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Glassy-winged Sharpshooter Area Wide Management Program

Fresno, Kern, Madera, Riverside and Tulare Counties, California

Environmental Assessment
August 2015

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Agency Contact:
Beth Stone-Smith
Plant Protection and Quarantine
Animal and Plant Health Inspection Service
U.S. Department of Agriculture
650 Capitol Mall, Suite 6-400
Sacramento, CA 95814

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I. Purpose and Need

The glassy-winged sharpshooter (GWSS), *Homalodisca vitripennis* (Germar) (Hemiptera: Cicadellidae), formerly *Homalodisca coagulata*, is a leaf-hopper insect native to the southeastern United States and northeastern Mexico. GWSS transmits and spreads the bacterium *Xylella fastidiosa*. Strains of this bacterium cause disease to several host plants including grapes (Pierce's disease), citrus, stone fruits, almonds, alfalfa and oleander. The pathogen attacks the plant's xylem or water-conducting tissues and chokes the flow of water and nutrients within the plant, resulting in stress and eventual death of the plant.

The introduction of GWSS to California is a serious threat to the grape industry due to its ability to spread Pierce's disease. GWSS is present in 14 counties in California including Fresno, Imperial, Kern, Los Angeles, Madera, Orange, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara, Santa Clara, Tulare and Ventura (CDFA 2010a). All of the counties with GWSS have Pierce's disease except Imperial County but not all of the counties with Pierce's disease have GWSS (CDFA 2010b). Additional counties are at risk of getting both GWSS and Pierce's Disease (Appendix A).

Xylella fastidiosa is not a quarantine pest in the United States and there are other insect vectors, including the less aggressive blue-green sharpshooter, that spread the bacterium. However, the presence and spread of GWSS in California, where it is regulated by CDFA, presents a greater threat to agriculture by increasing the incidence and severity of Pierce's disease because: (1) it moves faster and farther than other vectors of *X. fastidiosa*; (2) it has a much wider host range; (3) its breeding habits and hosts are different; and (4) it feeds on the larger (basal) stems of plants, making pruning ineffective (CDFA 2011b).

The host list for GWSS is extensive, including at least 295 host plants (CDFA 2011a). Because of its wide host range and ability to vector the bacterium, GWSS threatens a wide variety of crops, ornamentals, and native plants in California with the grape and wine industries identified by state and federal scientists, and economists, as being under considerable risk. Pierce's disease kills or renders grapevines unproductive within two to three years. Pierce's disease caused the destruction of wine grape industries in Southern California and was responsible for the loss of 40,000 acres of grapes near Anaheim in the 1880's. More recently, "California's first indication of the severe threat posed by this new disease and vector combination occurred in Temecula, Riverside County, in August of 1999, when over 300 acres of grapevines infested with the glassy-winged sharpshooter were destroyed by Pierce's disease. Losses continued to mount in Temecula and other infested areas in following years, eventually exceeding 1,100 acres statewide by 2002" (CDFA 2012). In 2012, California's grape industry was around $3.8 billion and associated economic activity estimated at $62 billion (CDFA 2012). In addition to potential losses to commercial agriculture and nursery crops, CalTrans has estimated that it could lose approximately $52 million in oleander along 2,100 miles of freeway because oleander is a host to GWSS and susceptible to the bacterium. Potential losses to backyard fruit production and home ornamentals are more difficult to estimate, but are expected to be significant.

Accordingly, the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) is proposing to cooperate with the California Department of Food and Agriculture (CDFA), County Agricultural Departments, and local grower groups in an Area Wide Management Program for GWSS to reduce the impact to the grape industry in the counties of Fresno, Kern, Madera, Riverside and Tulare.

APHIS' authority to cooperate in this program is based upon Title IV– Plant Protection Act, Public Law 106-224, 114 Stat. 438-455, which authorizes the Secretary of Agriculture to take measures to prevent the dissemination of a plant pest that is new to or not known to be widely prevalent or distributed within or throughout the United States. Authorities for CDFA's pest eradication and quarantine actions are based on Sections 407, 5301, 5302, and 5322, of the California Food and Agricultural Code. Authorities for actions against pests taken by California agricultural commissioners at the county level are based upon Sections 2271-2287 of the California Food and Agricultural Code.

This environmental assessment (EA) has been prepared in compliance with APHIS' National Environmental Policy Act of 1969 implementing procedures (Title 7 of the Code of Federal Regulations, part 372). This EA considers the potential effects on the human environment should APHIS either take no action or implement an area wide management program to control the spread of GWSS in six counties within the state of California.

II. Alternatives

Alternatives considered for this program include (1) no action, and (2) an expansion of the GWSS area wide management program and available control measures (proposed alternative).

A. No Action

APHIS and the CDFA are currently engaged in a statewide Pierce's Disease Control Program (PDCP) that is targeted at slowing or stopping the spread of the GWSS and Pierce's disease in California. CDFA regulates the shipment of host plants and other host material to prevent the spread of GWSS into new areas of the State. The no action alternative would be characterized by no change to APHIS support of control activities for GWSS. The current CDFA PDCP control strategy relies on five elements to stop or slow the spread of the GWSS until long-term solutions are developed for Pierce's disease (CDFA 2012). The four elements summarized below represent the No Action Alternative. Details of the strategy are found in CDFA's Pierce's Disease Control Program's 2012 Annual Report to the Legislature (last accessed September 26, 2013, http://www.cdfa.ca.gov/pdcp/):

1. Statewide Survey and Detection
   CDFA monitors GWSS infestations and populations through the use of traps and visual detections. The Survey and Detection element of the program is designed to locate new infestations of GWSS and verify non-infested areas remain free of the pest. Survey for GWSS currently occurs in 43 counties that are not infested or partially infested. Surveys focus on trapping in urban, residential and nursery settings. APHIS provides oversight of and funding for the surveys conducted in the counties.

2. Rapid Response and Treatment
   When one or more GWSS are found in a new area, delimitation surveys are conducted by the County to determine if an infestation is present, and if so identify the boundaries of the infestation. APHIS provides oversight of and funding support for the delimitation surveys. If an infestation is confirmed (ie. five or more adult GWSS within a radius of 300 yards within a five-day period, or multiple life stages detected at a given time), treatments are conducted by PDCP personnel and County cooperators in urban settings; in agricultural settings individual growers are responsible for treatments in a manner that is approved and supervised by the County Agricultural Commissioner. APHIS does not provide funding support for pesticide treatments nor does the Agency coordinate or administer pesticide treatments.

Area wide management programs coordinate insecticide treatments in commercial citrus blocks around grapes and other commodities to control GWSS. Current area-wide management programs occur in Kern County (USDA 2002b). Area wide management programs are done cooperatively between County Agricultural Commissioners and the CDFA. CDFA's Pierce's Disease Control Program's 2012 Annual Report to the Legislature summarizes the trapping and survey activities and insecticide treatment activities that occurred under these area wide management programs.

3. Outreach
   The CDFA and the PDCP recognize the importance of engaging the public and growers about the management program for Pierce's disease and its vectors including GWSS. The outreach efforts are intended to inform stakeholders about the importance of these pests and to explain the management strategies available for controlling GWSS and Pierce's disease. APHIS is not directly involved in CDFA's outreach campaigns, but does produce information about GWSS and Pierce's Disease that is available to the public.

4. Research
   CDFA, USDA, the University of California and the California State Universities, together with other state and local agencies, industry and agricultural interests continue to engage in research to understand the spread of Pierce's disease and control methodologies to slow or stop its spread.

B. Preferred Alternative

Under this alternative, APHIS would cooperate with the California Department of Food and Agriculture (CDFA), County Agricultural Departments and local grower groups in a comprehensive strategy to reduce (but not eradicate) populations of GWSS in Fresno, Kern, Madera, Riverside and Tulare counties. Specifically, APHIS would expand its participation in the GWSS area-wide management program by adding four additional counties (Fresno, Madera, Riverside and Tulare) to the Program as well as coordinate and fund pesticide treatments in commercial citrus groves and surrounding windbreaks (Kern county only) that are collocated with grape vineyards. This participation would be in addition to APHIS activities in CDFA's PDCP as described in the No Action Alternative, which are providing financial support of inspection, survey, and research as well as coordinate survey activities.

APHIS will provide financial reimbursement to growers who make pesticide treatments to GWSS-infested commercial citrus trees and surrounding citrus orchard windbreaks (Kern County only) that are adjacent to commercial grape vineyards. GWSS migrates to citrus trees when grapevines go dormant during the winter months. The two advantages to applying pesticides when GWSS migrate to citrus are 1) Only one crop is being treated, reducing the number of acres on which pesticides are applied and the amount of pesticides used; and 2) GWSS populations naturally decline in the winter which may make it possible to disrupt the spatial distribution of the GWSS populations enough to reduce mating to the extent that the population will be substantially diminished. This, in effect, will reduce the potential for migration into adjacent crops (especially grapes) or to other distant production areas. Although GWSS is present in 14 counties in California, APHIS would only be involved in area wide management in Fresno, Kern, Madera, Riverside and Tulare counties. These counties were selected over other infested counties based on the the land area dedicated to the commercial production of grapes and citrus. In addition to financial support, the proposed action would implement a coordinated management program in such a way as to minimize the usage of pesticides. In addition the program incorporates mitigative actions to prevent adverse effects to any waterbodies or residential properties that may occur in the proposed treatment areas.

Under the GWSS area-wide management program, growers will consult with program managers and be able to choose the appropriate control measures, based on their individual needs. The EPA-registered and APHIS-approved pesticides identified for use in the Program are chlorpyrifos, cyfluthrin, methomyl, pyrethrin (+piperonyl butoxide), imidacloprid, acetamiprid, dinotefuron, carbaryl and thiamethoxam.

III. Affected Environment

The GWSS area-wide management program described under the preferred alternative would cover five counties, specifically commercial citrus orchards collocated with commercial grape vineyards. Much of the affected environment occurs on or near land zoned for agricultural production. The GWSS area-wide management program includes the use of chemical pesticides to manage GWSS. Because of this, the affected environment may involve air, soil, and water quality and may affect neighboring counties that share air and water pathways.

A. Land Characteristics and Agricultural Production

Agriculture is important to the economy of the five counties that would be part of the GWSS Area Wide Management Program. In 2011, the six counties within the proposed program area harvested nearly 1.3 million acres of possible host commodities for GWSS, and reported over $6.5 billion in agricultural revenue. Three of the five counties boast the highest yields of grapes (wine, table, and dried) and almonds in California (CDFA 2012). In addition, Tulare, Kern, Fresno, Ventura, and Madera produce over 95 percent of the oranges in the State.

Fresno County

Fresno County covers approximately 6,000 square miles of central California and is located near the center of California's San Joaquin Valley which, together with the Sacramento Valley to the north, forms the Great Central Valley.

Fresno County is one of the most productive and diverse agricultural areas in the United States. According to USDA NASS 2007 Census of Agriculture, 978,948 acres of cropland (equivalent to 1,500 square miles or 25 percent of county’s land cover) were harvested in 2007 (USDA 2007). In 2006, the agriculture sector contributed $4.8 billion to Fresno County’s economy – 67 percent of which was attributed to vegetable, fruit, and nut crops. Around 40,000 acres of citrus were harvested for a value of ca. $211 million. Grapes were ranked the top crop - grown on 198,458 acres for a value of $562 million (Fresno County 2006). Organic farms cover nearly 41,000 acres; their agricultural production value for 2011 was just over $131 million (CDFA 2012).

Kern County

Kern County is located at the southern end of California’s Central Valley and covers 8,171 square miles. In 2011, 870,909 acres of cropland (equivalent to 1,361 square miles or 17 percent of the county’s land cover) were harvested (Kern County 2011). In 2011, Kern County’s agricultural crop production was valued at $4.2 billon, ranking third among the highestproducing counties in the state. Citrus was grown on over 55,000 acres; grapes on 82,624 acres. The economic value of citrus was $540 million; grapes $707 million. In addition, the county has 75 registered organic farms, some of which grow citrus and grape (Kern County 2011).

Madera County

Madera County covers approximately 2,147 square miles in the geographic center of California; bordered on the north by the Chowchilla River and on the south by the San Joaquin River. The county includes some of the richest agricultural land in the nation. In 2011, 669,490 acres of cropland (equivalent to 1,046 square miles or 49 percent of the county's land cover) were harvested (Madera County 2011). Of this, 6,200 acres was dedicated to organic farming, on which commodities that are hosts to GWSS were grown, including grape and almond (Madera County 2011).

Madera County's commercial citrus groves occupy 3,400 acres in the central valley portion and brought in $13 million in 2011 (Madera County 2011). Almonds are its single most valuable agricultural commodity, bringing in $400 million (Madera County 2011). In 2011, grapes were produced on 74,450 acres and were valued at $300 million. The value of organic production in 2011 was $16 million.

Riverside County

Riverside County is comprised of over 7,200 square miles of river valleys, deserts, mountains, foothills and plains, and extends from within 14 miles of the Pacific Ocean to the border with Arizona along the Colorado River. Over 209,710 acres is dedicated to cropland (equivalent to 328 square miles or around 5 percent of the county's land cover) (Riverside County 2011).

In 2011, the citrus, almonds, grapes, and stone fruit production was valued approximately $348 million; table grapes and citrus ranked among the top 10 agricultural commodities grown. In 2011, 16,808 acres were planted to citrus with harvest valued around $120 million; 11,391 acres were planted to grape, valued around $125 million (Riverside County 2011). The county also has 138 registered organic farms (Riverside County 2011).

Tulare County

Tulare County covers an area of 4,863 square miles. Agricultural production dominates the fertile valley floor in the western half. The County is the second-leading producer of agricultural commodities in the United States (Tulare County 2011), reporting over 1.6 million acres of harvested cropland (equivalent to 2,570 square miles or 57 percent of the county's land cover) in 2011 (Tulare County 2011). Of this, over 4,600 acres was dedicated to organic farming, with organic citrus grown on 1,897 acres and organic grapes grown on 915 acres (Tulare County 2011).

In 2011, citrus was grown on 119,086 acres; grapes on 61,060 acres (Tulare County 2011). The economic value for citrus was $872 million; grapes was $532 million.

B. Air Quality

The GWSS area-wide management program intersect five air quality basins. These include the Mojave Desert, South Central Coast, South Coast, San Joaquin Valley and Salton Sea Basins (CEPA 2011). These basins do not meet state air quality standards for several compounds, including ozone, particulate matter, nitrogen dioxide, and sulfur dioxide. Despite significant improvements, air quality remains a major source of public health concern in large metropolitan areas throughout the State. In particular, the San Joaquin Valley and the South Coast Air Basins continue to face significant challenges in meeting state and federal air quality standards for ozone and fine particulate matter. Among the contributors to poor air quality conditions within the region, mobile sources of emissions continue to increase along with population and vehicle miles traveled.

C. Water Quality

California is divided iinto 10 hydrologic regions, four of which occur within the five counties proposed for potential GWSS management activities (CDWR 2009). Details regarding each region within the survey area are summarized in other documents for the Colorado River, South Coast, South Lahontan and Tulare Lake Hydrologic Regions (CDFA 2009). The regions are delineated based upon the State's major drainage basins. Each region has distinct precipitation characteristics and waterbodies that channel or retain runoff. Multiple surface waterbodies within the current program area are listed as impaired under the Clean Water Act Section 303(d). Reasons for impairment vary widely with inorganic chemicals, such as heavy metals, to organic compounds, such as pesticides, being the causative agents. Nonchemical impairments, such as sedimentation have also been noted for some waterbodies (EPA 2006c).

Ground water provides more than 40 percent of California's drinking water; however, the quantity and quality of this resource varies between hydrologic regions. Groundwater quality in the region is affected by withdrawal and recharge rates as well as agricultural, residential, and commercial/industrial practices. Impairments to ground water quality include inorganic and organic contamination within the four hydrologic regions within the proposed program area. Inorganic contamination with total dissolved solids, nitrates, and some minerals are reported in the South Coast Hydrologic Region. Within the San Joaquin Valley Hydrologic

Region, trace elements, including arsenic, lead, selenium and fluoride are found at varying concentrations in the primary aquifers (USGS 2012).

One or more watersheds in all of the counties except Tulare that would be part of the proposed GWSS area-wide management program have chlorpyrifos listed as an impairment. The other pesticides proposed for use in the GWSS area-wide management program were not specifically identified as impairments. Two watersheds list Group A pesticides as impairments; three watersheds listed “pesticides-not specified” as impairments (EPA 2006c). The watersheds that cross the counties within the proposed GWSS area-wide management program area are shared with counties not part of the Program.

D. Ecological Resources

The proposed program area is in commercial citrus orchards collocated with grape vineyards in Fresno, Kern, Madera, Riverside and Tulare counties in California. The treatment areas are limited and pesticide application would only occur if trapping indicates a high enough population (ie. five or more adult GWSS within a radius of 300 yards within a five-day period, or multiple life stages detected at a given time) of GWSS to warrant treatment. Orchards are intensively managed agricultural areas however various non-target species may utilize these areas. The counties covered in the GWSS area-wide management program contain state identified rare plants and animals as well as federally protected species.

The program area covers a portion of California’s Pacific Flyway, an annual migratory bird route for millions of birds. In the San Joaquin Valley, agricultural lands are often managed to conserve migratory birds through a series of National Wildlife Refuges, Joint Ventures, the Central Valley Joint Venture Conservation Program, California Riparian Bird Conservation Program, and other joint ventures administered by the U.S. Fish and Wildlife Service (FWS 2010b, a, Pacific Flyway Council 2013) in cooperation with numerous State, Federal, local and nongovernmental partners.

Habitat Conservation Planning Efforts
In an effort to minimize the impacts of ongoing demands on remaining wildlands within the State, the U.S. Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS), in cooperation with the California Department of Fish and Wildlife and voluntary applicants, are currently engaged in numerous efforts aimed at conserving Federal and State listed species on remaining open spaces within the State. To date, these efforts are generally pursued through section 10 of the Federal Endangered Species Act (ESA) as amended and the California Endangered

Species Act's Natural Community Conservation Planning Act processes, covering over 9 million acres within the State (CDFW 2013a).

Within the State, four other ongoing land conservation planning efforts are pursued through FWS' Partners for Fish and Wildlife Program. In addition, FWS Partners Program assists private landowners and other interested parties with habitat restoration in wetland and riparian areas, as well as managing and removing invasive species. To date, over 62,000 acres have been restored (FWS 2010b).

Western Riverside County MSHCP

The Western Riverside County Multiple Species Habitat Conservation Plan (WRMSHCP) was created to implement one of America's most ambitious environmental efforts. To date, the WRMSHCP is the largest and most complex of the regional HCP plans developed to set aside half a million acres of habitat in southern California and protect 146 native species of plants and animals. The premise behind this regional planning effort was to identify and conserve high quality habitats and the species that depend on them while integrating and providing for future land use, transportation and wildlife conservation to residents of western Riverside County. The WRMSHCP covers habitat and focal species, including riparian/vernal pool ecosystems, coastal sage scrub, uplands, vegetative communities, and numerous threatened or endangered plant and animal species (CDFW 2013b). Agricultural communities included within the WRMSHCP are field crops, groves, and orchards. As of 2012, the county has reached 77 percent of the goal in the WRMSHCP (CDFW 2013a).

Coachella Valley MSHCP

The Coachella Valley Multiple Species Habitat Conservation Plan (CVMSHCP) aims to conserve over 240,000 acres of open space and protect 27 plant and animal species. By providing comprehensive compliance with federal and state endangered species laws, the CVMSHCP safeguards desert natural heritage for future generations by conserving natural communities and habitats. The CVMSHCP includes 27 species, including five plants, two insects, one fish, one amphibian, three reptiles, eleven birds and four mammals (CDFW 2013a).

Kern Water Bank HCP

The Kern Water Bank (KWB) occupies approximately 20,000 acres in the southern San Joaquin Valley. It is operated under a Habitat Conservation Plan/Natural Community Conservation Plan (HCP) which prescribes reporting and planning requirements, adaptive management methodologies, and avoidance and mitigation measures. The Kern Water Bank HCP was executed on October 2, 1997 by and among the FWS, the CDFG, and Kern Water Bank Authority, a joint powers authority. The HCP designates 3,267 acres of the Kern Water Bank as a Conservation Bank to assist the mitigation efforts of construction and maintenance projects that may temporarily or permanently disturb endangered species habitat. The HCP's primary water conservation objective is the storage of water during times of surplus for recovery during times of shortage. The primary environmental objective is to set aside large areas of the KWB for threatened, endangered, and sensitive species and to implement a program to protect and enhance the habitat (KWBA 2013).

Bakersfield Regional Habitat Conservation Plan (Kern County)
This Natural Community Conservation Plan was initiated in 1994 and was revewed in 2014 to last through 2019. The primary goal of this HCP is to protect native habitats that support threatened and endangered species while allowing project development to occur (CDFW 2013a).

Desert Renewable Conservation Plan (covers multiple counties including parts of Kern and Riverside County)
The desert regions of California provide extensive renewable energy resource potential. The goal of this plan is to protect and support the biological and natural resources, including threatened and endangered species while developing compatible renewable energy generation facilities and related transmission infrastructure to achieve renewable energy requirements and goals. The DRECP is intended to advance state and federal conservation goals in these desert regions while also facilitating the timely permitting of renewable energy projects under applicable State and federal laws (CDFW 2013a).

Salmon Recovery
There are 10 evolutionary significant units (ESUs) of Pacific salmon and steelhead listed by the National Marine Fisheries Service (NMFS) as either threatened or endangered in California. NMFS manages individual population segments within hydrological units to maximize recovery efforts; from 2000 through 2009, NMFS has invested over $121 million in salmon recovery efforts in the State of California (NMFS 2010). The majority of these funds are spent restoring degraded habitat and opening passage to historically occupied watersheds that have been blocked by reclamation and agricultural water developments. Historically, salmon and steelhead were abundant in all of the coastal and major river systems within the State. The program area contains one ESU, the Southern California Steelhead (*Oncorhynchus mykiss*).

IV. Environmental Impacts

Because the principal environmental concerns in the proposed program relate to use of chemical pesticides, this assessment will focus on the potential environmental consequences of those pesticides on human health and the environment.

A. No Action

Under the no action alternative there would be no additional APHIS involvement in the form of funding and coordination of pesticide treatments to control GWSS. State agencies, grower groups, or individuals would need to fill these gaps. With no additional APHIS involvement, the suppression of GWSS in the five counties that would be covered under the proposed area wide management program could be hampered, allowing more rapid expansion of GWSS into other urban and agricultural areas within California and surrounding States. That expansion would greatly increase the incidence of Pierce’s disease within the grape industry, and put the citrus, almond, and stone fruit industries at risk of diseases vectored by GWSS. The location of the program covers very rich farming areas and supports a robust agricultural economy. The moderate climate in this area would allow GWSS to become established within microclimates throughout the region. Once this occurs, the entire production area and the coastal areas would require extensive control programs to manage this insect pest. Any response to control such expansion of the current infestation by individuals or organizations could probably result in a greater magnitude of environmental impact because GWSS would need to be controlled over a wider area. Under those conditions, any available control measures (including more hazardous pesticides) could be used in an uncoordinated manner, resulting in greater environmental impact than is associated with the proposed action analyzed within this assessment.

1. Human Health

A likely option for most growers and homeowners are to control GWSS through pesticide applications. Although some replacement with non-host plants or plants that can tolerate GWSS damage and associated plant diseases is possible, this is not likely to be desired by most growers or homeowners due to time and financial constraints. The applications of control agents (in the absence of effective biological controls) are largely limited to pesticide applications that would be applied in response to observed damage to plants. The majority of these pesticide applications would be unsupervised and uncoordinated. Accordingly, greater pesticide amounts and higher frequency of application could be anticipated than would occur with a coordinated, cooperative program. In addition to direct toxic effects to humans from the pesticide applications, cumulative impacts of multiple exposures are more likely with the lack of coordinated treatments. Human exposure to pesticides and resulting adverse consequences from the no action alternative would be expected to exceed any adverse effects from a coordinated area wide program. The continuing spread of GWSS will reduce the amount of locally available produce from crops that are susceptible to plant diseases spread by this pest.

2. Ecological and Environmental Quality

A direct impact to nontarget species relates to the damage and loss of plants that serve as hosts of GWSS. GWSS feeds on at least 295 plant hosts and is a disease vector that can impact many of these hosts. The susceptible plants could include some endangered or threatened species. No action would be expected to result in continued spread at a rate similar to the last several years with increasingly greater harm to plant life. The recent uncoordinated control actions have not successfully contained GWSS and damage to plants has increased.

Anticipated broader pesticide use resulting from lack of coordinated control actions against GWSS could increase the pesticide load to the environment. Increased pesticide use could increase the likelihood of adverse effects to nontarget wildlife and domestic animals, which could include some endangered or threatened species. The potential increased populations and spread of GWSS would have adverse effects upon susceptible plants and those nontarget species that depend upon those plants for survival.

The primary impacts to environmental quality from the no action alternative are anticipated to be the results of uncoordinated use of pesticides. The expected increase in the use of pesticides with expansion of GWSS range could result in increased in pesticide loading with commensurate adverse impacts to air, water, and soil quality. These adverse impacts to environmental quality would be expected to exceed those of the proposed action.

B. Preferred Alternative

The GWSS area-wide management program includes cultural practices, chemical treatments, and biological control. APHIS’ participation in the program is to provide funding for reimbursing commercial citrus growers for their application of pesticides approved for use in the Program. The Program does not require chemical treatments to treat for GWSS but provides a list of recommended insecticides, that if used allow for reimbursement to growers for the cost of treatment. Growers can choose the insecticide that best fits their pest management strategy. APHIS encourages integrated pest management practices, including cultural and biological control methods, to reduce the usage of pesticides.

This section considers the impacts chemical treatments may have on environmental quality, human health, and nontarget species in and around

Fresno, Kern, Madera, Riverside and Tulare counties. Much of this discussion is based upon the results of the chemical risk assessment prepared for the GWSS Area Wide Management Program (USDA 2002a). The findings of that risk assessment is incorporated by reference.

The EPA-approved chemical pesticides recommended by APHIS for foliar treatments include chlorpyrifos, cyfluthrin, methomyl, pyrethrin (+piperonyl butoxide), imidacloprid, acetamiprid, dinotefuron, carbaryl and thiamethoxam. Pesticide treatments will be performed in commercial citrus groves in each of the five counties and surrounding windbreaks only in Kern County, that are collocated with grape vineyards. All uses will be in accordance with EPA-approved pesticide labels. Factors that influence the human health risk associated with pesticide use include pesticide toxicity and exposure to humans. Exposure to pesticides is influenced by environmental fate, and the use pattern for a particular pesticide as well as program practices.

For program insecticides restricted to applications in commercial citrus groves or surrounding windbreaks (Kern County only), potential human-related exposure during applications would be restricted to workers and applicators at the time of application. Protective gear, safety precautions on the label, State law, and standard program operating procedures are designed to ensure minimal risk to applicators (USDA 2002a, b).

Exposure to the general public is not expected except for the potential that the general population would consume treated citrus from orchards that receive applications of insecticides, however the exposure would be no greater than the current usage. EPA sets residue tolerances to levels intended to pose minimal risk to human health. Applications made in accordance with the label directions, including application rates, harvest and reentry intervals, and washing and disinfection of fruit at packinghouses reduces public exposure so that it is below tolerance limits and is unlikely to be harmful to the public. In addition, during treatment of residential areas, human exposure to program insecticides is minimized through adherence to recommended practices at the time of program control applications.

Human health and non-target species impacts from exposure to chlorpyrifos, cyfluthrin, methomyl, and imidacloprid were previously evaluated in a chemical risk assessment (USDA 2002a) and environmental assessments (USDA 2002b) (USDA 2015). The following sections discuss the toxicity, exposure, and potential impacts to human health and non-target species for each pesticide that was not previously evaluated. The environmental quality is also discussed for each pesticide.

Acetamiprid

Acetamiprid is a neonicotinoid insecticide used to control sucking insects on leafy vegetables, fruiting vegetables, cole crops, citrus fruits, pome fruits, grapes, cotton, and ornamental plants and flowers. Acetamiprid interrupts the function of the insect nervious system by acting as an agonist of the nicotinic acetylcholine receptor (nACHR) of the nerve cell's postsynaptic membrane. Acetamiprid has selective toxicity to insects because acetamiprid interacts with high affinity at the insect nACHR and low affinity at the vertebrate nACHR binding sites (EPA 2009).

1. Human Health

Acetamiprid has low to moderate toxicity to mammals. The acute toxicity data show that the acetamiprid technical is moderate toxic (Category II) for the oral route, and low toxic (Category III) for the dermal and inhalation routes. Acetamiprid end-use products (Assail™, Chipco™, and Pristine™) are low (Category III) to practically non-toxic (Category IV) for the oral, dermal, and inhalation routes (EPA 2002). Acetamiprid is not an eye or skin irritant, nor is it a dermal sensitizer. The EPA established an acute reference dose (RfD) of 0.10 mg/kg/day based on a no observed adverse effect level (NOAEL) of 10 mg/kg and a lowest observable adverse effect level (LOAEL) of 30 mg/kg (reduction in locomotor activity) from an acute neurotoxicity study in rat. The EPA established a chronic RfD of 0.07 mg/kg/day based on a NOAEL of 7.1 mg/kg/day and a LOAEL of 17.5 mg/kg/day (reduced body weight and body weight gain (females) and hepatocellular vacuolation (males)) from a chronic study using the rat (EPA 2002). Acetamiprid has generalized nonspecific effects such as decrease in body weight, body weight gain and effect to food consumption. Acetamiprid is not carcinogenic, mutagenic or genotoxic, and does not cause developmental or reproductive toxicity. It has low neurotoxic potential, and does not have any cumulative effects such as cholinesterase inhibition associated with the OP compounds. There is no indication of any effects on the endocrine system, nor any increased sensitivity of infants or children (EPA 2009).

Risk to workers is minimal due to the low toxicity of acetamiprid and reduced exposure to applicators as a result of label requirements including personal protective equipment (PPE). Risks to the general population that would consume treated citrus from orchards that received applications of this insecticide would be low due to the short half-life of acetamiprid and the timing of application relative to harvest.

2. Ecological and Environmental Quality

Acetamiprid is moderately toxic (acute oral) and practically nontoxic (subacute dietary) to avian species. Acetamiprid is moderately toxic (acute oral) to mammals. The two-generation rat reproduction study reported a chronic NOEC of 280 mg ai/kg based on reduced growth of offspring. Acetamiprid is moderately toxic to honey bees when contacted by a foliar spray; however, there is no residual toxicity once sprays have dried. Acetamiprid is much less toxic to bees than imidacloprid. Acetamiprid has relatively low toxicity when applied to the foliage of most species terrestrial plants (EPA 2005a, 2009). Terrestrial field dissipation studies show that acetamiprid is not persistent (EPA 2002). The moderate to low toxicity profile of acetamiprid to terrestrial organisms, the limited areas of application, and environmental fate of acetamiprid suggest low risk to non-target terrestrial birds and mammals. Acetamiprid will impact some sensitive terrestrial invertebrates that occur in the orchards however these impacts will be localized to agricultural production areas. Significant indirect impacts to terrestrial vertebrates that are insectivorous are not anticipated since many of these species have foraging ranges that would occur outside of the treated orchards. In addition only sensitive terrestrial invertebrates would be impacted and other sources of invertbates that are less sensitive to dinotefuran would be available. Degradates for dinotefuran are slightly to practically nontoxic to both terrestrial and aquatic animals from acute exposure suggesting low risk (EPA 2005a).

Acetamiprid is practically nontoxic to freshwater and estuarine/marine fish in acute exposures. Chronic exposure to acetamiprid reported an NOEC of 19.2 mg ai/L and a LOEC of 38.4 mg ai/L with reduced fish growth. For freshwater invertebrates, Acute toxicity of acetamiprid to aquatic invertebrates ranges from slightly toxic to very highly depending on the test species. Similarly the chronic toxicity of acetamiprid varies for aquatic invertebrates with low toxicity to freshwater water flea and high toxicity to amphipods and midges. For estuarine/marine invertebrates, the acute toxicity of acetamiprid ranges from slightly toxic to estuarine/marine mollusks to very highly toxic to the mysid shrimp. Acetamiprid is considered practically non- toxic to aquatic plants (EPA 2005a). Based on the low toxicity profile of acetamiprid to fish, some aquatic invertebrates, and aquatic plants, risks to these aquatic organisms are expected to be low. Risks to sensitive invertebrates will be reduced by following label recommendations, including protection of aquatic resources.

The program use of acetamiprid is not expected to have adverse impacts to soil, water, or air due to its environmental fate profile. Acetamiprid degrades rapidly in aerobic soil (half-life between 0.3 to 8.2 days), and is moderately persistent in water (an estimated half-life of 45 days for anaerobic aquatic metabolism) (EPA 2002). The foliar treatment application has low potential to impact surface water and groundwater because acetamiprid is unlikely to drift, run-off or leach (EPA 2005a). Acetamiprid is not persistent on plants with dissipation half-lives of less than 18 days (EPA 2002).

Pyrethrin

Pyrethrins are naturally derived extracts from certain species of chrysanthemum plants that have insecticidal properties. The insecticidal active components of the plant extracts are collectively known as pyrethrins with pyrethrin I and II the most common of the six components. The mode of toxic action occurs through effects on the sodium channels to stimulate nerves to produce repetitive discharges. This results in muscle contractions that are sustained until a block of the contractions occurs. Nerve paralysis can occur at high levels of exposure (Walker and Keith 1992). Pyrethrins have certain properties that serve to both intoxicate and repel certain insects. The control activity occurs through direct contact of the insecticide with the insect; therefore, thorough coverage of the host plants is important to the successful control of the insect.

1. Human Health

The acute oral toxicity of pyrethrin to mammals is low (Category III, oral median lethality value (LD_{50}) of 700 to 2,140 mg/kg). Acute dermal and inhalation toxicities are low to very low (Category III/IV, dermal LD_{50} of >2,000 mg/kg and inhalation median lethality concentration (LC_{50}) of 2.5 to 3.9 mg/L, respectively). Pyrethrin is a slight acute eye irritatant (Category III), and mild or slight acute skin irritatant (Category IV), but not a dermal sensitizer (EPA 2006b). These effects are avoided by the use of proper protective equipment by pesticide applicators. EPA has established an acute RfD of 0.07 mg/kg/day based on uncertainty and safety factors (100 and 3, respectively) applied to a NOEL of 20 mg/kg/day from an acute neurotoxicity study in rats (EPA 2006b). Pyrethrin is rapidly metabolized by mammals through oxidation and/or conjugation before excretion. The primary metabolites and degradation products of pyrethrin are considered to be of lower toxicity than the parent compound (EPA 2005b).

Synergism of the toxicity of organophosphates when combined with pyrethroids (such as pyrethrin) has been shown in laboratory and field tests (Horowitz et al. 1987, Keil and Parrella 1990). Although this is possible in the program area, it is unlikely that applications of organophosphates will be made to treatment sites at an interval close enough to program applications of pyrethrin to result in this effect. Tank mix applications of pyrethrin and organophosphate insecticides are not anticipated, and applications at intervals that would allow for residues of both chemistry classes to result in simultaneous exposure are not expected based on typical insecticide application intervals.

Chronic oral studies of the rat found a NOEL of 4.37 mg/kg/day which was used by EPA to derive the chronic RfD of 0.044 mg/kg/day (EPA 2006b). Developmental toxicity studies of rabbits demonstrate a maternal NOEL of 25 mg/kg/day and a developmental NOEL of 100 mg/kg/day. A reproductive study of rats indicates a reproductive NOEL of 196 mg/kg/day, and an offspring NOEL of 6.4mg/kg/day, based on decreased pup weights. Carcinogenicity studies of pyrethrin have equivocal data based upon a reported treatment-related increase in hepatocellular (liver cells) adenomas. Pyrethrin does not appear to be mutagenic or teratogenic, based upon available data (EPA 2005b).

In this program, pyrethrin is applied as a foliar treatment in commercial citrus groves and surrounding windbreaks (Kern County only). Worker exposure is minimized through the use of protective clothing and adherence to label required application rate and safety precautions. Risks to the general population that would consume treated citrus from citrus orchards that received applications of pyrethrin would be low due to the short half-life of pyrethrin and the timing of application relative to harvest.

2. Ecological and Environmental Quality

The acute oral and dietary toxicities of pyrethrin are practically non-toxic to avian species (oral LD_{50} >2,000 mg/kg bw; dietary LC_{50} >5,620 mg/kg diet) and low for wild mammals (Category III) (EPA 2006b). Available data indicate that inhalation and acute dermal toxicity are also low. Pyrethrin applications in citrus groves are unlikely to pose acute or chronic risk to birds and mammals due to low toxicity and lack of exposure at concentrations that would result in a dose that could cause adverse effects. Indirect impacts to insectivores from loss of terrestrial invertebrate prey generally are not expected due to the limited areas of application relative to the foraging range for most mammals and birds. In situations where pyrethrin would be used over large areas in citrus groves, there is the potential for some terrestrial invertebrate impacts that could result in temporary reductions in prey items. Not all terrestrial invertebrates would be expected to be affected, and there would be rapid recovery of the more sensitive terrestrial invertebrates because of the short residual half-life of pyrethrin. Adverse effects from commercial applications to terrestrial invertebrates on untreated trees are minimized by the lack of substantial drift of the large droplet size of the pesticide formulation applied to host plants.

The broad-spectrum activity of pyrethrin results in high toxicity to a range of invertebrates, including pollinators. The 48-hour contact median lethal dose for honey bees is 0.022 µg/bee (EPA 2015). Risk to pollinators would be expected in citrus groves where pyrethrin applications are made; however, these impacts would be minimized by the rapid degradation of pyrethrin, selective treatment of citrus, and adherence to precautionary label language designed to reduce exposure to honey bees (NPIC 2014). In addition, other nontreated flowering vegetation would be available for pollinator foraging.

Pyrethrin is highly toxic to fish and to most aquatic invertebrates (EPA 2006b). The greatest risk to aquatic resources is through drift from pyrethrin applications in citrus groves. However, adherence to label requirements will minimize drift and reduce exposure and risk to aquatic resources. Pyrethrin runoff is not expected to be significant to aquatic resources because this type of insecticide binds tightly to soil and has very low solubility, reducing the potential for transport and exposure to most aquatic organisms.

The program use of pyrethrins is not expected to have adverse impacts to soil, water, or air due to its environmental fate profile. Half- lives in soil and water are very short, thereby reducing the time for any potential impacts to soil and water quality. Pyrethrins are light sensitive. They have a photolysis[1] half-life of less than 24 hours in both soil and water (half-lives of 12.9 hours on soil surfaces and 11.8 hours in water for pyrethrin I). Less than 3% pyrethrins remained after 5 days on potato and tomato leaves, and pyrethrins do not readily spread within plants (EPA 2006b, NPIC 2014). Pyrethrins are less persistent to aerobic microbial metabolism (half-life of 10.5 days) than anaerobic microbial metabolism (half-life of 86.1 days). Pyrethrins bind tightly to soil particles, reducing their bioavailability in terrestrial and aquatic systems. Pyrethrins have low water solubility and short half-lives of 14 to 17 hours in alkaline water under hydrolysis (EPA 2006b). The low mobility and solubility for pyrethrin suggests that leaching into ground water resources is not expected. Impacts to air quality are also not expected, based on the chemical characteristics of pyrethrin that indicate low volatility. Pyrethrin would occur in the atmosphere as drift from ground applications; however, adherence to label requirements will minimize the potential for off-site drift.

Piperonyl butoxide

Piperonyl butoxide (PBO) is a synergist, a chemical that lacking pesticidal properties of its own but enhance the pesticidal properties of other active ingredients, such as pyrethrins and synthetic pyrethroids (EPA 2006a). PBO directly binds to microsomal enzymes in insects (mammals at high doses) to inhibit enzymes from breaking down other pesticides.

1. Human Health

PBO has a low acute toxicity by oral and dermal (Category III), and inhalation (Cateogry IV) routes. It is minimally irritating to eyes and skin, and is a dermal sensitizer. Liver is the major target organ for PBO. Subchronic studies of PBO treatment in rats and ICR mice showed increases in liver weight and clinical parameters such as cholesterol and enzyme activity, as well as liver histopathological effects such as enlargement of hepatocytes with glassy cytoplasm, oval cell proliferation, bile duct hyperplasia, and focal necrosis. A one-year PBO study in dogs

[1] Chemical decomposition induced by light or other radiant energy.

also resulted in increased liver weight, hepatocyte hypertrophy and elevated serum alkaline phosphatase activity. The guidline studies in rats and rabbits did not report developmental toxic effects in the concentrations tested. There was no evidence on neurotoxic effects and endocrine disruptor effects. EPA developed acute and chronic dietary RfDs of 6.3 mg/kg/day and 0.16 mg/kg/day, respectively for PBO. EPA classified PBO as a possible human carcinogen with no cancer quantification required. The mutagenicity tests show negative results (EPA 2006a).

Toxic effects from combined exposure of PBO and other active ingredients are not assessed by EPA since PBO does not effectively act as a synergist in mammals, and studies suggest that the enzyme inhibition in mammals is transient and only occurs at high doses. In addition, a study in humans reported no inhibition of microsomal enzymes at low doses (EPA 2006a).

The proposed use for PBO will be with pyrethrin and applied as a foliar treatment. Risks to workers will be minimal from the use of PBO based on its low toxicity and lack of significant exposure related to the label requirements, including PPE.

2. Ecological and Environmental Quality

PBO is practically nontoxic to birds, mammals and honey bees (EPA 2006a). Chronic avian toxicity data reporte an estimated NOEC of 300 ppm and a LOEC of 1200 ppm. Chronic mammal toxicity data reported an NOAEC of 1,000 ppm (89 mg/kg bw) and a LOAEC of 5,000 ppm (469 mg/kg bw) (EPA 2006a). Risks to terrestrial organisms are negileble based on the favorable toxicity profile.

PBO is moderately acutely toxic to freshwater and estuarine fish. Chronic data for freshwater fish report a NOEC of 0.04 ppm and a LOEC of 0.11 ppm. PBO is moderately acutely toxic to highly toxic to freshwater invertebrates, and highly toxic to estuarine invertebrates. Chronic data for freshwater invertebrates reported an estimated NOEC of 0.03 ppm and a LOEC of 0.047 ppm. PBO is also highly acutely toxic to amphibians (EPA 2006a). Synergistic effects studies show that PBO in a water body increases the toxicity of pyrethroids/pyrethrins, decreases the toxicity of OP insecticides that require metabolic activation, and has no effect on OP insecticides that do not require activation. Pyrethrin is highly toxic to fish and to most aquatic invertebrates (EPA 2006a). As discussed previously in the non-target toxicity and risk section for pyrethrin, the greatest risk to aquatic resources is through drift from pyrethrin and PBO applications in citrus groves. However, adherence to label requirements will minimize drift and reduce exposure and risk to aquatic resources. PBO runoff is not expected to be significant to aquatic resources because PBO has moderate to low mobility in soil and degrades quickly.

The program use of PBO is not expected to have adverse impacts to soil, water, or air due to its environmental fate profile. PBO degrades rapidly in the environment. In soil, PBO is metabolized by soil microorganism (half-life of 4.3 days) and has a moderate to low leaching potential (NPIC 2014). PBO photolysis in water (half-life of 8.4 hours). PBO may enter the atmosphere as an aerosol when applied by spraying. The estimated atmospheric half-life of PBO is 3.4 hours (EPA 2006a).

Thiamethoxam

Thiamethoxam is a neonicotinoid insecticide (thianicotinyl subclass) that has activity against chewing and sucking insects on a variety of crops. It is a broad-spectrum, systemic insecticide that is rapidly absorbed through plant roots/leaves and is translocated in the xylem from the based toward the apex. Thiamethoxam acts by interfering with nicotinic acetylcholine receptors in the insect nervous system, and mimicking the action of neurotransmitter acetylcholine (ACh) (EPA 2011). The primary metabolite of thiamethoxam is another neonicotinoid insecticide, clothianidin.

1. Human Health

Thiamethoxam has low acute oral toxicity to mammals (Category III), and has low acute dermal (Categoery III) and very low acute inhalation toxicity (Categoery IV) based on acute toxicity studies in rats. The technical material is not irritating to the skin and is a mild irritant to the eye, and is not a dermal sensitizer ((EPA 2010b, NIH 2015). Available mammalian studies suggest that effects occur primarily to the liver, kidney, testes, and blood in different test animals and exposures. EPA developed a dietary acute RfD of 0.35 mg/kg/day and a dietary chronic RfD of 0.012 mg/kg/day (EPA 2010b). Developmental effects have been observed in rat studies; however, effects were observed at doses that are maternally toxic. Thiamethoxam is not considered mutagenic and is not likely to be carcinogenic to humans (EPA 2010b).

Applications will be restricted to foliar applications in commercial citrus groves. Workers and applicators will be the population segment at greatest risk of exposure to thiamethoxam applications. Precautionary label language and personal protective equipment requirements will reduce exposure and risk to this group of the population. Thiamethoxam exhibits chemical properties that could result in the contamination of surface and ground water resources that may be used for drinking water. The potential for this type of exposure is reduced by following label recommendations regarding avoiding applications to soils that are highly permeable, or poorly drained, and the use of vegetative filter strips between areas of application and aquatic resources.

2. Ecological and Environmental Quality

Thiamethoxam is slightly toxic to birds from in acute oral exposure and practically non-toxic in subacute dieary exposure. Thiamethoxam is slightly toxic to mammals (EPA 2011). Thiamethoxam is highly toxic to honey bees (a 96-hr acute oral LD_{50} of 0.005 ug/bee) (EPA 2011). The available toxicity data resulted in label language designed to reduce exposure and risk to these types of pollinators. Adherence to thiamethoxam label requirements regarding the protection of honey bees will reduce exposure and risk to honey bees and other pollinators. Thiamethoxam is also expected to impact other sensitive nontarget terrestrial invertebrates; however, these impacts will typically be confined to areas within the citrus orchard. Impacts to nontarget terrestrial invertebrates adjacent to the orchard are not expected because foliar application exposure will be reduced by avoiding drift into nontarget areas.

Thiamethoxam acute toxicity to fish is considered to be practically non-toxic, while acute toxicity to aquatic invertebrates ranges from low to highly toxic, depending on the test organism (Barbee and Stout 2009, EPA 2011). Toxicity to aquatic invertebrates, such as freshwater cladocerans, is low, while toxicity to aquatic insects is high with median lethality and sublethal effect values in the low parts per billion range. The most sensitive acute toxicity for freshwater and estuarine/marine invertebrates are midge (48-hr EC_{50} of 35 ug/L) and and mydis shrimp (96-hr LC_{50} of 6,900 ug/L) (EPA 2011). The mebalolite clothianidin is more toxic to aquatic invertebrates than the parent thiamethoxam (48-hr EC_{50} of 22 ug/L for midge and 96-hr LC_{50} of 51 ug/L for mysid shrimp). Exposure and risk to aquatic organisms from thimethoxam, and the associated metabolite clothianidin, can be reduced by avoiding applications under conditions that would allow for runoff and drift.

Thiamethoxam degradation in soil is slow. Soil half-lives range from approximately 79 to 97 days (soil photolysis), and from 101 days to 353 days (aerobic soil metabolism) (EPA 2011). Comparative half-lives in water are shorter with values ranging from 2 to 3 days (direct aqueous photolysis), 16 days (aerobic aquatic metabolism), and 25 to 29 days (anaerobic aquaticmetabolism). Through hydrolysis, thiamethoxam is stable at pH 5 to 7 and has half-lives ranging from approximately 4 to 8 days at pH 9 (EPA 2011). Terrestrial field dissipation studies show that the half-life for broadcast application is relatively short at 13 days. Thiamethoxam is highly water soluble (water solibility of 4100 mg/L at $25^{o}C$) and exhibits chemical properties that suggest it could move off-site. Precautionary language on the label for water protection will reduce the potential for impacting surface and ground water. Thiamethoxam does not readily volatilize into the atmosphere), suggesting that any impacts to air quality would be primarily confined to treated areas during application.

Carbaryl

Carbaryl is a carbamate[2] insecticide with a mode of action that occurs primarily through acetylcholinesterase (AChE) inhibition[3] (Klaassen et al. 1986). Carbamates exhibit a reversible pesticide-enzyme binding reaction (carbamylation), which results in gradual decreases in binding as their concentration decreases through metabolism and excretion. Carbaryl is a broad-spectrum insecticide that is effective as a foliar treatment against leaf-dwelling insects.

1. Human Health

The acute oral median lethal toxicity of carbaryl is moderate to mammals (Category II). The acute dermal and inhalation toxicities are low (Category III and Category IV) (EPA 2004a). In animal studies, carbaryl was not an irritant to skin or eye and was not a dermal sensitizer. However, a number of incidents reported skin irritation and manifestations of an allergic response associated with human exposure (EPA 2004a). Carbaryl is readily metabolized and largely excreted from humans within 24 hours. The primary metabolite of carbaryl, 1-naphthol, is considerably less toxic than the parent compound. EPA has calculated an acute RfD of 0.01 mg/kg/day based on results from a comparative cholinesterase study using the rat and the use of a safety and uncertainty factor (EPA 2007).

The toxicity of carbaryl may be increased by exposure to some other carbamates and organophosphates (Knaak and O'Brien 1960, Keplinger and Deichmann 1967, Segal and Fedoroff 1989). Although this is possible in the program area, it is unlikely that the timing of program applications of carbaryl will occur at an interval close enough to result in this effect on toxicity.

A chronic feeding study of dogs determined a no observed effect level (NOEL)[4] of 3.83 milligrams per kilograms per day (mg/kg/day) for carbaryl based upon significant decreases in plasma and brain cholinesterase activity at higher doses (EPA 2003a). A subchronic rat neurotoxicity study found a NOEL of 1 mg/kg/day based upon decreased blood and brain cholinesterase[5] at higher doses (EPA 2007). Reproductive and developmental toxicity studies in rats found a maternal NOEL of 1 mg/kg/day and a teratologic[6] NOEL of 3.15 mg/kg/day. Carbaryl has been classified as a likely carcinogen based upon vascular tumors and hepatic and kidney adenomas (a type of benign tumor) found in a chronic

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[2] Carbamates are organic compounds derived from carbamic acid (NH_2COOH).

[3] Inhibitors of acetylcholinesterase act by disrupting the transmission of nerve impulses across the nerve synapses in animals. Depending on the degree of acetylcholinesterase inhibition, effects can include anything from headaches, mental confusion, blurred vision, and muscle twitching to muscle paralysis.

[4] The highest tested dose of a substance that has been reported to have no harmful health effects.

[5] An enzyme that is widely distributed throughout the muscles, glands, and nerves of the body that converts acetylcholine into choline and acetic acid.

[6] Causing malformations of an embryo or fetus.

carcinogenicity study. Chromosomal damage has been reported with high doses of carbaryl, but no in vivo[7] mutagenic effects have been observed (EPA 2007).

EPA performed a human incident review for carbaryl (EPA 2010a). The review showed that human health effects assocaiated with carbaryl exposure include dermal, neurological, gastrointestinal, and respiratory systems. The patients reported inhalation of carbaryl, or getting the product on their face, hands, arms, and legs accidentally while applying the product indoor and outdoor. Most incidents occurred in residential settings. The review also concluded that carbary exposure may be a risk factor for developing cutaneous melanomama. However, these incidents do not represent the current potential for carbaryl exposure because of the recent product changes to enhance safety.

Carbaryl is applied as a foliar treatment in the program in commercial citrus groves. Exposure is expected to be the highest for applicators; however, risks to applicators are expected to be low based on the proper use of PPEs and its low toxicity. Potential risks for the general public (adults and children) are not expected because the program use of carbaryl is for non residential applications and with the short half-life of carbaryl in the environment there is a low likelihood of exposure.

2. Ecological and Environmental Quality

The acute oral median lethal toxicity of carbaryl is moderate for mammals, while toxicity to birds ranges from toxic to practically nontoxic, with acute oral median lethal toxicity values from 16 mg/kg to greater than 2,000 mg/kg (EPA 2003b). There is the potential for indirect impacts to birds and mammals that forage for terrestrial invertebrate prey items in carbaryl treated citrus groves. Carbaryl has a short half-life in the environment; therefore, recovery of nontarget terrestrial invertebrates would be expected to occur for most invertebrates.

The broad spectrum activity of carbaryl results in high toxicity to most insects, including pollinators. The 48-hour contact median lethal dose for honey bees is 1 microgram per bee (µg/bee) (EPA 2003b). Adherence to carbaryl label requirements regarding the protection of honey bees will reduce exposure and risk to honey bees and other pollinators.

Carbaryl is moderately to highly toxic to fish, and very highly toxic to all aquatic insects and most aquatic crustaceans (EPA 2003b). Carbaryl is not subject to significant bioaccumulation[8] due to its low water solubility and lack of uptake in plant and animal tissues. Aquatic vertebrates and invertebrates may be exposed to carbaryl through runoff or drift adjacent to the site of application. Aquatic resources adjacent to citrus groves may

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[7] Experiments done in or on living tissue or a whole, living organism.
[8] The accumulation of substances, such as pesticides, or other organic chemicals in an organism.

receive exposure from carbaryl applications. Sensitive sites, such as shallow, static bodies of water, may be impacted by carbaryl applications. Risk is greatest for aquatic invertebrates because they are more sensitive to carbaryl, potentially resulting in indirect impacts to aquatic vertebrates that depend on these resources as prey. However, exposure and risk to aquatic sites can be reduced by adherence to label requirements for the carbaryl formulation that may be used in citrus grove applications.

Carbaryl is not expected to persist in the environment under the proposed use patterns. Carbaryl degrades rapidly in soil and water with half-lives in laboratory and field studies ranging from less than 1 day to approximately 20 days (USDA 2008). Carbaryl is not considered to be a threat to ground water resources because it is not considered to be mobile and susceptible to leaching. Carbaryl could impact surface water quality in situations where aquatic resources are adjacent to treatment sites. Water quality impacts will be minimized by following adherence to label requirements for ground and aerial treatments. On plant leaves, carbaryl has an average half-life of 3.2 days (EPA 2003b). Carbaryl is not expected to have impacts to air quality from volatilization[9] after application. Carbaryl will occur in the atmosphere during application as spray droplets; however, this will occur in the immediate area of application and will dissipate quickly after treatment.

Dinotefuran

Dinotefuran is a systemic insecticide belonging to the neonicitinoid class and the nitroguanidine subclass. Neonicotinoids are neurotoxins that act by binding to specific sub-sites or protein subunits of the nicotinic acetylcholine receptor (nAChR) to activates nAChR activity (USDA 2009).

1. Human Health

Dinotefuran has low acute toxicity to mammals (Category III), and very low inhalation and dermal toxicity (Cateogry IV). It is not considered a skin irritant based on skin sensitization and irritation studies (Cateogry IV); however, it is considered an eye irritant (Cateogry II). Based on sublethal study results, dinotefuran is not considered a carcinogen or mutagen; developmental effects only occur at doses that are maternally toxic. Immune- and endocrine-related effects have been observed in multiple studies (EPA 2004b). These effects were observed during prolonged exposures and are not anticipated in this program. The primary immune system-related effect observed in the studies was altered thymus weights which may not be related to direct immune toxicity of dinotefuran. However, this may be a secondary effect due to overall reduced body size and weight gain during exposures that were 13 weeks or greater, depending on the type of study. EPA established an acute dietary RfD of 1.25 mg/kg/day and a chronic dietary RfD of 0.02 mg/kg/day for dinotefuran (EPA 2004b). Based upon EPA’s evaluation of risk to different human

[9] The conversion of a chemical substance from a liquid or solid state to a gaseous or vapor state.

population subgroups, including occupational exposures, it was determined that the dinotefuran risk alone, as well as aggregate risk when including other neonicitinoid insecticides, did not exceed agency levels of concern (EPA 2004b).

Due to the mobility and persistence of dinotefuran, there is the potential for surface and ground water residues to occur in areas that are vulnerable to runoff and leaching. Adherence to label requirements and avoidance of dinotefuran applications to permeable soils will reduce the possibility of contamination of any drinking water resources. Due to the systemic nature of dinotefuran, there is the possibility of residues in citrus harvested for human consumption. The low residues that have been observed with similar insecticides in citrus, and the low toxicity to mammals suggests that adverse effects would not be expected for people that would consume citrus from groves treated with dinotefuran.

2. Ecological and Environmental Quality

Dinotefuran has low to moderate acute and chronic toxicity to nontarget wildlife, such as mammals and birds (USDA 2009). Direct risk is not expected based on conservative estimates of exposure and the available toxicity data. Indirect impacts to wildlife populations through the loss of invertebrate prey are also not expected to be significant because only sensitive terrestrial invertebrates that feed on treated trees will be impacted while other insects would be available as prey items. Dinotefuran toxicity is high for honey bees and, similar to other neonicotinoid insecticides, there is uncertainty regarding the impacts of residues from this class of systemic insecticides in pollen and nectar. Studies measuring pollen and nectar residues in other crops with imidacloprid, a neonicotinoid insecticide, have shown that sublethal effects occur above residues measured in the field. However, there is uncertainty regarding dinotefuran residue levels in pollen and nectar from citrus trees and potential impacts to honey bees.

Dinotefuran has low toxicity to fish and most aquatic invertebrates with the exception of some marine invertebrates where it is considered highly toxic. Available toxicity data indicate that degradates of dinotefuran are less toxic to aquatic organisms. Dinotefuran is susceptible to runoff which could occur in aquatic areas adjacent to citrus groves. Significant drift to sensitive aquatic habitats is not expected based on the method of application. Exposure and risk to aquatic organisms will be minimized by adherence to label requirements regarding applications near water. Risk is expected to be minimal to fish, although there is a possibility of risk to some sensitive aquatic invertebrates in very shallow water bodies adjacent to treated citrus groves.

For all insecticide applications in citrus groves, there is the potential for indirect risk to wild mammals and birds from the loss of available invertebrate prey that would occur after treatment. Risks from these types of effects are reduced for those birds and mammals that can forage outside of the treatment area and recovery of most invertebrate populations that will occur within the citrus groves after treatment will ensure that any impacts to mammals and birds are short-term in nature. The extent and time for recovery would be based on how persistent and broad spectrum a selected insecticide may be in its nontarget effects.

The high water solubility and soil adsorption characteristics of dinotefuran suggest that it is highly mobile in soil. Dinotefuran is potential persistent in environment with aerobic soil metabolism half-life of 81.5 and 138.4 days (mean and 90^{th} percentile, respectively) and does not break down in water through hydrolysis. It is somewhat susceptible to microbial degradation (aerobic aquatic metabolism half-life of 80.8 days, 90^{th} percentile). It, however, is very sensitive to photolysis (aqueous photolysis half-life of 1.8 days) (EPA 2004b). Because of the high mobility and solubility of dinotefuran, there is the potential for leaching into ground water; however, avoiding application to permeable soils and areas where the water table is high will mitigate the potential for contamination. Dinotefuran is not expected to impact air quality based on the method of application and chemical properties which suggest a low potential for volatilization.

C. Cumulative Effects

Cumulative impacts are those impacts on the environment which result from the incremental impact of a proposed action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. The cumulative impacts from the selection of the preferred alternative are considered incrementally negligible and would be less than those from the selection of the no action alternative.

A variety of crops grown in the five counties covered in the GWSS area-wide management program are treated to control other insect pests. Acetamiprid was used on 61 different crops; chlorpyrifos on 54 different crops; cyfluthrin on 43 different crops; imidacloprid on 95 different crops (including animal husbandry); methomyl on 43 different crops; and pyrethrins on 77 different crops (CDPR 2013). The proposed addition of the new insecticides discussed in this EA are expected to result in incrementally negligible cumulative impacts. Applications will be limited to commercial citrus orchards collocated with vineyards that currently receive chemical applications, including chemistries proposed in the GWSS program. Applications will only occur when GWSS detections exceed threshold levels, with program activities coordinated by APHIS, CDFA and county personnel. CDFA contracts treatment coordinators who advise growers when they are to make applications with the proposed list of insecticides that have been proven effective against GWSS. In addition the University of California's Integrated Pest Management Guidelines describe management options for pest and diseases in California's citrus crop (University of California 2012). The IPM guidelines describe application rates and usage restrictions to protect pollinators and the surrounding environment.

D. Threatened and Endangered Species

Section 7 of the Endangered Species Act (ESA) and its implementing regulations require Federal agencies to ensure their actions are not likely to jeopardize the continued existence of threatened or endangered species or result in the destruction or adverse modification of critical habitat. CDFA works with the FWS regarding the presence of listed species in areas where program activities may occur. In cases where CDFA and the FWS/NMFS determines that there is a potential for exposure of listed species to program activities a biological assessment will be prepared to ensure their protection. Mitigation measures for any of the proposed insecticides that are part of ESA-related litigation, or are part of a biological opinion, within the proposed action area will be implemented where appropriate.

E. Migratory Birds

The Migratory Bird Treaty Act of 1918 (16 United States Code (U.S.C.) 703–712) established a Federal prohibition, unless permitted by regulations, to pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird or any part, nest, or egg of any such bird.

Executive Order 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds," directs Federal agencies taking actions with a measurable negative effect on migratory bird populations to develop and implement a memorandum of understanding (MOU) with the FWS which promotes the conservation of migratory bird populations. On August 2, 2012, an MOU between APHIS and the FWS was signed to facilitate the implementation of this Executive order.

Proposed insecticide applications will occur in citrus groves where birds may nest and forage. Orchards are disturbed areas that are actively managed for agricultural production. The proposed insecticides vary in their toxicity to birds however most have low toxicity and would not be expected to result in direct risk beyond other chemical applications that would occur in these areas. There would be some loss of invertebrate prey items for birds that forage in citrus orchards and the impacts will depend on the specific chemical used in the GWSS program. The loss of prey items for insectivorous birds will be localized to treated areas within the orchard that may receive a chemical treatment. Birds would typically have a foraging range larger than the areas treated in a orchard and would have access to invertebrates within the orchard that aren't sensitive to chemical treatment.

F. Other Considerations

Executive Order (EO) 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," focuses Federal attention on the environmental and human health conditions of minority and low-income communities, and promotes community access to public information and public participation in matters relating to human health and the environment. This EO requires Federal agencies to conduct their programs, policies, and activities that substantially affect human health or the environment in a manner so as not to exclude persons and populations from participation in or benefiting from such programs. It also enforces existing statutes to prevent minority and low-income communities from being subjected to disproportionately high or adverse human health or environmental effects. The human health and environmental effects from the proposed applications are expected to be minimal and are not expected to have disproportionate adverse effects to any minority or low-income family. The use pattern and available data regarding risk for each of the proposed insecticides suggests that minority and low income populations will not be at a disproportionate risk.

EO 13045, "Protection of Children from Environmental Health Risks and Safety Risks," acknowledges that children, as compared to adults, may suffer disproportionately from environmental health and safety risks because of developmental stage, greater metabolic activity levels, and behavior patterns. This EO (to the extent permitted by law and consistent with the agency's mission) requires each Federal agency to identify, assess, and address environmental health risks and safety risks that may disproportionately affect children. Use patterns for chemical use in the GWSS area-wide management program and available chemical risk assessment data suggests that children will not be at risk from GWSS program activities.

Executive Order 13175, "Consultation and Coordination with Indian Tribal Governments" was issued to ensure that there would be "meaningful consultation and collaboration with tribal officials in the development of Federal policies that have tribal implications…." The location of commercial citrus groves in or near to tribal lands was considered in terms of the potential treatment of such citrus under the GWSS program. A request for consultation with tribes that occur in the five counties that are covered in this EA was submitted to each tribe.

NEPA requires compliance with laws and regulations that fulfill the purpose of preservation and protection of important historic and cultural resources, such as the National Historic Preservation Act (NHPA, 16 U.S.C. 470 et seq.) and the Archeological Resources Protection Act (ARPA, 16 U.S.C. 470aa-mm). The GWSS program will involve the deployment of detection traps and the recommendation of pesticides that can be applied by commercial citrus growers.

The proposed action for the GWSS program involves targeted chemical applications and other program activities that are designed to prevent adverse effects to historic and archeological properties and therefore are not expected to affect any district, site, building, structure or object that is included in or eligible for inclusion in the National Register of Historic sites under the National Historic Preservation Act, or the Archeological Resources Protection Act.

No designated historic or archeological sites have been identified within or nearby the current program boundaries and no adverse effects to such sites are anticipated as a result of program pesticide applications. Should the program area expand to culturally-sensitive areas APHIS will contact the California Office of Historic Preservation to determine if the proposed action will have a negative impact on historic properties.

V. Listing of Agencies and Persons Consulted

Plant Protection and Quarantine
Animal and Plant Health Inspection Service
U.S. Department of Agriculture
650 Capitol Mall, Suite 6-400
Sacramento, CA 95814

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Policy and Program Development
Environmental and Risk Analysis Services
4700 River Road, Unit 149
Riverdale, MD 20737

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Appendix A. Glassy-winged sharpshooter distribution in California