solely dedicated to this purpose. The person in this position will work with electronic content and marketing specialists, faculty, staff, and students to conduct this business.