

California Oaks Threatened by Invading Wood Borer

By Mary Louise Flint, UC Statewide IPM Program and Entomology Department, University of California, Davis; Tom W. Coleman, USDA Forest Service, Forest Health Protection, San Bernardino; and Steven J. Seybold, USDA Forest Service Pacific Southwest Research Station, Davis.

Over the last decade and a half, more than 21,000 mature oaks in eastern San Diego County, California have been killed by a new invasive oak borer, the goldspotted oak borer (GSOB), *Agrilus auroguttatus*. Killed trees reside in forests, parks, and residential landscapes in an area covering about 1,900 square miles. Nobody knows how GSOB arrived in California, but researchers suspect it was transported in firewood from its native areas, possibly from Arizona or northern Mexico.

The adult beetle is a colorful, 0.4-inch-long buprestid (a family of destructive, wood-boring beetles) with six gold spots on its wing covers (see photo, below). Although eggs have never been seen in the field, they are believed to be laid in bark cracks, mostly on the main trunk or stem of oaks. GSOB larvae feed beneath the bark (see photo, page 8), damaging the nutrient-conducting tissues of the tree; the cambium, where new radial growth of the tree initiates; and the wood surface, where water conduction occurs. Preliminary research data indicate the pest's life cycle takes about a year to complete. Feeding from several generations results in death of susceptible trees within a few years.

Thinning of the tree crown and twig dieback are often the first damage symptoms noticed. However, many other factors, including drought, disease, or other insect pests, can cause similar symptoms. A

tree declining from GSOB attack can be distinguished from decline due to other factors by the characteristic D-shaped exit holes left when adults emerge. Emergence holes are found on trunks, mostly from a height of 6 feet down to the very base of the tree. Where high numbers of larvae are feeding, tree sap builds up within the dead phloem tissues and leaks out onto the bark as dark red or black sap flowing from bark cracks. Woodpecker damage to the bark surface of trunks and larger branches can also be a clue signaling GSOB attack.

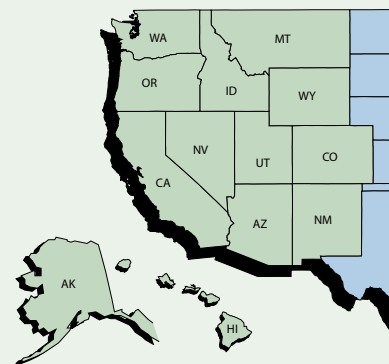
Our research team has developed a Tree Health Rating System for land managers and others wishing to evaluate trees and the need for removing them. The rating system is available in the publication, *Goldspotted Oak Borer: Field Identification Guide*, which also contains photographs of GSOB life stages and damage symptoms. The guide is available on the University of California Statewide IPM Program (UC IPM) Web site, www.ipm.ucdavis.edu/PDF/MISC/GSOB_field-identification-guide.pdf.

Three California native oak species in the San Diego area are known to be killed by GSOB. These are coast live oak, *Quercus agrifolia*, California black oak, *Q. kelloggii*, and canyon live oak, *Q. chrysolepis*. Larger trees are most susceptible. Young trees or shrub oaks with less than 8-inch diameters appear to be less likely to suffer major injury. Engelmann

oak, *Q. engelmannii*, is occasionally attacked, but tree mortality in this species has not been solely linked to GSOB. Susceptibility of other California native oaks, such as interior live oak, *Q. wislizenii*, valley oak, *Q. lobata*, and blue oak, *Q. douglasii*, is unknown, because these species do not grow in the current GSOB infestation area. However, research is under way to determine

Center Scope

The Western IPM Center enhances communication between federal and state IPM programs in the western United States: Alaska, Arizona, California, Colorado, Hawaii and the Pacific territories, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. It serves as an IPM information network, designed to quickly respond to information needs of the public and private sectors.



Goldspotted oak borer adult.

Tom W. Coleman, Forest Health Protection, USDA Forest Service

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Gary Kramer, USDA-Natural Resources Conservation Service

Director's Comments

The past year has been a roller coaster ride for IPM Center funding. It looked as if Congress was never going to pass a 2011 budget. Then several continuing resolutions were passed. Variations had either no Regional IPM Center funding, or one house had funding while the other one didn't. Then both had funding, but differing amounts. In the end, the Centers received about \$1 million less than in previous years. Through a competitive grant process, funding was allocated by USDA-NIFA for only 1 year. This makes it difficult to plan and make decisions for managing Centers. It essentially eliminates the ability to fund research projects, which normally need multiple years to complete. Therefore, the Western IPM Center has focused on outreach and work group projects through our competitive grants program. We received 17 applications in the categories of Work Groups, Publications/Outreach, and Pest Management Strategic Plans. Our review panel met in January and made recommendations for funding.

The Regional IPM (RIPM) Grants Program (managed by the WIPMC but funded directly by USDA-NIFA) funds research and extension projects of up to 3 years' duration. Fortunately, this program has not been cut, although the release of the RFA was very late this year. Proposals are due on February 29.

Congress did pass the 2012 agriculture budget reasonably early last year. Thanks to the support of IPM Voice and many other groups and individuals, the Regional IPM Centers were funded, including restoring the \$1 million lost in 2011. I am hopeful that USDA-NIFA will be able to release an RFA later this year for 4-year programs, rather than 1-year.

This will greatly enhance the functionality of the Centers and make applying for management of a Center more appealing.

This issue of *The Western Front* supplements our Annual Report with highlights of the past year's work. We continue to accomplish a great amount of work with exceptionally competent collaborators. One of these collaborators is Dr. Dawn Gouge, whom we profile in this issue.

Work is well under way on our three signature programs of the 2011 grant (see article below). The Water Quality/IPM Best Management Practices group met in Portland and broke into subgroups to develop curricula for PSEP educators, Master Gardeners, professional landscapers, and growers. We expect to present final drafts of curricula at the Western Region Pesticide Meeting in Cody, Wyoming, in May.

"Protecting Beneficials in Hawai'i and the American Pacific: A Workshop on the Conservation of Pollinators and Other Beneficial Species" will be held in April. The desired outcome of the workshop is education about the theory and practices of conservation of beneficial species so that farmers, beekeepers, and other pest managers realize the rewards of encouraging beneficial species. Letters of invitation have been sent.

The invasive species signature program has recruited work group members representing various disciplines for the first meeting later this year.

We hope to see you at the Regional IPM Centers' booth at the 7th International IPM Symposium.

—Rick Melnicoe

Three New Signature Programs Begin in Western Region

Based on stakeholder-established regional priorities, the Western IPM Center has interacted with stakeholders in the West and garnered their commitment to participate in the development of three signature programs related to 1) IPM and water quality, 2) pollinators and beneficial species, and 3) invasive species. Last September, WIPMC leadership and staff began directing the new programs. All three programs will foster new collaborations between individuals and among individuals and agencies.

IPM and Water Quality

The WIPMC is leading a work group to develop multi-disciplinary "Best Management Practices to Reduce Pesticide Impacts on Water Quality in the West" curricula adapted to different audiences and needs (e.g., Pesticide Safety Education Program [PSEP] educators, Master Gardeners, professional landscapers, and growers). To serve these audiences, 1-hour modules are being created for 1) agriculture, 2) urban settings (parks, golf courses, etc.), and 3) urban settings (Master Gardeners/homeowners). Draft curricula will be peer-reviewed in 2012, and first use of the finalized modules is scheduled for January, 2013.

Expected Outcomes:

- Increased knowledge of water quality issues and increased expertise in and adoption of IPM practices as effective BMPs for maintaining water quality among Master Gardeners, conservation districts, landscape professionals, Natural Resources Conservation Service Technical Service Providers, farmers, ranchers, institutions and municipalities, homeowners, urban communities, and others.

Protecting Pollinators and Beneficials

In Hawaii and the Pacific Basin Territories, local Extension Specialists and agents have established outreach programs for farmers about cultural practices and pest management (including pest identification). But they have now identified a need to educate growers throughout this geographical area about how to apply the relatively new concept of conservation of pollinators and other beneficial species. This need has even been articulated by growers themselves, who have become aware of the importance of taking action to maintain pollinator populations, following the arrivals of the varroa mite and small hive beetle. A 2-day workshop entitled, "Protecting Beneficials in Hawai'i and the American Pacific: A Workshop on the Conservation of Pollinators and

Other Beneficial Species" will be held for growers and extension personnel on April 18 and 19 in Waikiki Beach, Hawai'i.

Expected Outcomes:

- Enhanced production yields because of increased knowledge and awareness of how to protect native pollinators.
- Increased awareness and knowledge of the IPM practices of conservation of beneficial organisms, with a focus on pollinators, within a production system.
- Increased networking, communication, and awareness of pollinator health threats in participants' own and neighboring communities and territories.

Coordinating Responses to Invasive Species in the West

Invasive species pose a serious threat to agriculture, natural resources, and urban communities. Over the last 10 years, the invasive species that have significantly impacted plant agriculture and natural resources in western states have included pathogens, insects, and weeds. An overall goal of this signature program is to improve the prevention, detection, reporting, rapid risk assessments, and response to new invasive species.

The WIPMC will convene a meeting of a broad range of invasive species specialists throughout the region to identify high priority invasives in the West. Pest-specific work groups will then be formed to provide leadership, communication, and coordination of responses to these identified high-priority invasive species. The overall goal of each work group will be to develop a process to ensure good regional communication and collaboration for earlier detection and rapid response to manage, control, and/or eradicate the identified high-priority species. Each work group will develop and distribute an output in the form of an educational tool that will be designed to enhance the West's existing eXtension Invasive Species Community of Practice.

Expected Outcomes:

- Greater awareness and knowledge of early detection and management strategies for the identified high-priority invasive species in the West.
- Reduced spread of and damage by invasive species in the West due to better regional cooperation and better information on detection and management/control.
- Wide dissemination of pest-specific eXtension publications and any other publications produced by the work groups.

Highlights of Western IPM Center Grants Programs

The following highlights of WIPMC grants programs show the breadth of projects funded and the impacts made to improve the economic benefits of adopting IPM practices and to reduce potential risks to human health and the environment caused by the pests themselves or by the use of pest management practices.

Expansion of the Online High Plains IPM Guide to Include Agricultural, Rangeland, and Wildland Recommendations

Principal Investigators: Fabian Menalled, William Lanier, and Mary Burrows, Montana State University



Gary Kramer, USDA-NRCS

Summary: In 1998, a collaborative effort among researchers at Montana State University, Colorado State University, the University of Wyoming, the University of Nebraska, and South Dakota State University led to production of the High Plains Integrated Pest Management Guide for Colorado, Western Nebraska, Wyoming, Montana, and Western South Dakota. The overall goal of the Guide was to provide IPM information for crop and range insect and disease pests. Based on its success, and with the goals of reaching a larger audience and enhancing the ability to update research-based information, the Guide was converted to an online version (<http://wiki.bugwood.org/HPIPM>), and researchers partnered with the Bugwood network to enhance the archive of high-quality images related to agriculture and IPM. These developments increased the value and appeal of the Guide as an online resource.

A weakness in the Guide was the lack of information on the integrated management of agricultural, rangeland, and wildland weeds. The regulatory and educational priorities of the Pest Management Strategic Plan for Pacific Northwest and Montana small grains include defining the pre-plant period for herbicide labels; facilitating development of tools for monitoring; preventing and controlling invasive weed species; educating growers on plant-back restrictions based on soil type, pH, and soil moisture; learning to identify, monitor, and prevent invasive weed species; understanding identification of weed stage for proper control; learning proper use of herbicide-resistant crops; and educating growers on herbicide resistance. Project researchers requested funds to address these priorities by enhancing the online version of the Guide through inclusion of integrated agricultural, rangeland, and wildland weed management guidelines. Project objectives included 1) coordinating a regional effort to

produce and Web-publish on the High Plains IPM site fact sheets containing information on weed biology, ecology, impacts, and integrated management of agricultural and rangeland weeds, 2) integrating these weed fact sheets with information in an electronic-based weed identification key, and 3) disseminating the online High Plains IPM weed ecology and management information and weed identification key across a wide audience.

Results: A total of 22 authors from seven states collaborated in the production of the fact sheets. Contents included information on identification and life cycle, habitats, impacts, biology and ecology, management approaches, biological control, mechanical and cultural control, chemical control, examples of herbicides that can be used, and references. Photos and line drawings were also included to ease weed identification. The fact sheets were Web-published using the wiki format in the Bugwood High Plains IPM Web site. Finally, these fact sheets were linked to an electronic key to identify common agricultural and rangeland weed species (see related project, below). Because the fact sheets were loaded into the Bugwood High Plains IPM site in a wiki format, the authors are ultimately responsible for updating them. Project researchers conducted three online training programs to train authors on uploading information into the wiki fact sheets. A total of 99 fact sheets have been produced and Web published. The online Guide was disseminated to county extension agents, farmers, ranchers, natural resource managers, and others across the region.

Impacts and Potential Impacts: The development and distribution of weed biological and ecological information, as well as the integration of this information with biological, cultural, mechanical, and chemical management recommendations, provides the bedrock for developing IPM recommendations. The information presented in the weed fact sheets, as well as its integration with the electronic identification key (see below), has significantly improved the delivery of IPM strategies. Users across the High Plains region can use the Web site to obtain information on reduced-risk pest management approaches and adapt this knowledge to the specifics of where they live or work. Additionally, the weed information enhances the High Plains IPM Guide by providing users with a single starting point for pest management for all regionally-important pests.

An Electronic, Multi-Entry Key for Identifying Weedy Plant Species in Small Grain Fields

PIs: Fabian Menalled and William Lanier, Montana State University; Ned Tisserat and Ronda Koski, Colorado State University



Jeff Vanuga, USDA-NRCS

Summary: Weed management requires rapid and accurate identification of weedy plants. Improper identification can result in misapplication of herbicides or failure to adequately control a weedy plant species at the time that it is most vulnerable to IPM practices. For timely and effective management, crop producers and crop management advisors need easily accessible resources for weedy plant species identification linked to current chemical and nonchemical control recommendations. However, the number of taxonomists with the knowledge to identify non-crop plant species and the number of identification services available to crop producers and crop management advisors have decreased.

Project researchers requested funds to enhance an existing electronic, multi-entry diagnostic key by adding weedy plant identification information. The key had been previously developed to aid in the diagnosis of diseases, abiotic problems, and arthropod pests of small grains. Commercially-available software specifically developed for construction of electronic, multi-entry keys (Lucid Builder™) was used for the development of the key. Multi-entry keys developed from this software employ a process in which each possible cause of a problem is scored against every character state listed in the key. Users may select any character state in any order, to reduce the number of possible causes. This freedom to randomly work through the key offers tremendous advantages over traditional dichotomous keys, where questions must be answered in a specific order for the identification or diagnosis to proceed. Project objectives included 1) developing a multi-entry key to aid in the identification of weedy plant species that occur in small grain production fields, 2) integrating the key with Web-based weed management information, and 3) conducting outreach sessions to train extension specialists, diagnosticians, crop advisors, and growers to use the key.

Results: A total of 343 weed species belonging to 41 families were included in the multi-entry key. These weed species can be identified utilizing 50 morphological and phenological features grouped in eight categories (i.e., location in which plant was collected, current life stage of the plant, general description of the plant, life cycle, botanical family, stem characteristics, lower stem and underground characteristics, and inflorescence characteristics). Additionally, researchers included a “helpful resources” category that provides links to many useful online sites and numerous weed identification keys. Researchers coordinated 22 authors from seven states to produce fact sheets containing information on the biology, ecology, and integrated management of agricultural and rangeland weeds (see related project, above). The fact sheets were linked to a Lucid key to identify common agricultural and rangeland weed species. Finally, project researchers conducted several training sessions targeted toward producers and extension specialists to demonstrate how to use the multi-entry weed identification key.

Impacts and Potential Impacts: The multi-entry weed identification key is a powerful, user-friendly, and informative resource that allows stakeholders across the region to identify weedy plant species. This information is enhanced with figures, photos, and information on the biology, ecology, and current chemical and nonchemical management recommendations. This resource provides growers, crop advisors, extension agents, diagnosticians, and others associated with crop production with an easy-to-use aid to identify and manage weeds of small grains. The integration of the electronic key with weed fact sheets has enhanced the development of IPM strategies.

Innovative Outreach for City Parks to Implement IPM Strategies

PIs: Shelley Connor, Northwest Center for Alternatives to Pesticides; Tim Stock, Oregon State University



Rick Melnicoe

Summary: Research shows that pesticides used in yards and public spaces often end up in rivers, threatening water quality and making wider adoption of IPM in urban settings critical. Many city park employees in the Northwest have been leaders in adopting IPM techniques. As the number of city parks managed without pesticides grows, city park managers still often work in isolation and lack information and techniques for managing weeds without herbicides. The overall

goal of this project was to develop innovative, interactive tools and conduct outreach to increase implementation of IPM strategies among city park employees across the West. Specific project objectives included 1) launching an online site that hosts a blog, discussion forums, a resource list, and other social networking features, where city park managers can share information and resources on proven, successful IPM strategies used in managing parks; 2) interviewing at least five city park managers to create at least 12 blog posts on proven, successful IPM strategies; and 3) creating five 3- to 5-minute videos on specific IPM practices used in maintaining city parks to post on the site.

Results: Project participants developed user-generated content and officially launched the Sustainable Parks Information Network (SPIN) Web site to support city park managers. The project has provided a means for innovative, peer-to-peer outreach and IPM education for park employees throughout the West. During the project period there were 18 blog posts on proven, successful IPM strategies. The site has added archived PowerPoint presentations and 10 short videos highlighting IPM practices and discussions with IPM professionals. Members have the ability to contact each other directly or to start public discussion threads. After the site was launched, collaborators conducted outreach through 1) periodic emails to members, 2) highlights in the Northwest Center for Alternatives to Pesticides' *Action News*, 3) direct meetings and video projects with SPIN members in Washington, Oregon, California, and Montana, and 4) 20 presentations to landcare-specific audiences reaching more than 600 potential SPIN members. Site membership grew from 25 initial and founding members to 92, increasing roughly threefold.

Impacts and Potential Impacts: Of SPIN members surveyed, 70 percent claimed the network had helped them connect with others in their field to learn about IPM. The same group also reported they had recommended SPIN to their peers. Forty percent indicated they had been active in producing content for the site in the form of a blog, video, or discussion question. Around 50 percent stated specifically that they have reduced their use of pesticide chemicals or have changed their practices to include only least-toxic pesticides. Ninety percent indicated they had tried new IPM techniques as a result of discussion occurring through or because of the site. Through a local campaign, SPIN members in Ketchum, Idaho, worked with city administration and staff and local landscapers to craft a new, county-wide IPM policy for parks and public spaces. The new policy explicitly prioritizes preventive, ecological, and non-chemical steps for pest management. This project has expanded to accommodate the growing interest in applying IPM techniques in schools, low-income housing units, and other urban public spaces. Forums specific to these venues are currently under development on the SPIN site.

Utah Tree Fruit IPM Implementation Survey/ Development of IPM Outreach Material for Utah and Colorado Tree Fruit Growers

PIs: Marion Murray, Diane Alston, and Ruby Ward, Utah State University

This two-part project consisted of a grower IPM survey and extension/outreach activities in tree fruit IPM.



USDA-NRCS

Survey. The value of all tree fruit crops in Utah was almost \$17 million in 2006. Because fruit crops receive from 20 to 100 percent more inputs of non-renewable resources than many other crops, tree fruits are a high priority for the Utah State University (USU) Extension IPM program as they seek to enable sustainable IPM practices. Project collaborators surveyed Utah tree fruit growers about their pesticide use and IPM practices. Prior tree fruit pest management surveys provided comparison data for changes in IPM practices over time. Objectives for the survey project were to 1) design and deliver a statewide tree fruit IPM assessment survey and 2) from the survey data, determine the extent of IPM adoption and education/research needs in Utah's tree fruit industry.

Extension/outreach. With an increase in small farms in the western United States, new orchardists have a great need for educational resources in tree fruit production. This part of the project was a joint effort with Colorado to produce the first comprehensive commercial tree fruit production guide for the Utah-Colorado region. Collaborators supplemented the guide with a Web site with short videos on tree fruit pest monitoring techniques and key pest identification, designed to target commercial and hobbyist growers. Objectives this part of the project were to 1) produce and distribute a regional Utah-Colorado tree fruit production guide in print and online, 2) produce Web-enabled video shorts of IPM tree fruit pest identification and scouting techniques, and 3) develop a Web site to house the tree fruit production guide and scouting videos.

Results for Survey: 382 tree fruit growers were surveyed in Utah, with a response rate of 74 percent. Twenty-one percent of respondents considered themselves IPM practitioners, yet 30 percent selected at least seven of 22 IPM practices. Reported barriers to IPM included cost, lack of qualified labor, investment of time, and outside pest pressure (urbanization). Respondents not practicing IPM most commonly said they would adopt IPM if they were guaranteed a 100 percent fail-proof system, if the consumer were better educated in IPM, and if costs were decreased. For pesticide use, those practicing IPM reported greater pesticide reduction than those practicing conventional or organic agriculture.

Results for Extension/Outreach: The tree fruit production guide was printed and distributed to almost 500 commercial growers in Utah and Colorado. The Web site design is complete, and project collaborators are adding content. They created several test videos in 2010 and planned to complete the videos in 2011. To evaluate the project, postage-paid postcard surveys were attached to the guides. They also plan to distribute a formal survey, have “mini-survey” links on the Web site, and look at Web site analytics.

Impacts and Potential Impacts: Survey results will allow collaborators to document the successes and failures of the USU IPM program in tree fruits; guide them in future research and education needs in fruit IPM; allow them to gain an improved understanding of changes in, and use of, IPM practices in Utah; and leverage future funding. Growers will potentially experience increased profits because of having up-to-date information on a broad arsenal of pest management options, including state-specific products. They could also save money in scout training costs through the use of the free videos. Increased confidence in implementing IPM strategies could boost IPM implementation, lead to optimized pesticide use, and result in shifts to reduced-risk pesticides. Training videos will equip commercial and backyard growers to better identify pests and implement formal scouting practices. Other states in the Intermountain West could also benefit from this project by participating in future editions of the tree fruit production guide and by linking to the training videos available on their states' Web sites.

Outreach to Preserve Pheromone Mating Disruption Programs in California and Oregon Pear Orchards

PIs: Rachel Elkins and Kris Lynn-Patterson, University of California Cooperative Extension; Richard Hilton and Philip VanBuskirk, Oregon State University



Rick Melnicoe

Summary: Since the early 1990s, pear growers, researchers, and extension personnel in the West have worked hard to establish and maintain pheromone-based, area-wide IPM programs, but population and land use changes are jeopardizing these programs. Residential growth has encroached into key pear growing areas of California and Oregon. In addition, pears have struggled economically due to decline of the cannery market and global competition. The combined effects of residential migration and economic difficulty have resulted in increased numbers of abandoned commercial orchards; scattered, unfarmed trees on "ranchettes;" and unmanaged residential backyard fruit trees. These trees harbor many pests. When they are located in proximity to responsible commercial pear growers, pests migrate into neighboring commercial orchards and create problems for growers, who then must use more and harsher pesticides. Though codling moths have a limited host range, even a single unmanaged tree can ultimately produce hundreds of mobile moths that can then move into surrounding orchards. This outreach project proposed a combined effort for northern California and southern Oregon. Objectives included 1) identifying and characterizing locales of unmanaged trees that may harbor pests, threatening the IPM program

success of commercial growers; 2) conducting education and outreach to the residential population within ¼ mile of commercial pear orchards, educating them on how to implement responsible IPM practices for backyard apple and pear trees and on the implications for neighboring commercial growers of harboring pests in those trees; 3) encouraging residents to remove backyard apple and pear trees by offering industry-provided incentives; and 4) collecting, summarizing, and sharing project data with relevant agencies, other potential user groups, and the research/extension community.

Results: Outreach methods used by project collaborators include newspaper articles, an annual gardening calendar, information booths at public events and farmers' markets staffed by University of California Master Gardeners, and cooperation with local nurseries. Residents are being encouraged to 1) ideally, remove unmanaged trees and replace them, if desired, with recommended low-maintenance shade trees or other non-threatening fruit and nut trees, and 2) properly care for trees and manage pest populations so they do not pose a problem to commercial pear growers.

Impacts and Potential Impacts: Program effectiveness is being measured by documenting the number of unmanaged trees before, during, and at the end of the program. Consumers of the project's information are being surveyed on the usefulness of the products, whether they have learned anything, and whether their behavior has changed. Preliminary results less than a year after the program began showed that many more people were aware of the problem. Individual homeowners have started to remove unmanaged trees, and an owner of an abandoned orchard in Lake County, California, is working with the agricultural commissioner to find a cost-effective way to take out the orchard. Two unmanaged orchards in Jackson County, Oregon, were removed. Because of the growing awareness of the issue and the efforts of Master Gardeners who are promoting low-maintenance, drought-tolerant plantings, homeowners not willing or able to spend a lot of time tending to fruit trees are getting increasingly interested in planting low-maintenance trees, natives, and xeriscape plants.

Polk County Nutria Control Research Project

PI: Jackie Hastings, Polk Soil and Water Conservation District



John & Karen Hollingsworth, U.S. Fish and Wildlife Service, Bugwood.org

Summary: In Oregon, nutria are a non-native invasive species that pollute water; displace native wildlife; cause damage to dikes, crops, and riparian vegetation; and potentially transmit disease to pets, livestock, and humans. Traditional methods of control (trapping or shooting) can effectively reduce isolated

populations, but local efforts are worthless because of the reservoir of nutria that move in and repopulate an area. The purpose of this project is to build the foundation for developing the first Regional Nutria Management Plan in the Pacific Northwest. The plan focuses on collecting data and building alliances with industry and user groups. Data will be used to seek future funding to continue addressing nutria populations and their effects on agriculture, water quality, and human health. Project objectives include 1) educating the public about nutria through workshops and newspaper articles, 2) developing a protocol for documenting nutria damage, 3) documenting nutria damage throughout Polk County, 4) testing nutria throughout Polk County for various diseases, 5) testing nutrias' effect on water quality through bacteria testing, 6) evaluating nutria control measures to determine what methods are most practical and effective, 7) working with landowners to record the number, sex, and size of captured nutria, and 8) compiling all data collected into a final report to be used to as a foundation for creating a Regional Nutria Management Plan in the Pacific Northwest.

Results: Project collaborators produced a newspaper article, workshops, a display at the Polk County Fair, a newsletter article, and fact sheets and fliers that have been distributed throughout Polk County. A data recording sheet was developed that includes nutria activity, damage, location, date, and physical data on captured nutria. Nutria activity has been documented throughout Polk County and physical data recorded on more than 150 nutria. Every nutria in the program has been examined for disease, reproductive status, and tooth extraction (to provide accurate age). Woven wire was installed along pond dikes to evaluate effectiveness against nutria damage. Data are being collected on additional control methods. Size, weight, sex, and location data are being collected on every nutria turned in.

Impacts and Potential Impacts: Ash Creek, a mid-size tributary of the Willamette River, has been listed as critical habitat for juvenile salmon and is monitored by the Oregon Department of Environmental Quality for water quality. A significant health and environmental concern for this area has been the high volumes of bacteria found in the water and the destruction of riparian vegetation. In 2010, more than 100 nutria were removed from this ecosystem through this project. The Ash Creek Water Control District and the City of Independence (through which Ash Creek runs) have been strong partners in the nutria control efforts and feel there has been significant improvement in water quality.

A main objective of this project is to bring natural resource partners together to build a regional Nutria control program. The project has directly resulted in a nutria population study through the Oregon Department of Fish and Wildlife, disease testing through Oregon State University, and an environmental damage study through Portland State University. These research efforts may help build support for additional funding sources.



Dawn Gouge

Associate Professor and Associate Specialist in Urban Entomology, University of Arizona

Dawn Gouge, who has served on the Western IPM Center's Advisory Committee since 2007, is an Associate Professor and Associate Extension Specialist in urban entomology at the University of Arizona, stationed at the Maricopa Agricultural Center (MAC) Experiment Station (35 miles south of Phoenix). Dawn and WIPMC Director Rick Melnicoe first met as fellow committee members on the IPM Coordinating Committee of the Arizona Pest Management Center (APMC), a virtual Center. APMC Associate Director Al Fournier had told Dawn about the WIPMC's ag- and non-ag-related activities, but when Rick spoke on the WIPMC's functions at a committee meeting, Dawn was "blown away" by the opportunities for collaboration on urban IPM issues. She talked to Rick right after the meeting and told him she'd like to start a work group and PMSP on IPM in schools. "Dawn is passionate about protecting children's health," Rick said. "She is the one who conceived of the idea of doing an IPM in schools PMSP and has maintained a leadership role in the West and nationally for IPM in Schools." Linda Herbst, WIPMC Associate Director, said, "Dawn brings a good, strong urban component to the Advisory Committee, and she's a really active participant in the meetings." Rick added, "Dawn is a good thinker, a good team player, and a really pleasant person to work with. Whenever I have contacted her for information, she's right on it."



Dawn Gouge

For her part, Dawn cited the significant impacts of these Center-funded projects on school IPM collaborations in the West, saying, "Before, we were loosely connected and collaborated rather poorly, but we became very well connected through the work group experience and through the PMSP priority-setting exercises." In working together, they realized how much they all had in common—and how much they liked each other. "Five or 6 years down the road, we have a tight-knit, multi-state group of people who collaborate and cooperate on many different things. We have experienced greatly increased efficiency, communication, and collaboration," Dawn said. In addition to these synergies in school IPM, work group participants have found areas of overlap in their efforts to extend pesticide safety and IPM education in public housing. And in all of their outreach, there is free sharing of materials back and forth. Dawn summed up the benefits by saying, "We have become a network of experts that rely upon each other, and our effectiveness has increased dramatically in spite of funding decreases."

In addition to her service on the WIPMC's Advisory Committee, Dawn currently serves on a number of university, regional, and national committees and boards, including the U.S. Bed Bug Working Group, the EPA National Tick Task Force, and the IPM Institute of North America's Green Shield Advisory Committee. Dawn is co-chairing the program committee for the 7th International IPM Symposium (<http://www.ipmcenters.org/ipmsymposium12/>) and serves on its steering committee.

Background and Education

Dawn was born and raised in Liverpool, England, and said her parents "were hippies who took my sister and me on wonderful, low-budget travel adventures. My Mum and Nan [grandmother] were the kind who would take you out into the garden and put your hands in the soil and impress upon you how important it was to appreciate the earth. My Nan was the first IPM advocate I ever met."

Dawn said she always loved bugs. She was particularly fascinated by preventable diseases but didn't consider herself brave enough to go

into medicine, so she thought initially she would go into tropical agriculture. "But I got more involved in applied zoology and got interested in public health pests," she said. (Applied zoology is the practical side of zoology, including animal husbandry, veterinary science, parasitology, public health issues, etc.) On the parasitology side of things, Dawn was drawn to pathogenic bacteria and entomopathogenic nematodes (nematodes that infect and parasitize soil-dwelling insects). Dawn found these nematodes particularly alluring because "they are a very effective and balanced way of managing pests. Once the pest is dead, the nematodes die too. I was fascinated by the fact that they are an effective, self-limiting biocontrol agent."

After completing her undergraduate degree in applied biology (University of Wales, Bangor) and her Ph.D. in entomology and nematology (University of Reading), Dawn came

to the United States in 1995 for a postdoctoral position at the Western Cotton Research Lab (USDA-Agricultural Research Service), where she worked for the lab director, Thomas Henneberry. "It was a wonderful opportunity," Dawn said. "He sent me all over the world. He was remarkably supportive and fully behind my publishing as primary author. I will always be grateful."

Current Position with University of Arizona

In 2000, after 2 years with Texas A&M's Department of Entomology, Dawn began her work at the University of Arizona, where she has numerous research, teaching, and extension commitments.

Research. Dawn's research efforts focus on pest ecology and reduced-hazard management of structural and public health pests, including venomous arthropods, disease vectors, bed bugs, cockroaches, ants, and termites. Dawn is very knowledgeable about scorpions, which envenomate 10,000 to 14,000 people in Arizona every year and lead to thousands of fatalities per year south of the U.S. border. Dawn said, "There's something very natural about being cautious about spiders and scorpions. Scorpions have been around for 430 million years—they predate insects. There's something embedded in our psyche telling us not to go near them." Dawn is fascinated by bark scorpions, which she said have an intricate and very elegant life. The other reason she wanted to focus on their ecology and sustainable management was her work with schools and childcare facilities, where children have potential exposure. She said the school districts take scorpions very seriously, and some apply dramatic amounts of pesticides every few weeks for scorpions. "The logical question for me to ask was, at what point will you realize it's not working?" said Dawn. She and her colleagues were able to show that physically collecting and removing them and then freezing, crushing, or releasing them somewhere else was far more effective at reducing on-site populations.

Teaching at UA. Dawn's teaching commitments include UA classes on IPM as well as Centers for Disease Control and Prevention (CDC)-accredited public health classes on IPM, pesticide safety, and health impacts of pests and pest management practices. She also supervises and serves as external examiner for UA Masters and Ph.D. degree students. Dawn said, "I love teaching students. They are so dedicated, driven, and focused. And they're reading everything that's published, so it keeps me on my toes. I have to be up to date, or they'll let me know I'm behind!"

IPM in Schools Extension. Dawn's research interests and teaching expertise made her a perfect fit for her spearheading efforts with school

IPM. She enthusiastically promoted her idea for a national PMSP on IPM in schools and was one of many collaborators who worked with Project Director Tom Green (IPM Institute of North America) on the project, funded in 2006 by all four regional IPM centers and USDA-National Institute of Food and Agriculture (NIFA). Dawn served as co-editor with Green on the first (2008) and second (2011) editions of the PMSP, which is entitled *School IPM 2015: A Strategic Plan for Integrated Pest Management in Schools in the United States*. National momentum from this project built quickly, and four regional school IPM work groups were funded by the IPM Centers as a result of the initial PMSP workshop. Dawn served as Co-Project Director of the western region group during its first two funding cycles (2007 and 2008) and co-directs the current group as well (funded in 2011). Since their initial funding, the group has received \$350,000 in additional funds from EPA and USDA, significantly leveraging the support provided by the WIPMC.

Dawn is proud of these successful group efforts on IPM in schools. She feels that getting the national implementation team together—including partners from EPA, USDA, the Centers for Disease Control, state government, the nonprofit sector, and industry—was an important milestone for IPM in the urban sector. “Being able to focus on common goals through the PMSP is an incredible achievement,” she said, emphasizing that she is just one of a very large number of people working on this. Dawn said the PMSP was “one of the hardest things I’ve been involved in, because you can never achieve full consensus on all things at all times. But we were satisfied with our efforts and delighted with the final document. It is a living document, and a greater and greater number of people are involved in the national effort. There was greater consensus on the most recent document, and we have better working relationships, communications, and collaborations. It really has pulled people together, whereas it very easily could have divided. Ultimately, we are all working to improve children’s environmental health.”

Looking ahead for IPM in schools, Dawn would like to see an increase in the existing network of implementers in states so that every state has an active program and state coordinator. She said, “People across the country with minimal amounts of money can do this.” Dawn added she is a firm believer in legislation and thinks there is a need for minimum federal IPM standards for children’s environments. Dawn serves on the National School IPM 2015 Steering Committee and has been honored with a number of awards for her work on protecting children’s health.

Other Community Extension. In addition to her work on IPM in schools, Dawn participates in other community education initiatives, including IPM-related educational outreach in public housing and outreach and intervention work with tribes. The former focuses on community responses to bed bugs, cockroaches, and other common pests in public housing. Dawn said the core motivating factor in all of her work is “to improve the quality of life for people.” In the course of her career she has realized that “people really don’t care about what you know until they know that you care. This is a quote from my friend and coconspirator Tim Stock (Oregon State University). Once that penny dropped, I think I became much more effective at what I did.” She added, “The more you work with communities, the more you realize that IPM is people management rather than pest management. This is another quote, from friend and coconspirator Marc Lame (Indiana University).” About her community teaching, Dawn said, “It’s such an uplifting experience. Sometimes it’s heartbreaking: there are tears in every single bed bug class, and hugs from people, too. It is satisfying to alleviate—at least for that moment—some fears and help at least a little bit. It feels like I’m making life a little easier for people under stress.”

As Dawn continues the public housing IPM implementation efforts, she will focus specifically on changing her presentations to be more helpful to audience members who do not read. In addition, she and her colleagues are preparing a survey to assess chemical use patterns and personal stress associated with bed bugs. She said people are using things like gasoline, because they are so desperate to get rid of the bed bugs. She and her colleagues will assess the literate and illiterate populations using TurningPoint technology as well as an online survey. They also want to better assess how people are acquiring bed bugs. “As a society we need to assist economically disadvantaged communities, which inadvertently serve

as bed bug reservoirs. If we fail to help this portion of society, we will never be free of bed bugs.”

Medicocriminal Entomology

Since 2000, Dawn has served as a medicocriminal entomology expert supporting law enforcement agents. The medicocriminal section of the forensic entomology field focuses on necrophagous insects (insects that feed on a human corpse as it decomposes). Determination of *post mortem* interval is usually the primary goal, but other information is sometimes established. Dawn does field examinations and testifies in court hearings, and she said, “The reality is nothing like CSI Miami!”

A Snapshot Week

Dawn described a recent week like this: “On Monday I was in the lab, maintaining lab cultures, harvesting nematodes, feeding bed bugs, and working with the scorpions. On Tuesday I finalized a grant application and taught a class in afternoon (in Tucson). On Wednesday I testified at a court hearing. Thursday I visited the home of a couple of students from one of the schools in Maricopa County.” Dawn said that the school district does not allow students to come to school if their home has a serious bed bug infestation. She was asked to visit this home to see if they had reduced their infestation to an acceptable level so that the children were not likely to bring bed bugs to school. She added that many families with limited resources will never get rid of the bed bugs. It really requires a professional to completely eradicate

them, and many families cannot afford it. “We are sometimes able to get *pro bono* help from a professional, but with this family we were not able to. They had lived with the bugs for over a year. But they had implemented many of our suggestions and had dramatically reduced the population, so the children were not missing school. There have been instances where students are not allowed to attend school. On Friday, I conducted resident briefings at a public housing unit.”

Personal

Dawn said, “I have a wonderful 10-year-old daughter, Annaka, who can tell you everything you don’t want to know about bed bugs, cockroaches, and scorpions. We were stranded in Philadelphia last Christmas because of the winter blizzards. In the elevator of the hotel, my daughter announced to several hotel occupants, ‘I know the first thing I’m going to do once we get to the room. Look for bed bugs!’ She is a super little biologist and very enthusiastic about all living creatures. My lovely sister Alison (a museum archeologist and super-mum) lives down the road, and between us we have four growing IPM advocates, five canines, two snakes, one gecko, an unknown number of millipedes, one tarantula, and two very understanding men. I think my Nan would be proud of us.”

Contact Dawn at dhgouge@ag.arizona.edu.



PMSP Update

Ongoing:

- **Cucurbit Crops (Hawaii, Guam)**
- **Desert Turf (Arizona, Nevada, and Southeastern California)**
- **Grass Seed (Idaho, Oregon, and Washington)**
- **Low Desert Cotton (Arizona and Southeastern California)**
- **Orchid (Hawaii):** Currently being reviewed
- **Seed Potato (Alaska, California, Colorado, Idaho, Montana, Oregon, Washington):** Currently being reviewed
- **Turf (Hawaii):** Currently being reviewed

the range of California and ornamental species of oak that can serve as developmental hosts for GSOB.

Currently, there are no research-based management tools available to control GSOB once it infests trees. Research is under way by the authors and others to evaluate the efficacy of various topical and systemic insecticides for control; however, buprestids have historically been difficult to manage with pesticides. Although woodpeckers reduce larval numbers in many areas, and two parasitic wasp species and generalist predators have been found in larval samples, biological control appears to be insufficient in California to protect trees from death.

At present, the primary tool we have for managing GSOB is preventing movement of infested wood. Leaving infested cut logs on site for 2 years or grinding them are procedures known to effectively eliminate spread of viable GSOB larvae.

GSOB distribution is still limited to San Diego County, primarily in eastern areas including and surrounding the Cleveland National Forest, although there is one site of infestation near La Jolla, north of urban San Diego. The beetle is likely to move slowly on its own, and natural barriers without oak trees between the infested areas and northern California oak woodlands may also moderate spread. However, one load of infested firewood in the back of a truck would be all it might take to move this pest into northern parts of the state.

A consortium of groups, including the USDA Forest Service and Animal and Plant Health Inspection Service (APHIS), UC Cooperative Extension and UC IPM, the California Department of Forestry and Fire Protection (CAL FIRE), California State Parks, the California Department of Food and Agriculture (CDFA), the California Forest Pest Council, and the Nature Conservancy, have joined forces to urge the public to buy firewood locally and not transport it out of infested areas. They are also working with firewood vendors and arborists to get the message out. The program includes a Web site (<http://firewood.ca.gov>), educational programs for many audiences, posters, and outreach programs in parks and campsites.

(This article was adapted from a similar article by the authors published in the October 2011 issue of CAPCA Adviser, the magazine of the California Association of Pest Control Advisers.)

Further reading and resources:

Coleman, T.W. and S.J. Seybold. 2008. New Pest in California: The Goldspotted Oak Borer, *Agrilus coxalis* Waterhouse. Pest Alert. USDA: Forest Service PSW Region Pub R5-RP-022.

Hishinuma, S., T.W. Coleman, M.L. Flint, S.J. Seybold. 2011. *Goldspotted Oak Borer: Field Identification Guide*. University California ANR, Statewide IPM Program, available at www.ipm.ucdavis.edu/PDF/MISC/GSOB_field-identification-guide.pdf.

UC Cooperative Extension GSOB Web site, <http://ucanr.org/sites/gsobinfo>.

California Firewood Task Force Web site, <http://firewood.ca.gov>.

Don't Move Firewood Web site, <http://www.dontmovefirewood.org>.

Mark Your Calendar

2012

- 25th Vertebrate Pest Conference, March 5–8, Portola Hotel and Spa at Monterey Bay, Monterey, California.
<http://www.vpconference.org>
- Western Society of Weed Science Annual Meeting, March 12–15, Peppermill Resort, Reno, Nevada.
<http://www.wsweedscience.org/default.asp>
- 7th International IPM Symposium, March 27–29, Memphis, Tennessee.
- Entomological Society of America 60th Annual Meeting, November 11–14, Knoxville, Tennessee.
<http://www.entsoc.org/am/fm/index.htm>

2013

- Western Society of Weed Science Annual Meeting, March 11–14, Catamaran Resort Hotel, San Diego, California.
<http://www.wsweedscience.org/default.asp>
- Entomological Society of America 61st Annual Meeting, November 17–20, Austin, Texas.
<http://www.entsoc.org/am/fm/index.htm>



Goldspotted oak borer larvae feed beneath the bark.

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