

**ENTOMOLOGY 2021 STRATEGIC PLAN**  
**May 18, 2012 revised October 19, 2012**

**Purpose**

Improve the quality of life of the people of Arizona and the world by generating, disseminating, and applying information about insects

**2021 Vision (each component below is reflected in a specific strategic goal)**

1. The quality and impact of our research will be recognized in Arizona, nationally & globally.
2. Our IPM programs will be implemented in Arizona and other arid regions worldwide and will boost the economy, protect the environment, and promote better health.
3. The graduate program in Entomology & Insect Science (EIS) will attract the best students; students completing EIS degrees will be in high demand from employers.
4. Our outreach programs will educate, delight, and connect community members with Entomology, CALS, and the University of Arizona.
5. The UA Insect Collection will be the best source of specimens from the Sonoran Desert Region and a global center for specimen-based insect research.
6. Our programs will be well-supported by private donors, as well as by governmental agencies.

**Mission**

- Conduct outstanding research to better understand insects and their impact on humanity
- Provide distinguished education in insect biology
- Develop and deploy the most advanced technologies and progressive IPM programs in the world to minimize the negative impacts of insects and maximize their benefits
- Provide outstanding outreach programs about insects accessible to all community members

**Shared Values**

- Respect for all people
- Collaboration among department members
- Collaboration within & across disciplines with others in CALS, UA, and other institutions
- Knowledge is power
- Serve our profession and the people of Arizona and the world
- Excellence in all pursuits
- Passion for achieving positive outcomes
- Work hard and have fun doing what we love to do
- Provide value for resources invested in Entomology
- Develop programs with local and global relevance
- Take advantage of our desert environment & position in the front line of climate change

**2. RESEARCH STRATEGIC GOAL: Increase Entomology research productivity 50% by 2021.**

**A. Current situation and gap between current and desired situation**

Outstanding, cutting-edge research is our hallmark and the core strength that underlies excellence in our instruction, extension and outreach. We aim to capitalize on this core strength to increase Entomology research productivity 50% by 2021. Our internationally recognized research must rise to meet the challenges of climate change and a rapidly increasing human population. These challenges demand innovative interdisciplinary research to lead the way in combating crop pests, biomedical pests, invasive species, and the decline in biodiversity.

**B. Strategies to achieve goal**

- Target critical global issues with research led by our faculty and their collaborators
- Retain current faculty who have outstanding research productivity
- Recruit new faculty with outstanding research productivity
- Increase research productivity of current faculty
- Enhance collaborations in the Dept. and with others (UA, national, and international)
- Strengthen research infrastructure including support staff and facilities

**C. Actions**

**Time Period (Fiscal Years)**

- Create and lead interdisciplinary teams to address global challenges ..... 2013-21
- Reward faculty achievement with merit raises and promotions..... 2013-21
- Nominate faculty for awards to recognize their outstanding achievements ..... 2013-21
- Enhance mentoring of faculty by head and outstanding peers..... 2013-21
- Encourage and reward productive team efforts ..... 2013-21
- Recruit faculty in areas with strong extramural funding prospects: mitigating .. 2014-21 effects of climate change on biodiversity, pollinators, & food security; invasive species; insect genomics and bioinformatics; and insects of biomedical importance.
- Increase efficiency of grant submissions ..... 2013-15
- Obtain more funding from international sources ..... 2013-21

**D. Inputs needed to achieve the goal**

- Research support staff: 12 FTE, \$420K salary per year + ERE\*\*
- 6 tenure-track faculty lines (0.80 FTE research, 0.20 teaching): \$480K salary per year + ERE; startup of \$1.8M
- Staff to support and streamline grant submissions: 1 FTE, \$35K salary per year plus ERE
- Four additional lab modules in Marley for Entomology
- Repair or replace shared research equipment (e.g., autoclaves): \$15K per year

**E. Objective metrics that will be used to track progress towards attaining goal**

- Extramural research funding per faculty research FTE per year
- Publications listed in Web of Science per faculty research FTE per year
- Citations per departmental publication in Web of Science
- Faculty honors and awards

**Note:** We expect 4-6 current tenure-track faculty will leave the department by 2021. Thus, filling the 6 requested faculty lines would maintain or slightly increase the number of tenure-track faculty.

\*\*amendment approved by faculty October 19, 2012

**3. IPM STRATEGIC GOAL: By FY19, greatly enhance effectiveness of Integrated Pest Management (IPM) research, education, and Extension programs in Arizona for teaching students and stakeholders, and for solving economic, environmental, and health problems caused by pests.**

**A. Current situation:**

- Cooperative Extension and research programs in IPM have garnered national and international recognition for their development and deployment of new strategies with large impacts on the economy, environmental protection, & society (e.g., > \$500 million saved since 1996 in Arizona alone).
- Key IPM faculty have left (Watson, Kerns, Dennehy, Byrne) and others will leave in the next 10 years.
- An internationally recognized graduate IDP in Entomology & Insect Science, but we currently provide education to a very limited number of IPM scientists.
- Capacity to create a premier U.S. center for IPM research, education, and Extension is incomplete, but would attract major funding, the best scientists, science, and students of IPM, and would generate solutions to society's pressing needs for safe and secure food and fiber, and healthy environments.

**Desired situation:**

- A world-class student-centered graduate and undergraduate IPM educational program (IDP) that capitalizes on the high profile research and Extension programs currently in place.
- An interdisciplinary synergistic approach that enables a fully collaborative environment across unit boundaries and enhances our effectiveness at winning major grants and having major impacts.
- Establish the UA as a premier center for IPM research, education, and Extension that impacts the future of the science and its application and implementation, and supplies the workforce needed to educate a generation of students that will face daunting food security, safety, and environmental challenges posed by pests and pest-related risks.

**Gap:**

- New IPM teaching personnel are needed to develop the interdisciplinary curriculum that provides the third leg of our integrated research, education, and Extension IPM center.
- Cooperative structures needed to foster team development across unit boundaries.
- New IPM research and Extension personnel to fuel innovation in science and implementation.

**B. Strategies to achieve goal**

- Recruit faculty, other appointed personnel & classified staff needed in IPM
- Create a fertile environment for the development of translational sciences needed to support IPM
- Leverage resources from gifts/grants/contracts to support staffing needs (50% share of each)
- Partner with allied departments and units with similar interests to develop an IPM curriculum and to forge strong interdisciplinary relationships in research and Extension (Entomology (lead), Agricultural & Biosystems Engineering, Agricultural & Resource Economics, School of Natural Resources & the Environment, Plant Sciences, Soil, Water, and Environmental Science, Agricultural Centers (MAC, YAC, SAC, CAC), County and statewide Tribal Cooperative Extension Offices)
- Develop courses (IPM, Biocontrol, Advanced Topics in IPM, structural IPM, Medical & Veterinary IPM)
- Establish new Extension IPM programs to meet stakeholder needs (e.g., Greenhouse, Small Farms, Urban IPM)
- Establish stable funding for graduate student Extension assistantships & undergraduate research & Extension internships

**C. Actions**

**Time Period (Fiscal Years)**

Hire IPM faculty (80% research: 20% teaching) & 1 research specialist.....	2013
Offer 400/500 level IPM course (e.g., Integrated Pest Management).....	Spring 2014
Hire IPM faculty (80% research: 20% teaching) & 1 research specialist.....	2014
Establish two IPM RA/TAships .....	2014
Offer 400/500 level IPM course (e.g., Biological Control) .....	Spring 2015
Hire IPM faculty (80% Extension: 20% research) & 0.5 Extension educator .....	2015
Establish two IPM Extension Assistantships .....	2015
Offer 400/500 IPM course (e.g., Advanced Topics in IPM) .....	Fall 2015
Hire IPM faculty (80% Extension :20% research) & 0.5 Extension educator .....	2016

**D. Inputs needed to achieve the goal**

- Research/teaching faculty in IPM (2; \$166K/yr)
- Classified staff (2 @ 3 years each; \$390K total)
- Graduate assistantships (2 RA/TAs; \$50K/yr)
- Cross unit agreements to mentor students
- Extension/research faculty in IPM (2; \$166K/yr)
- Extension educators (appointed, 2 @ 0.5; \$64K/yr)
- Extension assistantships (2 Ext. Asst.; \$50K/yr)
- Undergrad summer internships (2@.5; \$4K/yr)
- One-time startup cost for 4 IPM faculty \$500K

**E. Objective metrics that will be used to track progress towards attaining goal**

- Number of IPM undergraduate and graduate students recruited to & graduated from IDP programs
- Number and amounts of grants awarded to IPM faculty
- Number and % of IPM graduates placed in career-track positions (near 100%)
- Number of professional continuing education units offered (CEUs) and delivered (No. of participants)
- Economic and social impacts of our IPM programs (\$ saved, pesticides reduced in the environment, etc.)
- Increased security and safety of food and fiber supply produced in Arizona
- Number of peer-reviewed publications created each year
- Number of awards and honors received by IPM faculty
- Successful and continuing leverage of staff resources (classified staff > 3yrs; 2@0.5 Extension educators)
- Interest in and extramural support for fellowships, internships, assistantships, and endowments

**Notes**

The investment in human capital is a ca. \$500K per year with one time costs of another \$390K in staff support. Leveraged returns on this investment will easily be 3-fold & costs mostly offset by IDC returns to University [average annual grants (realistic, initially): \$250K/yr/faculty or \$1M/yr; average IDC rate %30 or \$300K/yr; (ideally and over time) \$3M/yr total with ca. \$1M/yr in IDC].

- Federal re-organization of IPM funding under a consolidated “Crop Protection” line of the USDA will increase visibility and funding for this vital program, and increase and standardize IDC to 30% equivalent to an effective rate of 42.65% of TDC (from previous 0–22% depending on sub-program).
- USDA’s National Institute for Food and Agriculture (NIFA) has created the Agriculture and Food Research Initiative (AFRI) competitive grants program that now rewards large, collaborative, team-based, and integrated (research, education, Extension) projects. Many awards are in the millions of dollars and at least 30% of funds from this program will be allocated to the Extension components. IPM, as a practical science that can fully articulate with Extension implementation programs, will have many new opportunities for funding through this program. A premiere IPM center for research, education, and Extension at UA would be ideally positioned to capture major resources from this program. Current IDC cap at 30% for this program, but many believe that future authorizations of this program will increase this cap in the future. [http://www.csrees.usda.gov/business/awards/indirect\\_cost.html](http://www.csrees.usda.gov/business/awards/indirect_cost.html)

**3. GRADUATE PROGRAM STRATEGIC GOAL: Double the stable funding for Entomology & Insect Science (EIS) graduate students by FY21.**

**A. Current situation and gap between current situation and desired situation**

The Graduate Interdisciplinary Program in Entomology & Insect Science (EIS) is nationally recognized as excellent and attracts outstanding students. In the past 10 years, 94% of students completing MS or PhD degrees in our graduate programs (EIS and its previously separate parent programs Entomology and Insect Science) obtained positions related to their graduate training. Enrollment in EIS will increase 25% to 32 students in AY12-13. Yet, funding for students is unpredictable, which threatens future recruiting and the long-term success of the program. Although faculty grants support some students, the largest single funding source now is via TAs for undergrad courses that we do not control (i.e., Introductory Biology courses in the College of Science). We are grateful for CALS support for GAs, but this has declined in the last few years from about 3 to 1 GA per year. To attain the desired situation of a standing enrollment of 35 or more fully funded EIS students, we aim to double funding from stable sources.

**B. Strategies to achieve goal**

- Obtain NSF Integrative Graduate Education & Research Training (IGERT) grants
- Increase support of RAs via increased faculty research grants (see Research Goal)
- Develop endowments for GAs
- Improve online interface with potential students and the general public
- Increase funding from UA & CALS for TAs for undergrad courses taught by Entomology faculty

**C. Actions**

**Time Period (Fiscal Years)**

- Revise and resubmit two recent IGERT preproposals that were not funded..... 2013-15
- Submit new IGERT proposals..... 2016-21
- Develop donor base and obtain donations for supporting students ..... 2013-21
- Enhance Entomology & EIS web sites ..... 2013-14
- Create Facebook sites ..... 2013-15
- Develop and implement revenue-generating insect identification app ..... 2013-17
- Work with College of Science and VPR's office to make TAs in Intro. Bio. .... 2013-14 (MCB 181 and EEB 182) available only for graduate students (not undergrads or others as now)
- Seek CALS/UA support for TAs for two new undergraduate courses..... 2013-14 developed by Ento faculty: Secrets of Success (Tier 1 NATS) and Agroecology
- Seek CALS/UA support to increase funding to 0.50 FTE for TAs for 3 current ... 2013-15 undergrad courses (Living in Symbiosis, Insects & Culture and Insect Discovery)

#### **D. Inputs needed to achieve the goal**

- Faculty effort in IGERT proposal development and running funded IGERT programs
- Faculty effort in increasing extramural grant funding with support for RAs
- Faculty effort in recruiting and mentoring EIS students
- Efforts of department members and Advisory Board to develop donor base for student endowments: Attractive brochures, displays for Insect Festival, and web sites. Charitable black tie event for student endowment and other insect-related activities.
- Faculty teaching effort in large undergraduate courses
- CALS/UA increase in funding per year for GAs from current \$27K to \$66K
- CALS/UA support of TAs for 4 large undergrad courses, \$60K per year.

#### **E. Objective metrics that will be used to track progress towards attaining goal**

- Funding of EIS students from IGERT grants, faculty research grants, and endowments
- Fully funded EIS students (total number and %)
- EIS degrees granted per year
- EIS students enrolled per year
- Papers published by EIS students
- Presentations by EIS students at scientific meetings
- Awards won by EIS students
- Job placement of EIS graduates

#### **Notes**

- Core and joint Entomology faculty are the major advisors for nearly all EIS students.
- Our EIS program goal aligns with the VPR's goal of increasing UA graduate student enrollment.

**4. OUTREACH STRATEGIC GOAL: Double the number of people we reach each year through sustainable outreach programs to better connect the community with Entomology & CALS, to meet public demand for insect information, and to support K-12 science education.**

**A. Current situation and gap between current situation and desired situation**

We deliver outreach via 3 main programs: Insect Discovery, the Arizona Insect Festival, and the UA Insect Collection (UAIC). Insect Discovery serves ca. 2000 K-8 students yearly and teaches ca. 25 UA undergraduate and graduate students how to communicate science to the public. The first Arizona Insect Festival (2011) delighted 2000 visitors and received great local press. In the past year, associates of the UAIC delivered 25 presentations on insects to community groups and responded to 3000 insect identification inquiries from the public. Despite the success of our current outreach programs, an enormous community demand remains for information about insects and for insect-related science enrichment for K-12 education. Moreover, these programs are supported largely by temporary extramural funding. To solve the problem of unstable funding and to capitalize on the opportunity to connect better with the community, we aim to obtain long-term funding and double the number of people served by Entomology outreach programs.

**B. Strategies to achieve goal**

- Provide opportunities for graduate students to increase expertise in outreach through paid positions, courses, and seminars
- Enhance communication statewide among all UA insect-related outreach activities
- Establish endowments for Insect Discovery and the Insect Festival
- Train K-12 teachers how to use insects to teach science
- Develop online insect outreach materials to reach beyond the local community

**C. Actions**

**Time Period (Fiscal Years)**

- Contact UA faculty statewide to coordinate insect-related outreach programs .....2012-13
- Catalog K-12 insect outreach resources online including links to programs ..... 2012-13
- Recruit more undergraduate students to Insect Discovery preceptor course..... 2012-15
- Invite community members and vendors to participate in Insect Festival ..... 2012-15
- Enhance UAIC and Insect Discovery websites..... 2012-13
- Provide teacher training in insect collecting methods (NSF Collections grant) ..... 2013-14
- Develop a graduate course in communicating science and public outreach ..... 2013-15

**D. Inputs needed to achieve the goal**

- Funding for 2 new semesters of Outreach TAs per year (0.5 FTE) - \$32K per year
- Increased undergraduate volunteer involvement for course credit
- Faculty, student, and staff participation in annual Insect Festival
- Financial support for Insect Festival - \$10K per year until endowment is established



**E. Objective metrics that will be used to track progress towards attaining goals**

- Number of people served by Insect Discovery, Insect Festival, and UAIC
- Number and amounts of funded grants supporting outreach
- Number and amounts of donations supporting insect outreach
- Number of insect-related K-12 programs statewide included in online outreach catalog
- Number of new collaborations among insect outreach programs
- Impact of Insect Discovery and other insect outreach programs on K-12 student learning

**5. INSECT COLLECTION STRATEGIC GOAL: Make the University of Arizona’s Insect Collection the world’s best source of arthropod specimens from the Sonoran Desert Region and a global center for insect research**

**A. Current situation and gap between current situation and desired situation**

The 2 million specimens of the University of Arizona Insect Collection (UAIC) are a unique treasure for research, extension, education and outreach focusing on biodiversity of the Sonoran Desert Region. However, major investments are needed to modernize the UAIC and fully realize its benefits. To achieve the desired situation, we will: a) move the entire collection into modern facilities, b) increase space allotted to UAIC, c) improve visiting researcher facilities, and d) initiate a funded visiting researcher program. A renovated, digitized UAIC will enhance our competitive position for extramural funding by improving our capacity to conduct research on pest management, invasive species, and effects of climate change; and it will position the Department as a global center for specimen-based insect research.

**B. Strategies to achieve goal**

- Secure collection in modern cabinets and drawers to protect them from damaging beetles.
- Install a mobile system to allow for compacting cabinets to maximize space.
- Integrate orphaned collections into the main collection, following updated taxonomy.
- Renovate and unclutter the collection space to increase space for research.
- Capture specimen-level data, including georeferences, and provide this information online
- Create a Virtual Network (interactive, web-based) with other collections in the Southwestern US.
- Advertise annual competition for Visiting Arthropod Systematist.
- Organize a UAIC board of advisors to help guide these transitions, connect with the larger community of systematists, and select annual Visiting Arthropod Systematists from applications.
- Connect UA students, faculty, staff with the local community of retired systematists and active amateur entomologists – sponsor biennial entomology meetings (first one is planned for June 2012).
- Connect with the community of professional systematists that visit SE Arizona to collect arthropods from the Sonoran Desert Region.

**C. Actions**

**Time Period (Fiscal Years)**

- Develop UAIC website and UAIC logo ..... 2012
- Apply for NSF Collections Improvement and NSF Digitization funding.....2011-12
- Form UAIC Advisory Board..... 2012
- Establish Visiting Arthropod Systematist endowment .....2011-12
- Develop application guidelines, advertise, and select first Visiting Systematist .....2012-13
- Host first Visiting Arthropod Systematist..... 2013
- Digitization: hire undergrads to capture data and develop database .....2012-15
- Install compactors and move specimens into new cabinets.....2012-14

#### **D. Inputs needed to achieve the goal**

- Schlinger Foundation Endowment for Visiting Arthropod Systematist (\$625K, obtained)
- NSF-CSBR infrastructure grant (\$468K, approved for funding)
- NSF-ADBC digitization grant (\$333K, obtained)
- CALS matching support for NSF grants (\$40K, funds committed for physical renovation)
- Permanent room in basement of Forbes to house the UAIC Alcohol and Frozen Tissue Collections (CALS, space committed). Two -80 freezers (BIO5, resource committed)
- Temporary staging area in basement of Forbes while we prepare for renovations (CALS, space committed).
- Acquire Forbes room 402 for expansion of collection (Entomology, space committed).
- Space in Forbes for 10 undergraduates to work digitizing the collection
- Server space and 0.25 FTE IT support (\$12K per year) for specimen-level database.
- 0.5 FTE RA for collection support (\$20K per year). Hiring graduate students will allow us to train the next generation of biological research collection guardians and provide them with experience for expressing the importance of such efforts to the public.
- Senior Program Coordinator, 1.0 FTE, \$50K + ERE per year, 0.5 FTE funded now by NSF. The UAIC curator (W. Moore) is a tenure-track Assistant Professor position with 0.20 FTE time for curation. She will need support to manage these labor- and management-intensive NSF projects so she can focus on her research and teaching.
- Long-term support for Associate Curator, 1.0 FTE (position now held by Carl Olson).

#### **E. Objective metrics that will be used to track progress towards attaining goal**

- Progress of renovation relative to timeline provided in NSF proposal.
- Number of visitors and specimen loans
- Damage caused by dermestid beetles.
- Number of specimen records published online.
- Assess level of curation of collection using standard method (McGinley system)
- Use of collection for local entomology meetings, sorting events by students, and outreach
- Number of research articles published using the UAIC
- Amount of extramural resources obtained for collection improvement
- Amount of extramural resources secured and used for Visiting Systematists, fellowships, endowments, etc.
- Number and scope of inter-institutional, regional, national, and international requests of UAIC and collaborations formed.

**6. DEVELOPMENT GOAL: Raise \$2 million from private donors to support our programs by FY21.**

**A. Current situation and gap between current situation and desired situation**

The Department of Entomology fulfills UA's Land Grant mission by offering economically important research, extension and outreach to our state's stakeholders in agriculture, urban pest management, biodiversity conservation, and education. We are unique in UA and CALS because we focus on insects, which generate tremendous public interest. However, we receive little direct financial support from the public. We will connect with the community in new ways to increase stakeholders' financial support of Entomology & CALS.

**B. Strategies to achieve goal**

- Increase visibility to stakeholders and all citizens of the state & region
- Connect with the community through events such as the Arizona Insect Festival, programs such as Insect Discovery, and resources such as the UA Insect Collection (UAIC).
- Maintain and enhance our high Department profile in local and national news.

**C. Actions**

**Time Period (Fiscal Years)**

- Work with the CALS Development Office to seek funding for our programs .....2013-21 (Insect Discovery, EIS grad program, UAIC, Insect Festival, etc.).
- Hire a part-time **Development Coordinator** to work with the Department & CALS ..... 2014 to organize support-raising events and to increase the profile of the Department.
- Establish an **Advisory Board** to connect with the community and be our advocates ....2012-13 in diverse circles within the State (medicine, agriculture, pest management, etc.).
- **Renovate** the Entomology classroom (Forbes 412) and main business office .....2013-15 (Forbes 410) to project a more modern image to visitors.
- Work with CALS to build **appealing exhibits** in the main lobby of Forbes, in the .....2013-15 Student Union, and elsewhere on campus that would highlight the accomplishments and activities of the Department and other CALS Departments.
- Enhance the **department website** with development goals and ways for.....2013-15 stakeholders to become involved with departmental activities.
- Hold regularly scheduled support-raising events such as the Insect Festival, .....2013-21 insect-themed social events, and high-end events with invited supporters and potential new supporters.

**D. Inputs needed to achieve the goal**

- Effort by faculty and other Department members to support development
- Effort by Entomology Advisory Board
- Part-time Entomology Development Coordinator who will increase our profile, organize fund-raising events, and garner new resources: \$30K per year
- Collaboration from CALS Development Office
- Funds for physical renovations, exhibit development, and IT support: \$15K per year

**E. Objective metrics that will be used to track progress towards attaining goal**

- Funds raised per year