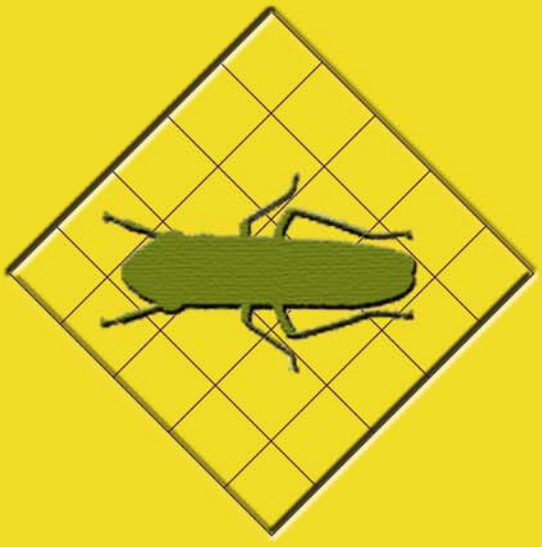
Pierce's Disease Program



Report to the Legislature
May 2003

California Department of
Food and Agriculture

Cover design by Paul Gordon, California Department of Food and Agriculture

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Statement of the Secretary

It has been just over three years since Temecula grape growers saw their vines wither from the effects of Pierce's disease. At the time, many feared that the arrival of the glassy-winged sharpshooter, which spreads Pierce's disease at an alarming rate, could topple our state's hugely successful agriculture industry.

Thanks to the cooperative efforts of industry, government, and the research community, the outlook today is much brighter. The Pierce's Disease Program has devoted considerable resources and expertise to fighting the glassy-winged sharpshooter and the disease-causing bacteria it spreads—and we have achieved marked progress. Experienced scientists, advisors, field personnel, and administrators are tackling one of the most significant threats to agriculture in 20 years. We haven't won the battle yet, but we are gaining ground.

This report details the good news about the progress we've made against Pierce's disease and the glassy-winged sharpshooter. We at CDFA look forward to continuing on this path with our many valued partners.

William (Bill) J. Lyons, Jr.
Secretary, California Department of Food and Agriculture

Executive Summary

The Pierce's Disease Program saw progress and encouraging results on many fronts in 2002, demonstrating continued success at minimizing the statewide impact of Pierce's disease and the glassy-winged sharpshooter. Following are highlights from 2002.

Contain-the-spread activities successfully prevented the spread of the glassy-winged sharpshooter to new areas of the state. Of 65,800 shipments of regulated nursery stock made in 2002, only 77 were found to contain live sharpshooter life stages, yielding a success rate of 99.88%. For bulk grapes, no sharpshooters were found in 20,000 shipments from counties with infested areas. The vast majority of bulk citrus shipments (98.9%) were free of live sharpshooters, with only 170 out of 15,000 shipments found to harbor live insects.

Statewide survey efforts found new infestations of the sharpshooter in Fresno, Imperial, Sacramento, Santa Clara, and Tulare counties, while confirming that 35 at-risk California counties are completely free of infestation. Quality control checks were conducted on county and state trapping programs to ensure survey programs are run effectively and uniformly.

Rapid response activities continued against isolated infestations discovered in prior years as well as against new infestations found in 2002. Sharpshooter populations were notably lower in areas treated in prior years. In August 2002, complete eradication of a sharpshooter infestation found almost two years earlier in Brentwood, Contra Costa County was declared. This marked the first time that a localized infestation of the sharpshooter was eradicated.

Outreach continued to play a key role in the program. In 2002, inaugural issues of newsletters were prepared and distributed to stakeholders to enhance communication. Since the start of the program over 1,000 articles and reports about Pierce's disease and the glassy-winged sharpshooter have appeared in national and international publications, on television and radio shows, and on internet Web sites. Our own Web site has received over one million visits.

Research progressed on the disease and its vectors, conducted by the nation's best plant health researchers. The program held its second annual Pierce's Disease Research Symposium in December, featuring progress reports on 70 current research projects and facilitating communication among researchers, stakeholders, and funding agencies. In late 2002 the prestigious National Academy of Sciences was engaged to review past and current research efforts and develop a long-term research strategy for solving the Pierce's disease problem. Meanwhile, field-based pest management pilot projects and epidemiology studies generated useful information on management options for growers already battling the disease and its prolific and unrelenting vector.

Biological control continued to post encouraging results. Approximately 290,000 tiny parasitic wasps were produced and released in 2002 against the sharpshooter. This was more than twice the number released in the prior year. Releases were made in nine counties and involved four different species of wasp. Thirty-five field recoveries of the introduced wasps were made, indicating possible establishment of these beneficial insects.

Environmental compliance remained a top priority. In March 2002 the Draft Environmental Impact Report for the program was completed and released. A 50-day public comment period was established, and five public meetings were held throughout the state. Meanwhile, as in

prior years, environmental monitoring and consulting with stewardship agencies were included in treatment programs to ensure protection of the environment.

The program benefited from the input of several advisory groups composed of industry stakeholders, government officials, and scientists. These groups provided useful ideas and recommendations concerning priorities, funding, contracts, research, and operational issues.

A total of $6.4 million in federal funds was disbursed to 44 growers in four counties under a compensation program developed and implemented by the program, to compensate growers for vineyard losses caused by Pierce's disease and the glassy-winged sharpshooter.

Overall, 2002 was a very productive and encouraging year for the Pierce's Disease Program, one in which the united efforts of government, industry, and the research community helped achieve significant progress in this important battle against a devastating plant disease. With adequate levels of support and the continuing help of this coalition, we are confident we can continue to protect our precious plant resources for current and future generations of Californians.

Background

The Threat

Pierce's disease has been present in California for more than 100 years. The disease has caused sizable losses in California viticulture in the past, but the damage occurred primarily in traditional "hotspot" areas and until recently was usually not severe enough to completely prevent grape production in affected areas. This situation changed dramatically with the arrival of the glassy-winged sharpshooter. Entire vineyards in traditionally safer areas could now be destroyed, and viticulture is threatened in significant regions of the state. Counting only grapes, the disease now threatens a crop production value of $3.2 billion and associated economic activity in excess of $33 billion. Other crop and ornamental plant resources such as almonds ($897 million) and susceptible species of citrus ($1.07 billion), stone fruits ($905 million), and shade trees are also at risk, either from the Pierce's disease strain of the bacterium or from related strains found elsewhere in the world. Recognizing this dire situation facing California, the Governor and Legislature established the Pierce's Disease Program in May 2000 within the Department of Food and Agriculture to minimize the statewide impact of Pierce's disease and the glassy-winged sharpshooter.[1]

Pierce's Disease

Pierce's disease of grapevines was first noted in California near Anaheim around 1884. The disease is caused by a strain of the bacterium *Xylella fastidiosa*. It kills grapevines by clogging their water-conducting vessels (xylem). Several strains of this bacterium exist, attacking and causing damage to different host plants including grapes, citrus, stone fruits, almonds, oleander, and certain shade trees such as oaks, elms, maples, and sycamores. Since its discovery, Pierce's disease has spread to other areas of the state and is currently known to exist in 24 counties. The University of California reported that the disease destroyed over 1,000 acres of grapevines in northern California between 1994 and 2000[2], causing $30 million in damages. There is no known cure for the disease.

Grapevine showing symptoms of Pierce's disease.

The Glassy-winged Sharpshooter

The glassy-winged sharpshooter was first reported in California in 1994 but probably arrived and established itself in the state in the late 1980s. It is native to the southeastern United States and northeastern Mexico. It feeds on the xylem fluid of a large number of plants. The sharpshooter builds up large populations on a diverse array of host plants and is an aggressive flyer, traveling greater distances than native sharpshooters.

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[1] See Appendix A for a brief chronology of program events.
[2] Report of the Pierce's Disease Research and Emergency Response Task Force. April 2000.

California's first indication of the severe risk posed by this new disease and vector combination occurred in Riverside County in August of 1999, when over 300 acres of grapevines infested with the glassy-winged sharpshooter were destroyed by Pierce's disease.

Adult glassy-winged sharpshooter.

Scientists believe that the glassy-winged sharpshooter has the potential to increase both the incidence and severity of Pierce's disease in California. As observed in the Temecula infestation, the sharpshooter:

- Builds to high populations that substantially increase the number of insects vectoring the destructive *X. fastidiosa* bacteria to crops;
- Covers longer distances in a shorter time than other sharpshooters;
- Makes use of more breeding habitats and plant hosts than native vectors; and
- Transmits the bacteria from vine to vine, resulting in an exponential increase in disease incidence in vineyards.

The combination of Pierce's disease and the glassy-winged sharpshooter constitutes an unprecedented threat to California's multi-billion dollar grape and wine industry, as well as to almonds, oleander, and other crop and ornamental plants.

Program Description

The Pierce's Disease Program works to minimize the statewide impact of Pierce's disease and the glassy-winged sharpshooter. The strategy is to slow or stop the spread of the glassy-winged sharpshooter while short- and long-term solutions to Pierce's disease are developed. This strategy relies upon the following five elements:

1. **Contain the Spread**
   Prevent the spread of the glassy-winged sharpshooter to new areas of the state by regulating shipments of host plants and plant materials.

2. **Statewide Survey and Detection**
   Find and monitor glassy-winged sharpshooter infestations and populations through trapping and visual survey.

3. **Rapid Response**
   Respond quickly to detections of the sharpshooter in new areas by intensively surveying the area and applying treatments if necessary.

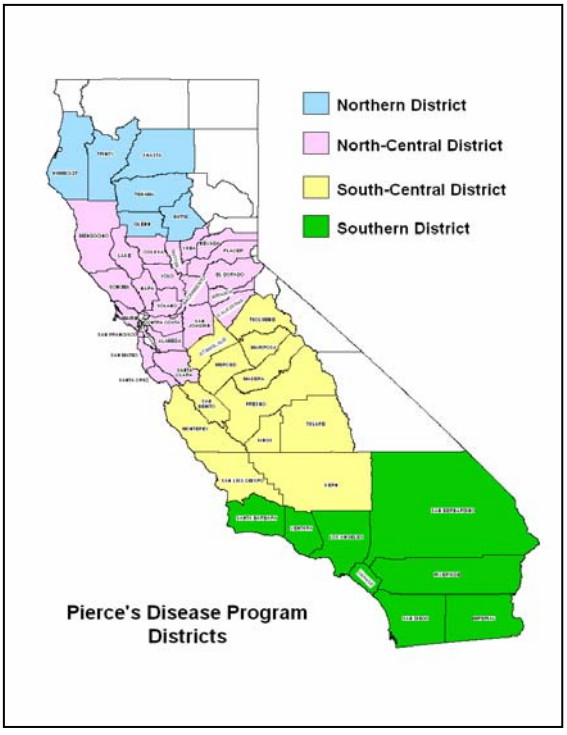
4. **Outreach**
   Raise awareness about Pierce's disease and its vectors while responding to the concerns of growers and the general public.

5. **Research**
   Develop solutions to Pierce's disease and its vectors.

Organization

The Pierce's Disease Program (PDP) is a partnership that includes the California Department of Food and Agriculture (CDFA), the County Agricultural Commissioners, the United States Department of Agriculture (USDA), the University of California, other state and local agencies, industry, and agricultural organizations throughout the state.

A Statewide Coordinator directs the program in accordance with the policies approved by the Secretary of Food and Agriculture. Program staff are located throughout the state and are responsible for coordinating and implementing various elements of the program, as well as communicating with program stakeholders. This includes working closely with the county agricultural commissioners to ensure that program activities are conducted in accordance with all statutory and regulatory requirements. Scientists



Map showing the Program districts.

at CDFA's Plant Pest Diagnostics Center provide pest identification services. Natural enemies of the sharpshooter are produced in CDFA and USDA laboratory facilities in Riverside and Bakersfield. Research is performed by researchers throughout the state and elsewhere under contract with CDFA, the USDA, industry, and other funding organizations. Local task forces help develop action plans, mobilize local resources, and share information with stakeholders and affected parties.

County Workplans

The agricultural commissioner of each county is responsible for conducting local Pierce's Disease Program activities. These activities are guided by annual workplans which are developed by the agricultural commissioners and submitted to CDFA for approval. As stated in legislation (Senate Bill 671), county workplans must include the following elements:

1. Proposed response to the discovery of the disease and its vectors (including delimitation and treatment);
2. Identification of a local coordinator;
3. Ongoing training of employees in the biology, survey, and treatment of Pierce's disease and its vectors;
4. Outreach information and training to local communities to respond to local concerns;
5. A proposed treatment program; and
6. A system to track and report new infestations.

Program activities are conducted year-round. County commissioners submit reports electronically to CDFA each month to report activities and support invoices. Audits are conducted on one or more counties each year to verify accuracy and appropriateness of charges and expenditures.

Advisory Groups

The Pierce's Disease Program is advised by several groups. These include the following[3]:

Pierce's Disease Advisory Task Force

The Pierce's Disease Advisory Task Force is composed of county agricultural commissioners, scientists, agricultural representatives, and other experts. The task force meets regularly to review program progress and develop recommendations for the secretary. It is advised by subcommittees which focus and provide advice on specific areas of the program.

Pierce's Disease and Glassy-winged Sharpshooter Board

The PD/GWSS Board is composed of representatives from the winegrape industry. It provides recommendations to the secretary on the use of funds collected under the winegrape assessment. Similar to the Task Force, the Board is advised by subcommittees established to focus on specific areas and issues.

[3] See Appendix B for a list of members in each advisory group.

Pierce's Disease/Glassy-winged Sharpshooter Science Advisory Panel

The PD/GWSS Science Advisory Panel is composed of university scientists who are experts on the disease and its vectors. The panel provides input and expertise on scientific issues associated with the program.

California Agricultural Commissioners and Sealers Association's (CACASA) Glassy-winged Sharpshooter Advisory Group

The CACASA GWSS Advisory Group is composed of agricultural commissioner representatives from each of the five CACASA Area Groups in the state. This group meets regularly to discuss issues of statewide and regional concern and to promote statewide program consistency and good communication among state and county cooperators.

Strategic Planning

Strategic planning is an ongoing process. In 2002, the program continued with its strategic planning efforts to ensure that the organization remained properly focused on appropriate goals and strategies.

The program used internal and external assessments and a review of strategies, activities, and performance measures to establish specific goals for 2003. These goals are as follows:

- Implement a mechanism for screening approved nursery stock treatments;
- Expand rearing capacity and releases of biological control agents;
- Complete the environmental impact report for the program;
- Establish a mechanism for improving coordination and monitoring of research and interaction with and among researchers; and
- Implement successful areawide sharpshooter suppression programs in Ventura County and other areas threatened by resident populations of the pest.

Summary of Accomplishments in 2002

The following summarizes the major accomplishments of the Pierce's Disease Program in 2002.

Contain the Spread

- Approximately 65,800 shipments of regulated plant material were made in 2002, with only 77 problem shipments. This is a success rate of 99.88%. This compares favorably to program results in 2001, which featured 57,600 shipments and 151 problem shipments, yielding a success rate of 99.74%.
- Program staff conducted 24 training sessions early in the year to prepare county staff for the busy spring nursery stock shipping season.
- As in prior years, no glassy-winged sharpshooters were found in bulk grape shipments during 2002.
- Bulk citrus shipments received closer scrutiny to mitigate the risk they presented of moving the sharpshooter. The Citrus Subcommittee met several times to develop improved mitigation measures, which were implemented in October 2002.
- Revised and expanded emergency regulations were filed in October 2002.

Statewide Survey

- Survey efforts found new infestations in Fresno, Imperial, Sacramento, Santa Clara, and Tulare Counties, triggering rapid response activities.
- Statewide survey guidelines were revised for the 2002 season, incorporating lessons learned from the prior season.
- Results from the statewide survey confirmed that 35 at-risk California counties are completely free of the glassy-winged sharpshooter.
- Quality control checks were conducted on county and state trapping programs, to ensure effectiveness and statewide consistency.
- The program made significant progress at developing an internet map server to quickly map and display discoveries of Pierce's disease and the glassy-winged sharpshooter.

Rapid Response

- Delimitation and treatment activities were conducted in areas of Butte, Fresno, Imperial, Sacramento, Santa Clara, and Tulare Counties where isolated infestations of the glassy-winged sharpshooter were found.
- In August 2002, based on several months of monitoring with no additional pest finds, the sharpshooter infestation in the Brentwood area of Contra Costa County was declared eradicated. This marked the first eradication of a localized infestation.

Public Outreach

- Inaugural issues of newsletters for stakeholders and winegrape assessment participants were prepared and distributed in 2002. These newsletters were developed to provide interested and affected parties with program updates and useful information. In addition, the newsletters work to keep the Pierce's Disease/GWSS Board's constituency informed of Board activities.

- An option for accessing information on Pierce's disease and the glassy-winged sharpshooter was added to the CDFA's Exotic Pest Hotline (1-800-491-1899). The information is available in English, Spanish, and Vietnamese.
- Information cards were developed by an industry cooperator advising citrus harvesters about the glassy-winged sharpshooter and how to prevent its spread.

Research

- The nation's best plant health and pest researchers were engaged in 70 research projects to aid in the fight against Pierce's disease and the glassy-winged sharpshooter.
- The second annual Pierce's Disease Research Symposium was held in December, featuring progress reports by researchers. Similar to last year, proceedings were prepared and distributed at the symposium.
- The National Academy of Sciences was engaged to review past, current, and potential research activities and develop a long-term research strategy for solving the problem of Pierce's disease. The project is expected to take 18 months and will include appointment of a 12-member committee.
- Pest management pilot projects were continued in Temecula and Kern County. These projects are the work of a partnership between CDFA, USDA, County Agricultural Commissioners, the University of California, and the agricultural industry. The program conducted trapping and provided other support to the Kern County Pilot Project, contributing to the development of information on successful control of Pierce's disease and the glassy-winged sharpshooter in a large, agriculturally-diverse area. Efforts are underway to expand the project area to include portions of Tulare County.
- A pest management pilot project was initiated in Ventura County, to test the effectiveness of areawide sharpshooter control in citrus to protect nursery stock from infestation.
- A barrier pilot project was begun at a large nursery in Ventura County to test the efficacy of 15-foot-tall screen barriers to protect nursery stock from surrounding sharpshooter infested areas.
- Planning was begun for an areawide project in the Coachella Valley where infected vines were found in 2002.

Biological Control

- Approximately 290,000 parasitic wasps were released in 2002 against the glassy-winged sharpshooter. This is more than twice the number released in 2001. Releases were made in nine counties and involved four different species of wasp.
- Thirty-five field recoveries of the introduced wasp species were made, providing an encouraging indication of natural enemy establishment.

Environmental Compliance

- The Draft Environmental Impact Report (EIR) for the Pierce's Disease Program was completed and released for public comment in March 2002. Approximately 140 individuals and organizations submitted comments. The CDFA is now preparing responses to the comments received and should release the Final EIR in early 2003.
- Environmental monitoring was conducted during treatment activities in Imperial and Santa Clara Counties. Summaries of study results were posted on the Department of Pesticide Regulation's Web site.

Advisory Groups

- The Pierce's Disease Advisory Task Force, Pierce's Disease/GWSS Board, and associated subcommittees developed recommendations for the secretary and the program.
- The program worked with a subcommittee of county agricultural commissioners to reach consensus on county workplan contract amounts for Fiscal Year 2002-03 in the face of necessary budget reductions.
- The Pierce's Disease/GWSS Science Advisory Panel developed comments and recommendations for each major element of the Pierce's Disease Program.

Other

- A total of $6.4 million in federal funds was disbursed to 44 growers in four counties under a compensation program developed and implemented by the program, to compensate growers for vineyard losses caused by Pierce's disease and the glassy-winged sharpshooter.

Contain the Spread

The Contain the Spread element of the program is designed to prevent the spread of the glassy-winged sharpshooter on articles and commodities shipped from the infested area. The focus is to mitigate the pest threat posed by the movement of commodities from infested areas to non-infested areas of the state.

Emergency regulations governing the movement of nursery stock and bulk grapes were first adopted on July 25, 2000. Regulations on bulk citrus shipments were added later following finds of live sharpshooters in citrus shipments. The emergency regulations have been renewed as necessary, and new emergency regulations were filed in October 2002.

Nursery

Nursery stock is a high-risk commodity in terms of glassy-winged sharpshooter mobility. California has almost 9,000 licensed nurseries, 60% of which are located in sharpshooter-infested counties. Many of these nurseries ship to the uninfested areas of the state. In 2002, nurseries in infested areas continued to absorb the costs associated with complying with nursery stock shipping regulations.

Activities to mitigate the risk of moving the glassy-winged sharpshooter on nursery stock include:

1. Inspection of nursery stock in infested areas prior to shipping to non-infested areas;
2. Treatment of nursery stock when necessary;
3. Certification of shipments; and
4. Notification of nurseries receiving nursery stock to hold the shipments for inspection prior to sale.

Inspection Results

There were approximately 65,800 shipments of nursery stock from the infested area to the uninfested area in 2002. Viable life stages of glassy-winged sharpshooter were discovered on only 77 of these shipments. This is a success rate of 99.88%. The 2002 results compare favorably with those from prior years (see table below). Egg masses are the most frequently discovered life stage of the sharpshooter in nursery stock.

Regulated Nursery Shipments

YEAR	NUMBER OF SHIPMENTS	GWSS FOUND	% FREE OF GWSS
2000	52,000	94	99.82%
2001	57,600	151	99.74%
2002	65,800	77	99.88%

Nursery shipment results.

Enforcement Actions

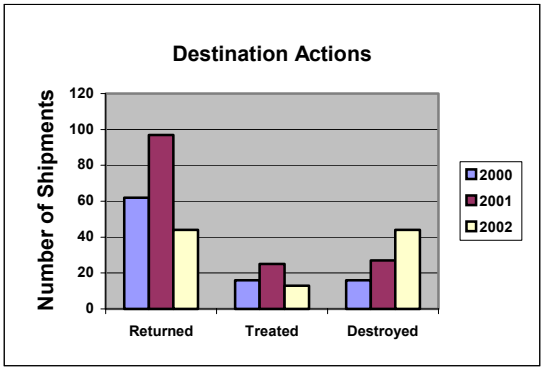
Enforcement actions are taken against nurseries and nursery shipments which violate the regulations. Actions can be taken at origin or destination. Actions that can be taken at origin consist of the following:

- ***Restriction*** The nursery is restricted from shipping certain host material species out of the infested area for a period of time.
- ***Suspension*** The nursery is suspended from shipping all host material species out of the infested area until the pest risk is mitigated.
- ***Revocation*** The nursery's compliance agreement is revoked and it cannot ship host material species out of the infested area for an established period of time.

Actions that can be taken at the final destination of nursery shipments include the following:

- ***Treatment*** The nursery shipment must be treated with an effective material.
- ***Return*** The shipment must be returned to origin.
- ***Destruction*** The shipment must be destroyed.

Shippers and receivers who violate nursery stock regulations are subject to fines. In 2002, administrative penalties were levied against two companies, totaling $4,000 in fines.



Number of actions taken at destination.

Bulk Grapes

Many of the state's grape growers sell their harvest to grape processors (i.e., wineries, juice manufacturers) located far from the production vineyard. Regulations and protocols are in place to prevent this large-scale movement of bulk grapes from moving live glassy-winged sharpshooters to new areas of the state. The program includes inspection and monitoring of origin vineyards and bulk grape shipments, along with a color-coded certification tag system for shipments from counties with infested areas. During 2002, approximately 115,000 shipments of bulk grapes were monitored. Nearly 20,000 of those shipments originated from infested counties and traveled to their destination with the required certification tags. Similar to prior seasons, no glassy-winged sharpshooters were found in any bulk grape shipments.

Color-coded tag used to certify shipments of grapes and citrus.

Bulk Citrus

Citrus trees are primary hosts for the glassy-winged sharpshooter throughout the year. When the weather is warm, the insects are active and will flee the disturbances associated with harvest. However, once the weather turns cold the sharpshooters are relatively inactive, and can end up in picking bags with harvested fruit, ultimately turning up at processing facilities in other parts of the state.

During the most recent citrus shipping season (October 2001 through September 2002), live glassy-winged sharpshooters were found in 170 out of approximately 15,000 shipments of bulk citrus received in Fresno, Kern, and Tulare Counties. This prompted a thorough review of the bulk citrus glassy-winged sharpshooter mitigation program. During 2002, CDFA staff met several times with industry, county, and federal representatives to improve the effectiveness of the program. Protocols were revised and strengthened, and these revisions were incorporated into new emergency regulations filed in October 2002. Efforts to refine the bulk shipment protocol continue, as do efforts to find acceptable pre- and post-harvest treatments for citrus.

Statewide Survey and Detection

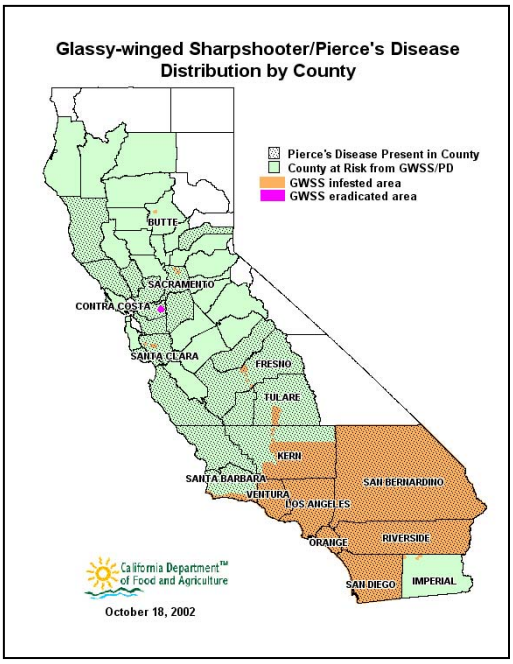
The Statewide Survey and Detection element of the program is designed to locate new glassy-winged sharpshooter infestations quickly, verify that areas remain free of infestation, determine infestation status, and monitor pest populations.

The activities of this element focus on systematically surveying and trapping commercial, residential, nursery, and cropland areas to determine if the glassy-winged sharpshooter is present.

Revised survey protocols were distributed to all California counties in the spring of 2002. The revisions reflected decreased emphasis on visual survey and more reliance on trapping to achieve initial detections of new infestations.

During 2002, onsite detection training was provided to county personnel in 43 counties. CDFA biologists assisted county personnel with field surveys and also conducted quality control inspections of county detection trapping programs. The program is developing an internet map server to quickly map and display discoveries of Pierce's disease and the glassy-winged sharpshooter.

Research and field experience have provided better information about the biology of the glassy-winged sharpshooter, allowing for further refinement of detection techniques. Each season of detection work contributes to our knowledge of the pest's distribution and furthers our ability to detect and stop its spread.



Map showing the at-risk area and the distributions of Pierce's disease and the glassy-winged sharpshooter.

Rapid Response

The Rapid Response element involves responding quickly to potential new infestations. When evidence of a potential new infestation is discovered, the county agricultural commissioner proceeds according to established protocols. The county first initiates a delimitation survey to determine if an infestation is present and, if so, how large an area is infested. In agricultural settings, treatments are applied by the grower in a manner approved and supervised by the county. In urban and residential areas, treatment costs are covered by the program and applied under supervision of the county.

During 2002, approximately 2,500 infested or adjacent properties were treated in six counties during rapid response activities. Treatments were applied on isolated infestations in Butte, Fresno, Imperial, Sacramento, Santa Clara, and Tulare Counties (see Appendix C for maps of treatment areas).

Sharpshooter populations were notably lower in areas treated in prior years. For instance, Fresno County detected 918 infested properties in 2000 and only 506 in 2002. Similarly, Tulare County found 1,027 infested properties in Porterville and Terra Bella in 2000 and only 735 properties in 2002. Butte County had only one infested property in 2002, compared to 12 in prior years. In Brentwood, Contra Costa County, no sharpshooters have been found since October 2000, and the infestation was declared eradicated in August 2002. This marked the first time a localized infestation of the sharpshooter had been eradicated.

Pre-Treatment Communication with Stakeholders

Specific steps are taken to ensure residents are properly advised and environmental concerns addressed before rapid response treatments are applied. A public meeting to provide community members the opportunity to learn about the treatment process and discuss it with environmental health and program specialists precedes any treatment in urban or residential areas. Door-to-door contacts, direct mail, and local media sources are used to inform residents of public meetings. Occupants of all properties scheduled for treatment are provided individual advanced notification of the treatment date and time as well as the label of the pesticide to be used and a phone number to call for more information.

To address environmental concerns, a California database of threatened and endangered species is consulted to determine if any listed species are present in the treatment area. Additionally, both the U.S. Fish and Wildlife Service and the California Department of Fish and Game are notified of impending treatments. The California Department of Pesticide Regulation, the California Department of Health Services, and other agencies are also notified prior to treatment.

Pesticide Use & Monitoring

Public safety is the number one concern whenever pesticide treatments are applied on sharpshooter infestations. Program staff and cooperators ensure that only the proper materials are applied in strict compliance with label and other restrictions.

The insecticide carbaryl was the material used against new infestations detected in the first year of the program. This material is labeled for use in residential settings on a broad variety of ornamental plants and fruit trees. The CDFA had previous experience with this material and had earlier done a full environmental review of its use[4]. Imidacloprid is a newer product that has proven very effective against the sharpshooter. It has been used in treatment programs on ornamental plantings. Cyfluthrin is another material that is being used on ornamental plantings.

The Environmental Hazards Assessment Program of the California Department of Pesticide Regulation monitors pesticide treatments to determine resulting target and nontarget residue levels. This information is used by the Pierce's Disease Program to assess proper application rate and coverage. Sampling results and related monitoring reports are available on the Department of Pesticide Regulation's Web site (www.cdpr.ca.gov/docs/gwss).

The program has enlisted the assistance of the California Conservation Corps and the California Department of Transportation in the fight against Pierce's disease and the glassy-winged sharpshooter. The California Conservation Corps has helped the program to quickly delimit new infestations and prepare for treatment activities. Caltrans employees have been trained to identify the sharpshooter and have assisted with treatment activities along California's highways.

Member of the California Conservation Corps helping delimit a newly-discovered sharpshooter infestation.

[4] Final Environmental Impact Report, Gypsy Moth Eradication Program in California. CDFA, 1992.

Outreach

The goal of the outreach effort is to raise awareness about Pierce's disease and the glassy-winged sharpshooter and the threat these pose to agriculture and the environment of California. We believe that public awareness leads to public involvement, which in turn leads to earlier detection of infestations and reduced damage from this serious pest and disease complex.

During 2002, the program built upon the significant progress made in earlier years by continuing to maintain program visibility and stakeholder awareness. This was accomplished through newsletters, press releases, public meetings, networking with stakeholders, and the program's Web site. Dozens of individuals involved or affected by the program have been trained and provided with materials for making presentations to local audiences. These volunteer representatives also serve as resources for local media, and as speakers for local events.

The ongoing outreach program also helps community members understand the significance of the threat of Pierce's disease and the measures available and under development to combat it. As infestations are discovered, outreach staff assist local authorities with planning and conducting public meetings; informing the media; providing information and instructive materials to local organizations; and working with local agricultural officials at responding to each community's unique social, environmental, and public health needs and concerns.

Accomplishments

Media Coverage

Over 1,000 articles and reports about Pierce's disease and the glassy-winged sharpshooter have appeared in national and international publications, on television and radio shows, and on internet Web sites since the start of the program. On balance, the coverage has been fair and factual and has included many statements and much information generated by the outreach program.

Media Guide

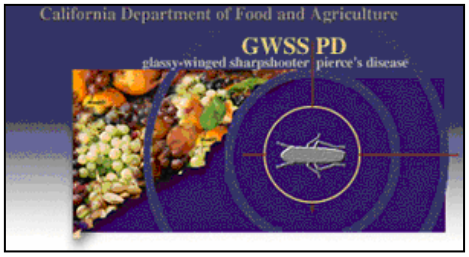
A media guide produced by the California Farm Bureau Federation in coordination with the program identifies scientific experts and industry spokespeople throughout the state who are available as contacts for reporters. These individuals have received extensive information on the program from the California Department of Food and Agriculture and have volunteered to help disseminate accurate, timely information through the media and other outlets. This guide is available in print and online.

Informational Materials

Program staff, working with the Outreach Subcommittee of the Pierce's Disease Advisory Task Force, have compiled a list of outreach materials produced by the program, county officials, the University of California, and industry groups. As needs arise in different counties and communities, this list of available materials will enable authorities to share these resources, quickly adapt them to match local needs, and deliver a more cohesive message statewide.

Web Site

The CDFA has a highly successful Web site dedicated to Pierce's disease and the glassy-winged sharpshooter. The Web site was activated in March 2000 and has received over one million visits. The site offers frequent updates on program activities, survey and regulation guidelines, treatment information, upcoming meetings and events, the host list, and other information. In addition, the Web site provides an interactive interface that allows direct activity reporting by local entities.



Graphic from the home page of the Program's Web site.

Research

Research continues to be an integral part of the Pierce's Disease Program, and holds the key to developing a long-term solution to the problem. The flurry of research activity which began at the start of the program continues, with approximately 70 projects being conducted in 2002 by some of the nation's best plant health researchers. Projects ranged from lab-based investigations at the molecular and genomic level to huge areawide projects in major agricultural areas. In total, more than $15 million has been committed to research. The information generated is giving valuable insight into the biology, ecology, and behavior of the plant disease and its vector, moving us closer to an eventual cure. See Appendix E for a list of research projects conducted in 2002.

Scientific Communication

The second annual Pierce's Disease Research Symposium was held in mid-December 2002 in San Diego. Like the first Symposium, this end-of-the-year event brought together researchers from throughout the nation and the world to learn about the latest developments and discoveries. A compilation of progress reports was prepared in conjunction with the meeting to help communicate these latest research findings. It is available in paper and electronic format.

Research Strategy

Using funds collected from the winegrape industry under Assembly Bill 1394 (Wiggins), the National Academy of Sciences (NAS) was engaged in late 2002 to develop a research strategy for solving the Pierce's disease problem. The NAS will seek out the best and the brightest across all disciplines to study past, present, and potential future research activities and identify the most promising avenues and directions to pursue. Half a million dollars has been dedicated to this 18-month project, which should be completed in mid-2004.

Research Partners

Assembly Bill 1394 assessments also funded 13 research projects in 2002, totaling approximately $1 million. Funding for other projects is being provided by the United States Department of Agriculture, the University of California, local government, and industry.

Pilot Projects

Kern County Pilot Project

The Kern County Pilot Project is a cooperative, multi-agency project being conducted to develop areawide pest management strategies against the glassy-winged sharpshooter in a large (13,000 acres), agriculturally-diverse area. USDA's Animal and Plant Health Inspection Service serves as the lead agency. The project involves year-round monitoring of sharpshooter populations and selective treatment of infestations when triggers are met. Last year, initial treatments were made in citrus in the winter and early spring, when sharpshooter populations were restricted to this crop. Monitoring during this, the second year of the project, identified

seven citrus groves that met treatment triggers. This is 78% fewer than the 32 groves that were treated in the first year of the project. Overall, sharpshooter populations remained at extremely low levels throughout the year.

A computerized data collection and management system was implemented this year, using barcodes and scanners to improve tracking of each insect trap in the project. The data collected is used for developing maps and analyzing the sharpshooter's distribution and movement.

Overall, the pilot project has made significant progress. The next phase of the study is to develop strategies that are least disruptive to established integrated pest management programs and the use of natural enemies.

Kern County Areawide Project

Following the early success of the Kern County Pilot Project, project personnel were approached by local growers and asked to develop a similar pest management program for the entire production area of Kern County. This area would include agricultural lands as well as the City of Bakersfield and several smaller communities (see map in Appendix D).

Monitoring for the glassy-winged sharpshooter and Pierce's disease is occurring throughout the entire project area. The traps provide information on sharpshooter population numbers and serve as indicators of developing "hot spots" where treatments may be needed.

The northern zone was selected as the initial area to begin the program, since it historically experienced more problems with the sharpshooter. The program will expand to additional zones in the spring.

Other Pilot Projects

During 2002, pilot project activities continued in Temecula, while new projects were initiated in Ventura and Riverside counties. The Temecula project was implemented to test management methods in the first area to suffer major losses from Pierce's disease vectored by the glassy-winged sharpshooter. This project continues to generate useful information which can be applied by growers facing similar pest conditions. A pest management pilot project was initiated in Ventura County in 2002 to test the effectiveness of areawide sharpshooter control at protecting nursery stock from infestation. This project will involve treating citrus groves in close proximity to nurseries. A barrier pilot project was begun at a large nursery in Ventura County to test the efficacy of 15-foot-tall screen barriers to protect nursery stock from surrounding sharpshooter infested areas, including riparian areas where pesticide treatments cannot be applied. Also during 2002, planning was begun for an areawide project in the Coachella Valley, where Pierce's disease-infected vines were found last year for the first time in many years.

Epidemiology Projects

In August 2002, two projects were begun to learn more about the epidemiology of Pierce's disease in the presence of glassy-winged sharpshooter. These projects involve surveying affected vineyards, identifying diseased vines, mapping the locations of these vines, and then tracking the progression and extent of disease under various conditions. These projects focus

on the Kern-Tulare county area, a major viticulture area within California at which the glassy-winged sharpshooter has recently arrived.

The first study, conducted by CDFA and funded by the Pierce's Disease/GWSS Board winegrape assessment, is evaluating the impact of epidemiological factors on the spread of Pierce's disease. Some of the variables being considered are the sharpshooter population size, differences in disease susceptibility of various grape cultivars, vine age, proximity to citrus or other sharpshooter overwintering hosts, chemical treatments of vineyards, prompt removal of diseased vines, and weed control.

The second study, conducted and funded by the University of California's Cooperative Extension Service, is seeking to determine the extent of Pierce's disease in areas infested with the glassy-winged sharpshooter, and is exploring cultural practices that will help growers reduce economic losses from the disease.

In 2002, approximately 4,000 acres in 220 vineyards in Kern and Tulare counties were surveyed as a result of these two studies. A central data management center is being established to compile the project results. The resulting data, maps, and information will be shared with collaborating plant pathologists, statistical analysts, agricultural economists, and other researchers to maximize the opportunity to understand the epidemiology of Pierce's disease, determine how to better manage the disease, and generate projections for potential economic consequences and risk assessment.

Biological Control

Biological control involves using natural enemies of a pest to reduce the pest's population size and consequent damage. When successful, this method mitigates the need for pesticide-based solutions for pest control. It is one of the most promising long-term solutions for combating the glassy-winged sharpshooter.

The biological control component of the Pierce's Disease Program has three major activities:

1) Biological control agent selection;
2) Biological control agent production; and
3) Release and evaluation of biological control agents.

Biological Control Agent Selection

Selecting the right organisms to use as natural enemies is critical to the success of biological control efforts. The most successful agents will persist in the new target environment, reduce pest numbers to nondamaging levels, and not impact nontarget organisms. Early studies on the glassy-winged sharpshooter revealed that the sharpshooter's most important natural enemies were tiny wasps that oviposited (laid eggs) in the eggs of the sharpshooter, killing them. Based on this finding, the primary effort of the glassy-winged sharpshooter biological control program has been to rear and release these tiny egg parasites. However, efforts to identify additional promising natural enemies will continue. Climate matching techniques have been used to find regions in South America that have a climate similar to inland California. Natural enemies of sharpshooters in these regions may be able to control the sharpshooter in California more effectively than insects collected in the more humid, native range of the glassy-winged sharpshooter. To date, eight species of egg parasites have been collected from South America and are undergoing appraisal as potential biological control agents of the glassy-winged sharpshooter.

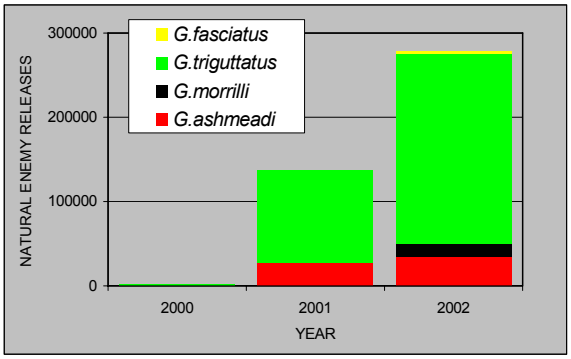
Tiny wasp parasites on a GWSS eggmass.

In 2002, another species of egg parasite was added to the list of biological control agents being reared and released against the sharpshooter. The new parasite, *Gonatocerus fasciatus*, has a number of attributes that favor it as an early season control agent. It has been found further north and earlier in the year than other parasite species, and is gregarious, meaning that several wasps emerge from one sharpshooter egg compared to only one per egg for other species of *Gonatocerus*. The permit for release of this insect into California was approved in August and releases started in September.

Biological Control Agent Production

Two program facilities were established in 2001 for producing biological control agents of the glassy-winged sharpshooter. These are the Mount Rubidoux Field Station, located in Riverside and wholly operated by CDFA, and the Oswell Street Biological Control Facility, located in Bakersfield and jointly run by CDFA and the USDA's Animal and Plant Health Inspection

Service. Together, these facilities produced over 290,000 parasitic wasps in 2002 and tested different approaches for increasing parasite production.



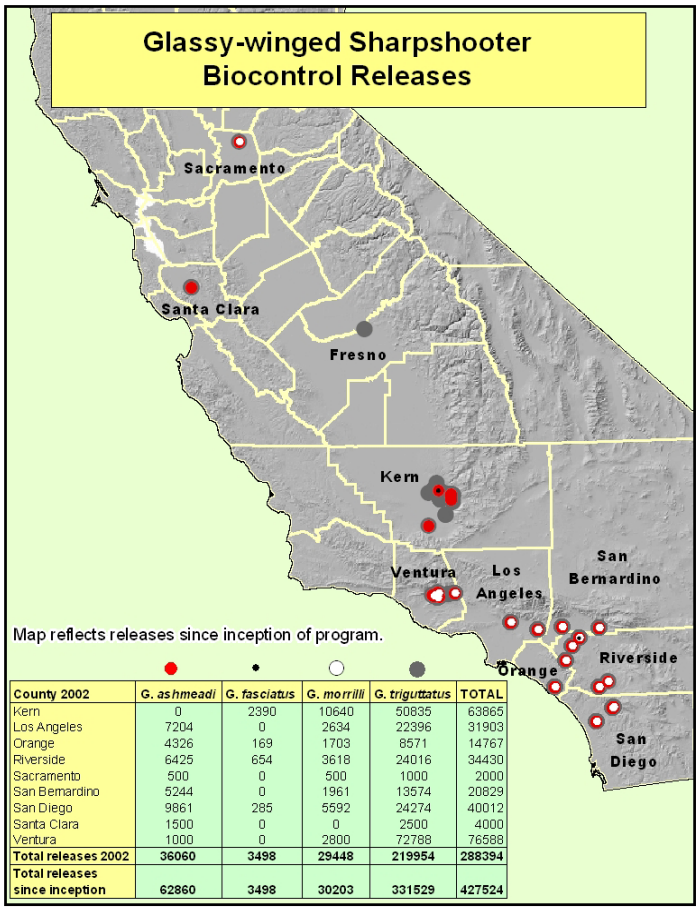
Natural enemy release numbers.

Both field-collected and laboratory-reared sharpshooters are used to obtain eggs for producing the egg parasites. Producing the parasites at rearing facilities is challenging because it requires that sharpshooters and their host plants also be cultured. Each step presents challenges, and the program is constantly evaluating each step to look for ways to optimize overall production. For instance, at the plant level, the program is researching the optimum plant species, lighting, fertilizer, and temperatures to use for producing sharpshooter eggs. Some of the sharpshooter eggs produced are stored at reduced temperatures to provide host material for parasites during times of low egg production, and others are retained for research and development.

Release and Evaluation of Biological Control Agents

Approximately 290,000 parasitic wasps were released against the glassy-winged sharpshooter in 2002. This is more than double that of the previous year. A total of 224 separate releases were made at 38 release sites in nine counties. Multiple recoveries of introduced parasites were made at 10 sites in five counties. These recoveries indicate that the introduced parasites can locate, parasitize, and develop on glassy-winged sharpshooter eggs for at least one generation.

In 2003 the program will continue to improve production techniques and finish renovation of facilities. Screening of exotic natural enemies in quarantine will continue, and release permits will be requested for those found to be promising. The program anticipates significant increases in parasite production and a corresponding increase in the importance of biological control as a component of the pest management system for the glassy-winged sharpshooter.



County 2002	G. *ashmeadi*	G. *fasciatus*	G. *morrilli*	G. *triguttatus*	TOTAL
Kern	0	2390	10640	50835	63865
Los Angeles	7204	0	2634	22396	31903
Orange	4326	169	1703	8571	14767
Riverside	6425	654	3618	24016	34430
Sacramento	500	0	500	1000	2000
San Bernardino	5244	0	1961	13574	20829
San Diego	9861	285	5592	24274	40012
Santa Clara	1500	0	0	2500	4000
Ventura	1000	0	2800	72788	76588
Total releases 2002	**36060**	**3498**	**29448**	**219954**	**288394**
Total releases since inception	**62860**	**3498**	**30203**	**331529**	**427524**

Map and table showing biocontrol agent releases.

Environmental Compliance

The CDFA continues with its commitment and efforts to ensure that the Pierce's Disease Program is conducted in an environmentally responsible manner. These efforts include preparation of a statewide programmatic Environmental Impact Report (EIR), adhering to a special consultation process with federal and state environmental stewardship agencies when treatments are planned in nonagricultural areas, conducting environmental monitoring during treatments, and ensuring that pesticide applications are performed by licensed pest control professionals in strict accordance with pesticide laws and regulations.

Last year's Report to the Legislature indicated that the Department was preparing a programmatic EIR for the statewide Pierce's Disease Program. The Draft EIR was completed and released for public review and comment in late March of 2002. The document informed the public and decision makers on the potential environmental effects associated with program activities. Since the Pierce's Disease Program is a program of statewide interest and concern, the Draft EIR was given extensive distribution, with copies being mailed to every city and county planning department in the state, every county board of supervisors, every county agricultural commissioner, the main branch of every county library, members of program task forces, panels, subcommittees, and boards, other government agencies, and interested parties. A notice of availability was also given wide distribution, and five public meetings were held throughout the state. The public comment review period ended mid-May 2002. CDFA is now preparing responses to the comments received. The Final EIR is expected to be released in early 2003.

Conclusion

This has been a significant year in the fight against Pierce's disease and the glassy-winged sharpshooter. The statewide Pierce's Disease Program continued to effectively address this serious pest problem through its comprehensive approach of preventing the spread of the sharpshooter to new areas, finding and responding to new infestations, maintaining effective outreach, and coordinating research. The program's success reflects the hard work of program staff and the contributions of industry stakeholders and federal, local, and University cooperators.

Looking ahead to 2003, specific goals have been established for improving program performance. These include implementing a mechanism for screening approved nursery stock treatments, expanding rearing capacity and releases of biological control agents, completing the environmental impact report for the program, bolstering coordination and monitoring of research, and implementing successful areawide sharpshooter suppression programs.

A key challenge to the program is the availability of resources. State funding continues to be critical to the success of the program. The federal government has recognized the importance of finding a solution by committing significant funding and has indicated it will provide future support. Industry's willingness to participate in funding has been demonstrated and is vital to the program's success. With the continuing cooperation and assistance of our government, University, and industry partners, we will continue moving closer to finding a long-term solution to this serious pest problem.

Financial Statement

Revenue and Expenditure Report

FISCAL YEAR	2001/02	2002/03
BEGINNING BALANCE	2,596,313	13,693
REVENUE		
State (Budget Act)	8,287,500	6,087,600
Federal (USDA)	6,321,159	10,995,000
Board Assessment		152,000
Research (AB 1232)	750,000	0
Total Resources	17,954,972	17,248,293
EXPENDITURES		
Personal Services	2,501,528	2,695,490
Operating Expenses	3,354,871	2,608,409
County Payment	12,084,880	11,917,424
Total	17,941,279	17,221,323
Fund Balance	13,693	26,970

Appendix A

Chronology of Program Events

1999

Early Summer 1999 - Winegrape growers in Riverside County notice a sudden and alarming increase in the death of grapevines in a number of area vineyards. The culprit of the destruction is Pierce's disease, spread by a new vector, the glassy-winged sharpshooter.

August 1999 - The Riverside County Board of Supervisors declares a local emergency. Riverside County and the City of Temecula each contribute $125,000 for research to combat Pierce's disease. Within days, Secretary William (Bill) J. Lyons, Jr. of the California Department of Food and Agriculture adopts an action plan and appoints a task force to develop long-term strategies and resources to combat the emerging threat. CDFA resources redirected to coordinate activities, meet with stakeholders, and implement the early stages of the action plan.

November 1999 - Governor Gray Davis signs urgency legislation (Assembly Bill 1232; Committee on Agriculture) allocating $2.25 million over three years for Pierce's disease research, and creating an advisory task force. Secretary Lyons secures federal assistance to reduce sharpshooter populations in Temecula.

2000

January 2000 - First meeting of the Pierce's Disease Advisory Task Force. Subcommittees established to review research proposals and develop management plans. A preliminary survey indicates that the glassy-winged sharpshooter is present in eight southern California counties.

February 2000 - Southern California nursery industry adopts voluntary inspection and treatment program to prevent spread of glassy-winged sharpshooter. Secretary Lyons meets with federal government officials to seek their assistance.

March 2000 - CDFA develops and releases statewide survey protocols and guidelines for counties to use to find infestations of the glassy-winged sharpshooter. Several noninfested counties begin to inspect incoming nursery stock shipments from infested areas. CDFA develops and activates Web site dedicated to Pierce's disease and the glassy-winged sharpshooter to keep stakeholders and cooperators better informed. The site is visited over 500,000 times during its first year of operation.

Spring 2000 - Scientists from CDFA and the University of California travel to Mexico to search for natural enemies of the glassy-winged sharpshooter, in support of the critical biological control element of the program.

May 2000 - The Pierce's Disease Program is formally established through urgency legislation (Senate Bill 671; Chesbro) signed by the Governor. SB 671 outlines specific requirements for county agencies and authorizes the CDFA to adopt program regulations. The legislation allocates $6.9 million to the program from the state's 1999/00 budget and supports an additional $6.9 million in the 2000/01 Budget Act. In San Joaquin County, a single glassy-winged sharpshooter is trapped in a nursery distant from the infested areas. The subsequent large-scale survey effort helps establish the protocol for responding to new sharpshooter discoveries. Later in the month, infestations of the sharpshooter are discovered in residential areas of Tulare and Fresno Counties. Multiple state and local agencies are mobilized for rapid response.

June 2000 - At Governor Davis' request, the federal government issues a declaration of emergency. Federal assistance of $22.3 million is committed to counter the spread of the glassy-winged sharpshooter and support research to find a solution to Pierce's disease.

July 2000 - Emergency regulations adopted by CDFA to regulate the movement of nursery stock and bulk grapes. Statewide compliance programs developed and implemented.

Summer 2000 - Survey and detection efforts find additional sharpshooter infestations in Fresno and Sacramento Counties.

August 2000 - Scientists from CDFA and the University of California initiate a pilot project by releasing limited numbers of a natural enemy of the glassy-winged sharpshooter, a tiny parasitic wasp from Mexico. Releases are made in Kern, Riverside, and Ventura Counties.

October 2000 - Additional new sharpshooter infestations are discovered in Butte, Contra Costa, Fresno, and Tulare Counties. State and local agencies work together to treat over 250 residential properties. In accordance with supplemental budget language, an Environmental Protection Task Force is formed by CDFA and begins a series of meetings to review the potential environmental impacts associated with program treatments. Live sharpshooters found in bulk citrus shipments; shipping temporarily suspended until CDFA adopts new emergency regulations for bulk citrus.

Fall 2000 - Kern County Pilot Project begins. This multi-agency project, lead and primarily funded by USDA's Animal and Plant Health Inspection Service, will study the movement of the sharpshooter and search for effective pest management methods in a large, agriculturally diverse area.

Late 2000 - CDFA conducts regional stakeholder meetings in Napa, Orange, Sacramento, San Diego, San Luis Obispo, Stanislaus, and Tulare Counties to gather input regarding program activities. Grape growers, vintners, nursery operators, environmental organization representatives, and general public members attend and comment on the program. The Environmental Protection Task Force issues recommendations to the Secretary in a formal report.

2001

Early 2001 - CDFA staff and an outside consultant begin preparing an Environmental Impact Report (EIR) covering the Pierce's Disease Program and activities of county co-operators.

April 2001 - Public scoping meetings held throughout the state to maximize opportunity for public input into the EIR process.

July 2001 - Assembly Bill 1394 (Wiggins) signed, bolstering research and other program activities by providing approximately $5 million per year for five years from an assessment on winegrapes. This urgency bill also establishes the Pierce's Disease and Glassy-winged Sharpshooter Board to develop recommendations on the use of collected monies.

December 2001 - CDFA organizes and holds the first annual Pierce's Disease Research Symposium, featuring progress reports by principal investigators on approximately 60 ongoing research projects dealing with Pierce's disease and the glassy-winged sharpshooter.

2002

March 2002 - Pierce's Disease Program Draft Environmental Impact Report completed and released for public review and comment. Five public meetings held in April throughout the state. Public comment period closes in May. CDFA now preparing responses to comments received.

August 2002 - Sharpshooter infestation in Brentwood (Contra Costa County) declared eradicated, marking the first time that a localized sharpshooter infestation has been eradicated. County now considered completely free of the glassy-winged sharpshooter.

September 2002 - Pierce's Disease/GWSS Science Advisory Panel meets in Sacramento to review program and develop recommendations.

October 2002 - New emergency program regulations filed.

December 2002 - CDFA organizes and holds the second annual Pierce's Disease Research Symposium, featuring progress reports on 70 research projects.

Appendix B

Board, Task Force, and Advisory Panel Members

Pierce's Disease/Glassy-winged Sharpshooter Board

Dana Merrill (Chair)
Mesa Vineyard Management
Paso Robles, CA

Kevin Andrew
Sun World International, Inc.
Bakersfield, CA

Dennis J. Atkinson
Tejon Ranch Company
Lebec, CA

Gregory Coleman
E & J Gallo Winery
Modesto, CA

Edgar "Pete" Downs
Kendall-Jackson Wine Estates
Santa Rosa, CA

Bennett Drake
Drake Enterprises, Inc.
Temecula, CA

Bradford Lange
Lange Twins, Inc.
Acampo, CA

Frank Leeds
Chavez & Leeds Vineyards
St. Helena, CA

Steve McIntyre
Monterey Pacific, Inc.
Soledad, CA

Albert Rossini
Rossini Farming Company, Inc.
Ceres, CA

Herb Schmidt
Robert Mondavi Winery
Napa, CA

Robert Steinhauer
Beringer Blass Wine Estates
St. Helena, CA

James Glen Unti
Canandaigua Wine Company
Madera, CA

Paul Wulf
Wulf Vineyards
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Lange Twins, Inc.
Acampo, CA

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Cooperative Extension
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Napa County Agricultural Commissioner
Napa, CA

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Almond Board of California
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Pavich Farms
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Manteca, CA

Kirk Brown
Golden State Vintners
Parlier, CA

Pete Camarda
The Wine Group
Madera, CA

Gregory Coleman
E & J Gallo Winery
Modesto, CA

Nat Dibuduo
Allied Grape Growers
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Edgar "Pete" Downs
Kendall-Jackson Wine Estates
Santa Rosa, CA

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Bronco Wine Company
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Galleano Winery
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Hal Huffsmith
Sutter Home Winery
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Bakersfield, CA

Cato Fiksdal
Los Angeles County Agricultural Commissioner
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Jearl Howard
Calaveras County Agricultural Commissioner
San Andreas, CA

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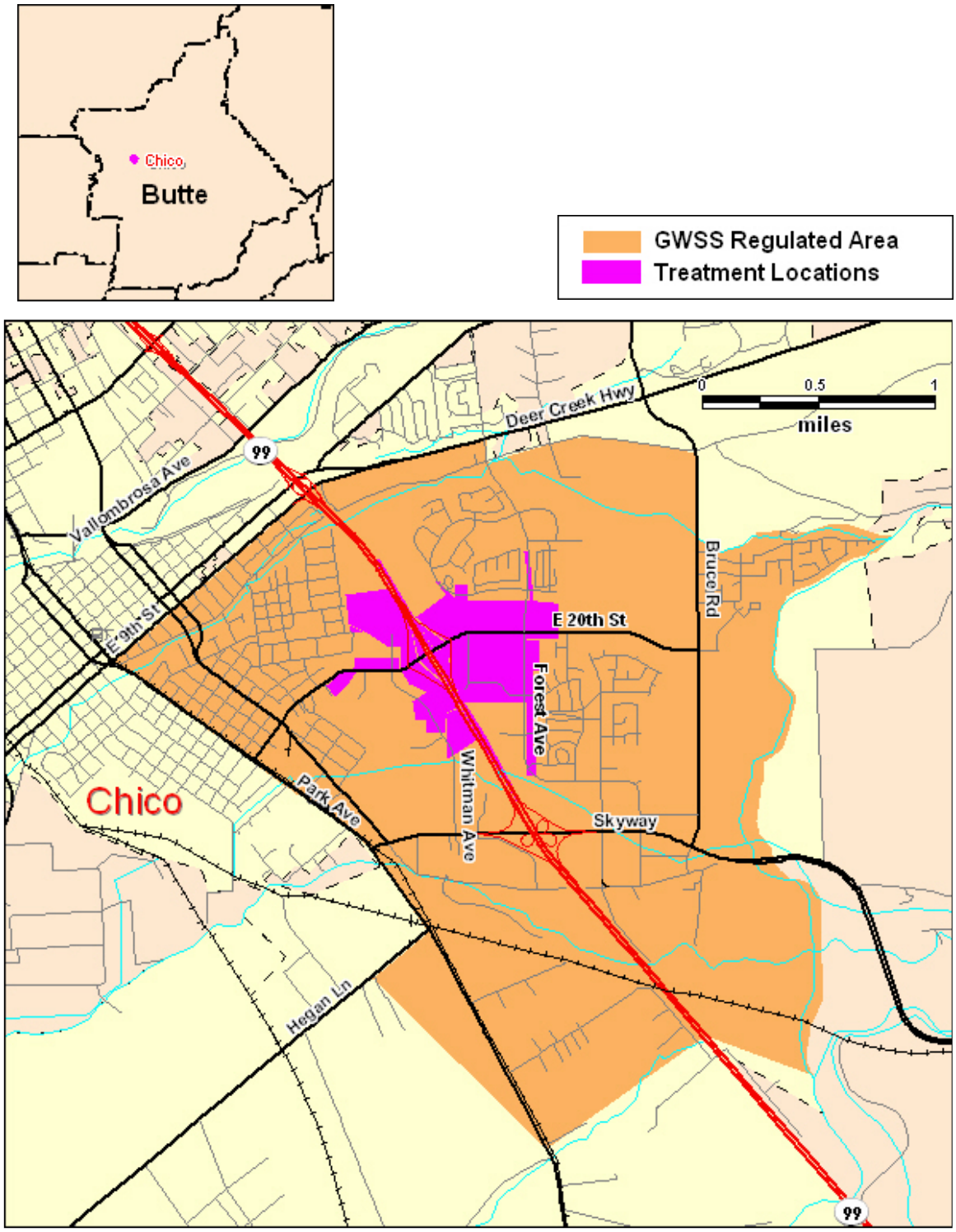
San Andreas, CA

Eric Lauritzen
Monterey County Agricultural Commissioner
Salinas, CA

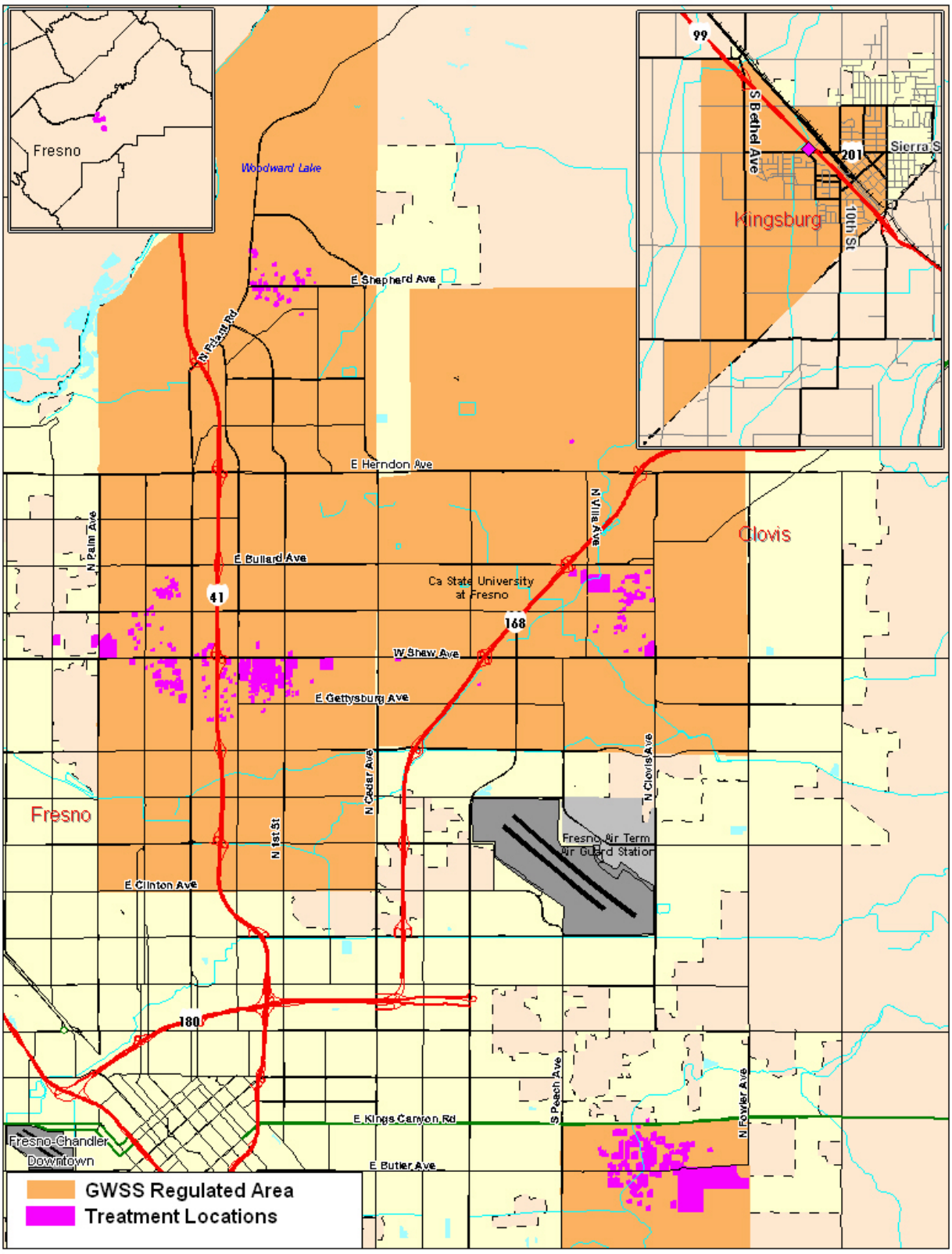
Appendix C

Treatment Areas

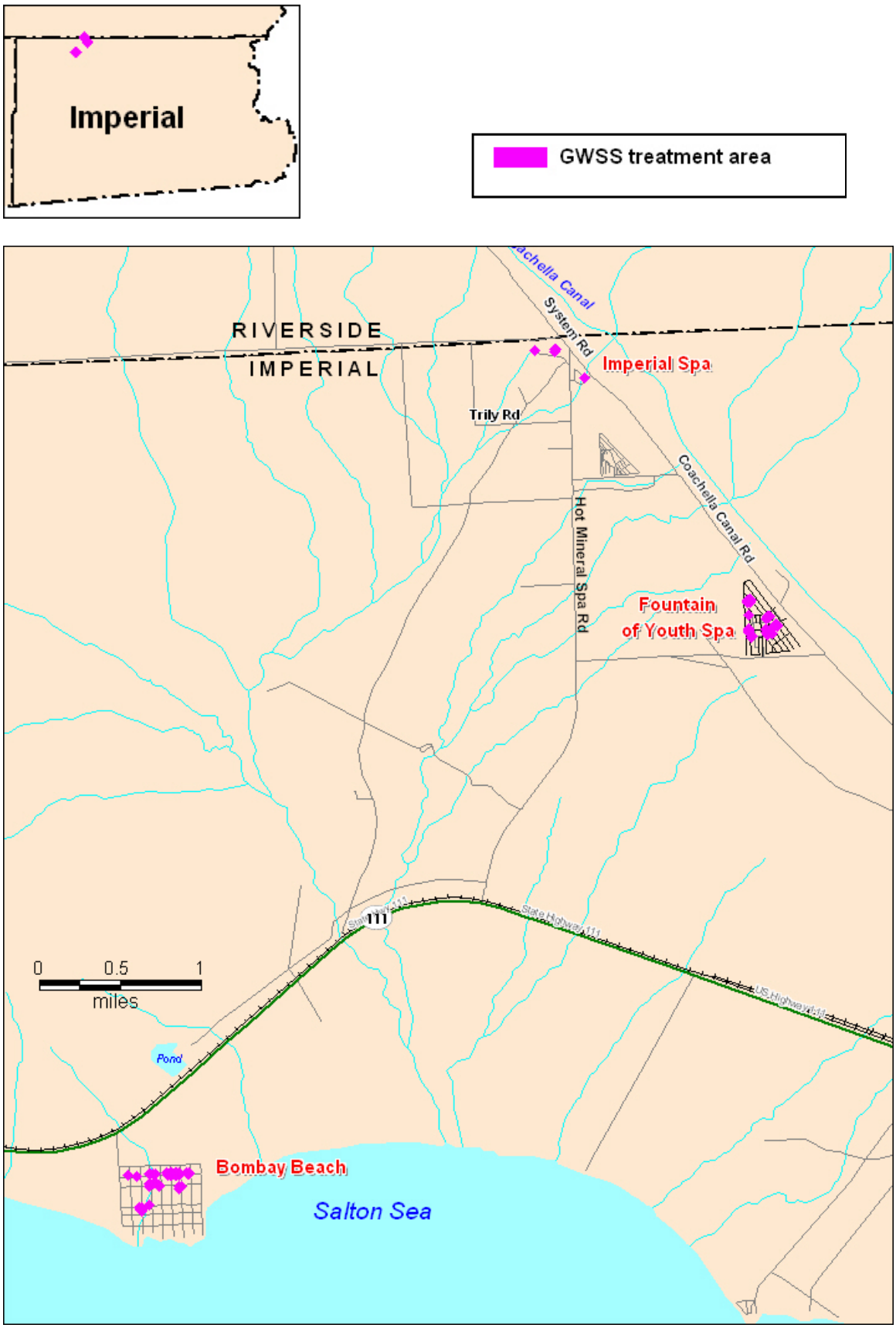
Butte County



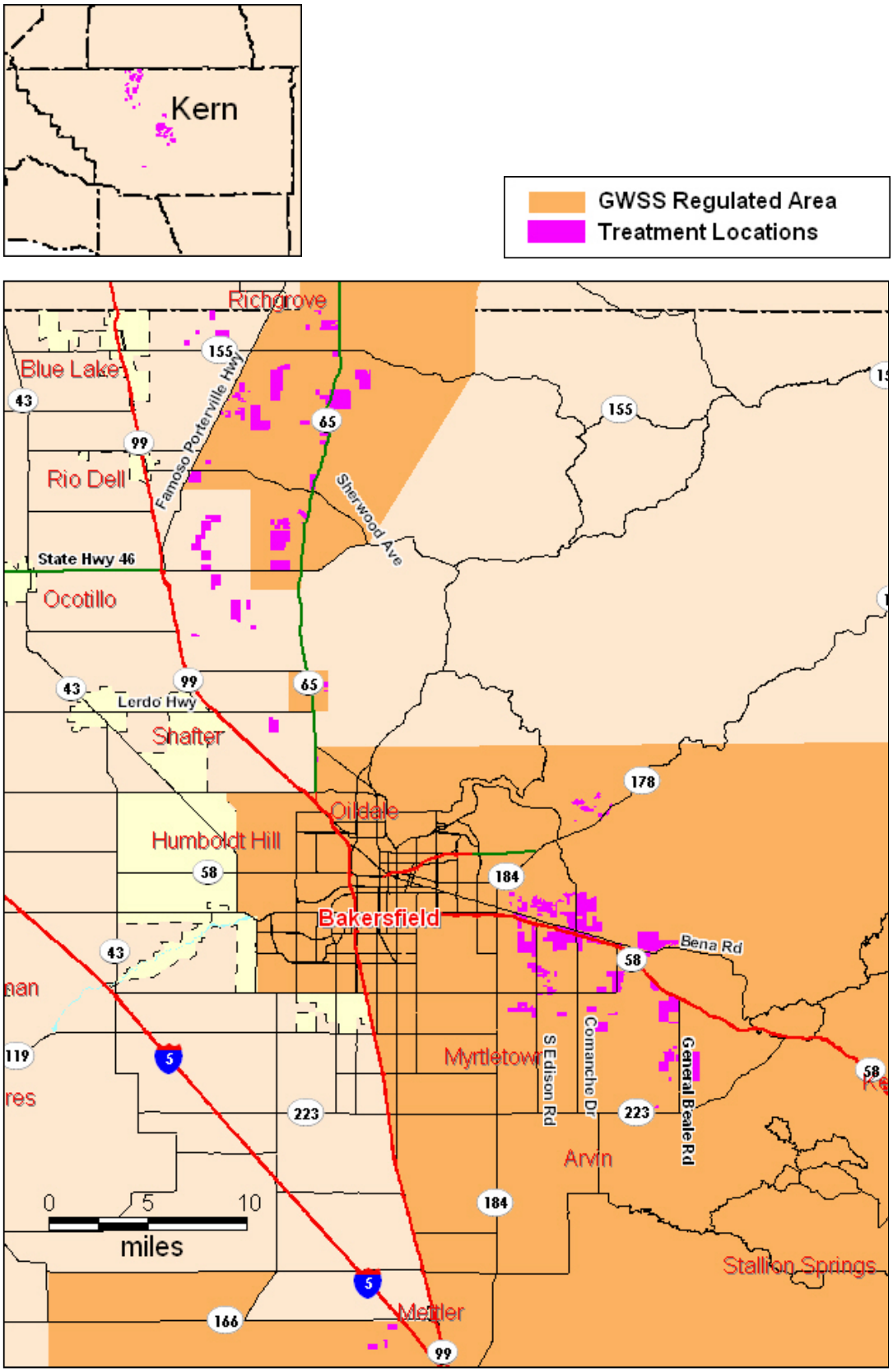
Fresno County



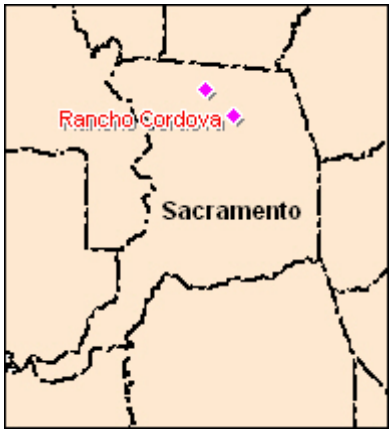
Imperial County



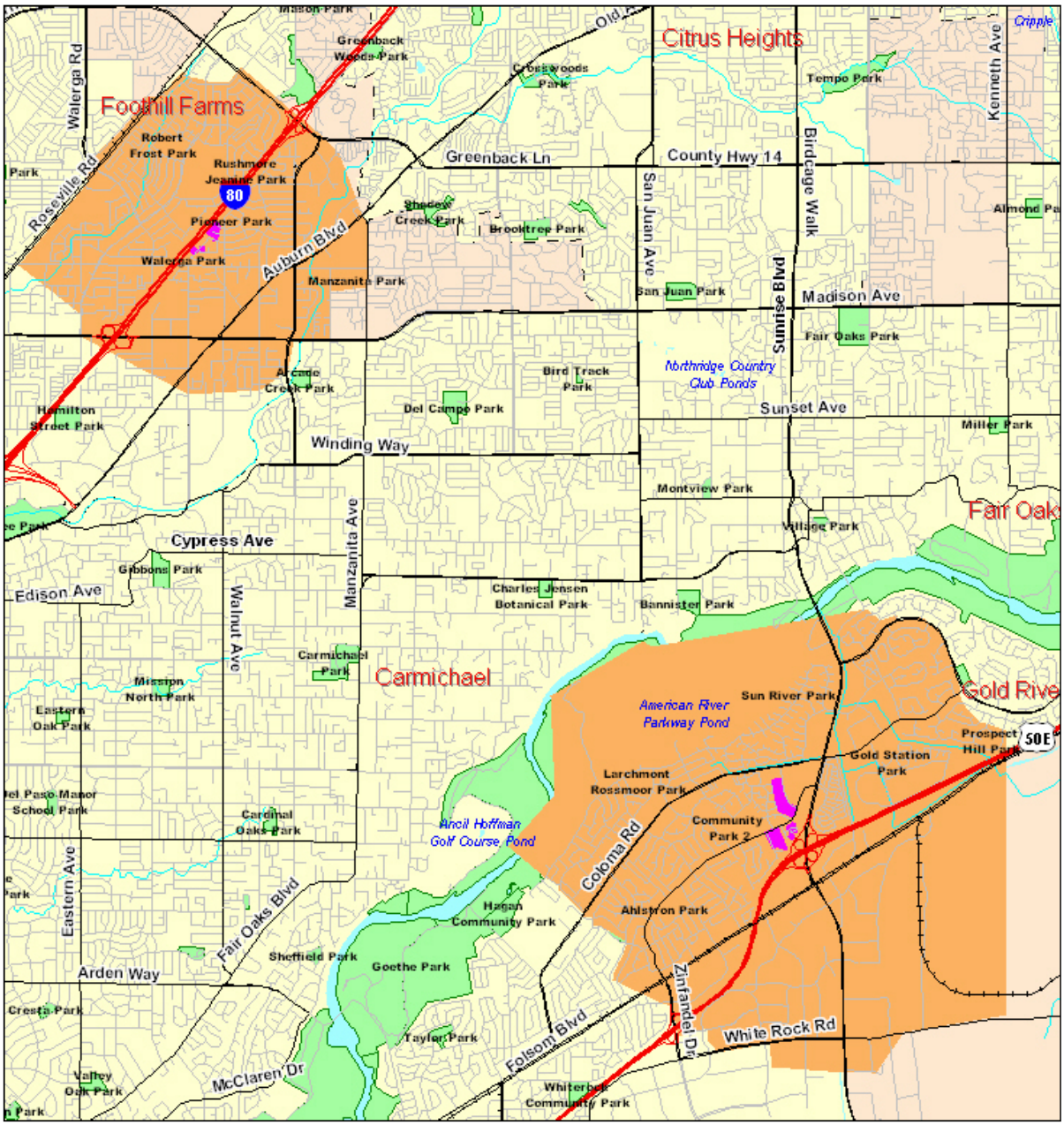
Kern County


Kern
GWSS Regulated Area
Treatment Locations
Richgrove
Blue Lake
Rio Dell
Famoso Porterville Hwy
Sherwood Ave
State Hwy 46
Ocotillo
Lerdo Hwy
Shafter
Oildale
Humboldt Hill
Bakersfield
Bena Rd
Myrtletown
S Edison Rd
Comanche Dr
General Beale Rd
Arvin
Stallion Springs
Mettler
0 5 10
miles
155
43
99
65
178
184
58
119
5
223
166

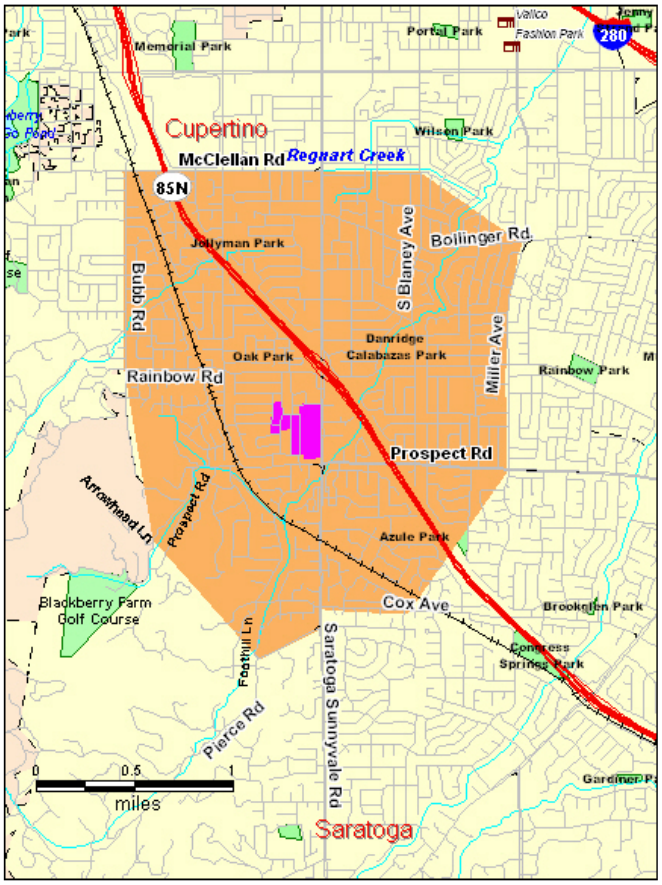
Sacramento County



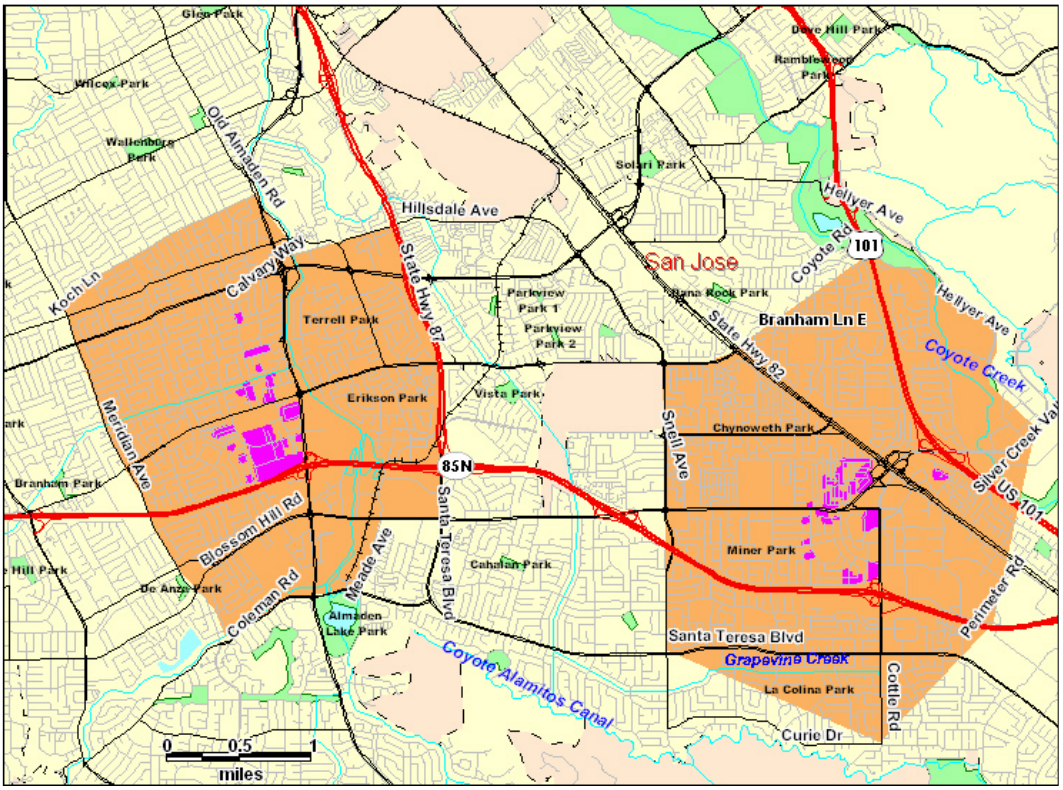
GWSS Regulated Area
Treatment Locations



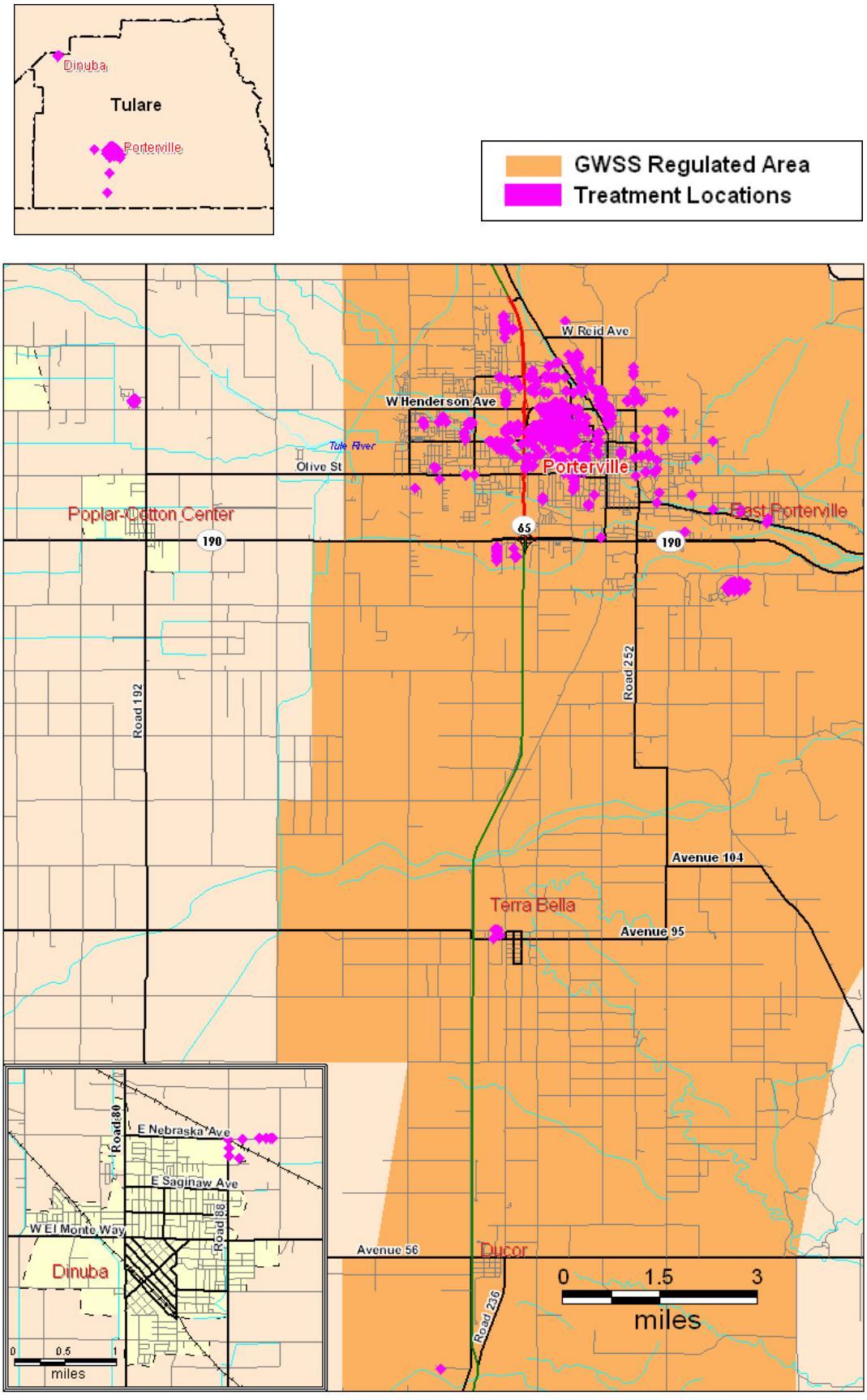
Santa Clara County



GWSS Regulated Area
Treatment Locations

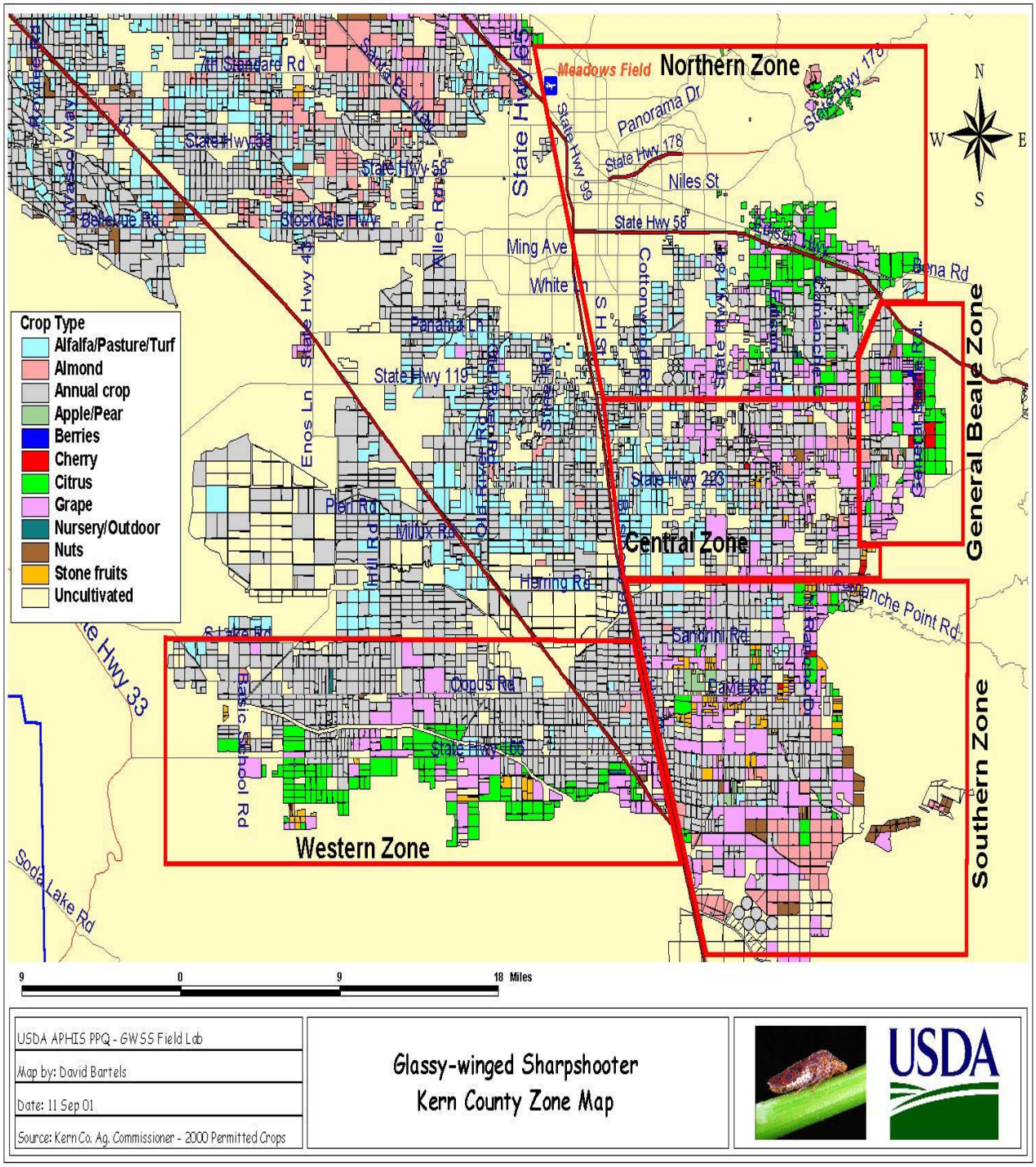


Tulare County



Appendix D

Kern County Areawide Pest Management of the Glassy-winged Sharpshooter



Appendix E

Pierce's Disease and Glassy-winged Sharpshooter Research Projects

Principal Investigator & Affiliation	Research Project
Breeding Cultivars of Grape Resistant to Pierce's Disease	
George Bruening, University of California, Davis	Virulence Analysis of the Pierce's Disease Agent *Xylella fastidiosa.*
Douglas Cook, Francisco Goes-da-Silva, and Hyunju Lim, University of California, Davis	Functional Genomics of the Grape-*Xylella* Interaction: Towards the Identification of Host Resistance Determinants.
Andrew Walker, University of California, Davis	The Genetics of Resistance to Pierce's Disease.
Andrew Walker and Summaira Riaz, University of California, Davis	An Expanded Genetic Map of *Vitis rupestris* x *Muscadinia rotundifolia* for Fine Scale Mapping and Characterization of Pierce's Disease Resistance.
David Gilchrist, University of California, Davis	Application of *Agrobacterium rhizogenes*-Mediated Transformation Strategies for a Rapid High Throughput Screen for Genetic Resistance to Pierce's Disease in Grape that Maintains Clonal Integrity of the Recipient Host.
Biological Control of Pierce's Disease	
Steven Lindow, University of California, Berkeley	Characterization of Fimbriae Production and Attachment of FimA- and FimF- Mutants of *Xylella fastidiosa* in vitro.
Michele Igo, University of California, Davis	The *Xylella fastidiosa* Cell Surface.
Harvey Hoch and Thomas Burr, Cornell University	Understanding *Xylella fastidiosa* Colonization and Communication in Xylem Lumina.
Steven Lindow, University of California, Berkeley	Management of Pierce's Disease of Grape by Interfering with Cell-Cell Communication in *Xylella fastidiosa.*
Donald Cooksey, University of California, Riverside	Biological Control of Pierce's Disease with Non-Pathogenic Strains of *Xylella fastidiosa.*
Donald Cooksey, University of California, Riverside	Control of Pierce's Disease Through Degradation of Xanthan Gum.
David Lampe (Duquesne University, Pittsburgh) and Thomas Miller (University of California, Riverside)	Paratransgenesis for Control of Pierce's Disease: Manipulation of Endophytic Bacteria for Paratransgenic Control of Pierce's Disease.
Blake Bextine and Thomas Miller, University of California, Riverside	Insect-Symbiotic Bacteria Inhibitory to *Xylella fastidiosa* in Sharpshooters: Pressure Bomb Extraction of Xylem Fluid to Improve Bacterial Detection of *Xylella* in Plants.
Carol Lauzon (California State University, Hayward) and Thomas Miller (University of California, Riverside)	Insect-Symbiotic Bacteria Inhibitory to *Xylella fastidiosa* (Paratransgenesis for Control of Pierce's Disease): Identification of Endophytic Bacteria Cycled by Glassy-winged Sharpshooters to Host Plants.

Principal Investigator & Affiliation	Research Project
Genetics of *Xylella fastidiosa*/Miscellaneous	
Valley Stewart, University of California, Davis	Surrogate Genetics for *Xylella fastidiosa.*
Carole Meredith and Abhaya Dandekar, University of California, Davis	Directing Potential Anti-*Xylella* Gene Products to the Xylem of Transgenic Grapevines.
Bruce Kirkpatrick and Magalie Guilhabert, University of California, Davis	Biological, Cultural, Genetic, and Chemical Control of Pierce's Disease: Production and Screening of *Xylella fastidiosa* Transposon Pathogenicity and Attachment Mutants.
Ed Civerolo, USDA-ARS, Parlier	Sequence of the Genome of *Xylella fastidiosa* Causing Pierce's Disease in California.
Peter Andersen, University of Florida, Quincy	Biological, Cultural, Genetic, and Chemical Control of Pierce's Disease: Xylem Fluid Chemistry Mediation of Resistance to Pierce's Disease.
Leonard Nunney, Richard Stouthamer, and Robert Luck, University of California, Riverside	Genome-Wide Identification of Rapidly Evolving Genes in *Xylella fastidiosa*: Key Elements in the Systematic Identification of Host Strains, and in the Search for Plant-Host Pathogenicity Candidate Genes.
Alexander Purcell, University of California, Berkeley	Fate of *Xylella fastidiosa* in Alternate Hosts.
Ed Weber, University of California Cooperative Extension, Napa	Trap Crops for Reducing Spread of Pierce's Disease.
Kendra Baumgartner, USDA-ARS, Davis	Biological, Cultural, Genetic, and Chemical Control of Pierce's Disease: Significance of Riparian Plants in the Epidemiology of Pierce's Disease.
Andrew Walker and Alan Tenscher (University of California, Davis); David Ramming (USDA-ARS, Parlier)	Breeding Pierce's Disease Resistant Table and Raisin Grapes.
Epidemiology of Pierce's Disease	
Alexander Purcell, University of California, Berkeley	Characterization and Studies on the Fundamental Mechanisms of *Xylella fastidiosa* Transmission to Grapevines by the Glassy-winged Sharpshooter.
Thomas Rost, Mark Matthews, and Joshua Stevenson, University of California, Davis	Mechanisms of Pierce's Disease Transmission in Grapevines: An Analysis of the Movement of *Xylella fastidiosa* in Xylem Pathways.
John Labavitch, Mark Matthews, and Carl Greve, University of California, Davis	The Development of Pierce's Disease in Xylem: The Roles of Vessel Cavitation, Cell Wall Metabolism, and Vessel Occlusion.
Donald Cooksey and Heather Costa, University of California, Riverside	Epidemiology of Pierce's Disease in Southern California: Identifying Inoculum Sources and Transmission Pathways.
Elaine Backus, University of Missouri, Columbia	Sharpshooter Feeding Behavior in Relation to Transmission of the Pierce's Disease Bacterium.

Principal Investigator & Affiliation	Research Project
Thomas Perring and Carmen Gispert, University of California, Riverside	Epidemiology of Pierce's Disease in the Coachella Valley.
Dean Gabriel, University of Florida, Gainesville	Role of Type I Secretion in Pierce's Disease.
Barry Hill (California Department of Food and Agriculture, Sacramento) and Jennifer Hashim (University of California Cooperative Extension, Bakersfield)	The Epidemiology of Pierce's Disease.
Biological Control of the Glassy-winged Sharpshooter	
James Hagler (USDA-ARS, Phoenix), Kent Daane (University of California, Berkeley), and Heather Costa (University of California, Riverside)	Development of a Monoclonal Antibody Specific to Glassy-winged Sharpshooter Egg Protein: A Tool for Predator Gut Analysis and Early Detection of Pest Infestation.
Isabelle Lauziere, Matthew Ciomperlik, and Lloyd Wendel, USDA-APHIS-PPQ, Edinburg	Biological Control of the Glassy-winged Sharpshooter in Kern County, California.
Allen Cohen, USDA-ARS, Mississippi	Development of an Artificial Diet for the Glassy-winged Sharpshooter.
Mark Hoddle, University of California, Riverside	Interspecific Competition Between *Gonatocerus ashmeadi* and *G. triguttatus* for Glassy-winged Sharpshooter Egg Masses.
Walker Jones, USDA-ARS, Weslaco	Biological Control of *Homalodisca coagulata.*
Roger Leopold and George Yocum, USDA - ARS, Fargo	Host Selection and Low Temperature Storage of the Glassy-winged Sharpshooter, *Homalodisca coagulata*.
Mark Hoddle and Richard Stouthamer, University of California, Riverside	Is the Glassy-winged Sharpshooter Parasitoid *Gonatocerus ashmeadi* (Hymenoptera: Mymaridae) One Species or a Complex of Morphologically Indistinguishable Species?
Serguei Triapitsyn and Mark Hoddle, University of California, Riverside	Searching for and Collecting Egg Parasitoids of the Glassy-winged Sharpshooter in the Southeastern USA and Northeastern Mexico.
Biology, Ecology, and Direct Impact of the Glassy-winged Sharpshooter	
Kent Daane (University of California, Berkeley) and Marshall Johnson (University of California, Riverside)	Biology and Ecology of the Glassy-winged Sharpshooter in the San Joaquin Valley.
Raymond Hix, University of California, Riverside	Glassy-winged Sharpshooter Impact on Orange Yield, Fruit Size, and Quality.
Robert Luck and Richard Redak, University of California, Riverside	Seasonal Changes in the Glassy-winged Sharpshooter's Age Structure, Abundance, Host Plant Use, and Dispersal.
Robert Luck and Mark Hoddle, University of California, Riverside	Spatial and Temporal Relations Between Glassy-winged Sharpshooter Survival and Movement, Xylem Flux Patterns, and Xylem Chemistry in Different Host Plants.

Principal Investigator & Affiliation	Research Project
Russell Mizell and Peter Andersen, University of Florida, Quincy	Keys to Management of the Glassy-winged Sharpshooter: Interactions Between Host Plants, Malnutrition, and Natural Enemies.
Randy Hunt, Indiana University Southeast, New Albany	Mating Behavior of the Glassy-winged Sharpshooter, *Homolodisca coagulata.*
Frank Zalom and Christine Peng, University of California, Davis	Reproductive Biology and Physiology of the Glassy-winged Sharpshooter.
Thomas Freeman, North Dakota State University, Fargo	Ultrastructural Contributions to the Study of the Glassy-winged Sharpshooter and Pierce's Disease.
Matthew Blua, Richard Redak, Carlos Coviella (University of California, Riverside), and David Akey (USDA – ARS, Phoenix)	Relationship Between Total Population Counts of Glassy-winged Sharpshooter and Numbers Obtained from Various Sampling Methods.
Matthew Blua, Blake Bextine, and Richard Redak, University of California, Riverside	Developing a Method to Detect *Xylella fastidiosa* in the Glassy-winged Sharpshooter.
Stuart McKamey, USDA - ARS, Washington, D.C.	Developing a Stable Classification of the Glassy-winged Sharpshooter genus *Homalodisca.*
Jiang Lu, Florida A&M University, Tallahassee	Host Plant Resistance to the Glassy-winged Sharpshooter in Grapes
Jacquelyn Blackmer and James Hagler (USDA-ARS, Phoenix); Gregory Simmons (USDA-APHIS-PPQ, Bakersfield)	Sampling, Seasonal Abundance, and Comparative Dispersal of Glassy-winged Sharpshooters in Citrus and Grapes.
Use of Pesticides and Alternative Treatments to Control the Glassy-winged Sharpshooter and Pierce's Disease	
Matthew Blua and Gregory Walker, University of California, Riverside	Impact of Sub-Lethal Doses of Neonicotinoids on Glassy-winged Sharpshooter Feeding and Transmission of Pierce's Disease.
David Akey and Thomas Henneberry (USDA-ARS, Phoenix); Matthew Blua (University of California, Riverside)	Control of Immature and Adult Glassy-winged Sharpshooters: Evaluation of Biorational and Conventional Insecticides.
Gary Puterka, USDA-ARS, Kearneysville	Alternatives to Conventional Chemical Insecticides for Control of the Glassy-winged Sharpshooter.
Nick Toscano, Nilima Prabhaker, and Frank Byrne (University of California, Riverside); Steven Castle (USDA-ARS, Phoenix)	Chemical Control of the Glassy-winged Sharpshooter: Establishment of Baseline Toxicity and Development of Monitoring Techniques for Detection of Early Resistance to Insecticides.
Nick Toscano (University of California, Riverside) and Steven Castle (USDA-ARS, Phoenix)	Laboratory and Field Evaluations of Imidacloprid and Thiamethoxam against the Glassy-winged Sharpshooter on Citrus and Grapes.
Elizabeth Grafton-Cardwell, University of California, Riverside/Parlier	Efficacy of Insecticides Used for Glassy-winged Sharpshooter Control in Citrus Nursery Stock.

Principal Investigator & Affiliation	Research Project
Peter Cousins (USDA-ARS, Geneva) and Jiang Lu (Florida A&M University, Tallahassee)	Rootstock Variety Influence on Pierce's Disease Symptoms in Grafted Chardonnay (*Vitis vinifera* L.) Grapevines.
Monitoring and Database Management	
Steven Castle and Steven Naranjo (USDA-ARS, Phoenix); Nick Toscano (University of California, Riverside)	Sampling, Seasonal Abundance, and Comparative Dispersal of Glassy-winged Sharpshooters in Citrus and Grapes.
Raymond Hix, University of California, Riverside	Development of Trapping Systems to Trap Glassy-winged Sharpshooter (*Homalodisca coagulata*) Adults and Nymphs in Grape.
David Bartels, Lloyd Wendel, and Matthew Ciomperlik, USDA-APHIS-PPQ, Edinburg	Spatial Distribution of Glassy-winged Sharpshooters in a Diverse Agricultural System, and Correlation Between Direct Observations and Sticky Trap Data.
Nick Toscano, Jian Bi, and Frank Byrne (University of California, Riverside); Steven Castle (USDA-ARS, Phoenix)	Plant-GWSS Interactions: Physiological and Biochemical Mechanisms Involved in Host Plant Selection with Particular Reference to Lemon and Orange Trees.
Raymond Hix, Nick Toscano, Richard Redak, and Matthew Blua, University of California, Riverside	Area-Wide Management of the Glassy-winged Sharpshooter in the Temecula Valley.
Richard Redak and Matthew Blua, University of California, Riverside	Impact of Layering Control Tactics on the Spread of Pierce's Disease by the Glassy-winged Sharpshooter.
Russell Mizell (University of Florida, Quincy) and Drion Boucias (University of Florida, Gainesville)	Mycopathogens and Their Exotoxins Infecting Glassy-winged Sharpshooter: Survey, Evaluation, and Storage.
Alexander Purcell, University of California, Berkeley	Exploration for Facultative Endosymbionts of Sharpshooters.
Lloyd Wendel et al., USDA-APHIS, Edinburg	The Area-Wide Pest Management of Glassy-winged Sharpshooter in Kern County.
Jennifer Hashim, University of California Cooperative Extension, Bakersfield	Monitoring and Control Measures for Pierce's Disease in Kern County.