United States
Department of
Agriculture

Marketing and
Regulatory
Programs

Animal and
Plant Health
Inspection
Service

Light Brown Apple Moth Sterile Insect Field Evaluation Projects in Long Beach and San Diego, California

Environmental Assessment
February 2011

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Appendix A. Maps of Evaluation Areas

I. Introduction

The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), in cooperation with the California Department of Food and Agriculture (CDFA), strives to improve the effectiveness of agency invasive plant pest control programs. Sterile insect technique (SIT) has become an increasingly important component of APHIS' programs. It has been an effective tool in many programs and is environmentally friendly.

A. Sterile Insect Technique

There is broad international consensus that control efforts against invasive species should be based on the area-wide concept of integrated pest management (IPM)[1] (Klassen and Curtis, 2005). SIT may be used as a key component in suppression or eradication programs by helping to create pest-free areas within IPM programs (Hendrichs et al., 2007; Pimentel, 2007).

It has been known since the 1950s that insect pests can be controlled or eradicated through a method based on SIT (Klassen and Curtis, 2005). SIT plays a significant role in ongoing containment and eradication programs for numerous pests around the world (Dyck et al., 2005; Bloem et al., 2005). SIT is defined by the International Plant Protection Convention (IPPC) as "a method of pest control using area-wide inundative releases of sterile insects to reduce the fertility of a field population of the same species" (Dyck et al., 2005). SIT involves the colonization and mass-rearing of the targeted pest species, sterilization of the insects through the use of gamma or x-ray radiation treatment, and release into infested areas. Mating between sterile and fertile insects causes sterility in their offspring (Dyck et al., 2005). With continued release of sterile insects in sufficient numbers, the wild pest target population will decline and be reduced to near zero levels causing local extinctions. SIT, when used on an area-wide basis and combined with other IPM control tactics, can lead to regional suppression or eradication of the target pest (Bloem et al., 2005).

The use of SIT has many advantages, including species specificity and compatibility with other area-wide control tactics, such as biological control, mating disruption, cultural control, and the use of biorational pesticides[2] (Dyck et al., 2005; Carpenter, 2000).

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[1] IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means, and with the least possible hazard to people, property, and the environment (EPA, 2009).

[2] Biorational pesticides are pesticides that are efficacious against the target pest but are less detrimental to natural enemies.

SIT has been used successfully as a control method to contain the spread of numerous insect pests, including moths, screwworms, tsetse flies, and fruit flies (Klassen and Curtis, 2005; Dyck et al., 2005; Hendrichs, 2001). Specifically, SIT has been successful in operational containment, suppression, and eradication programs against the codling moth (Canada), pink bollworm (United States), cactus moth (United States), painted apple moth (New Zealand), and false codling moth (South Africa) (Bloem et al., 2005; Carpenter et al., 2005; Suckling et al., 2007). In addition, this technology has been key in eradication efforts and preventing the establishment of several exotic pest fruit flies within the United States and several other countries.

1. Method of Sterilization

Adult stage insects are sterilized to ensure they will not produce viable offspring. Prior to field release, the insects are exposed to gamma or x-rays. All sterilization treatments are conducted in an approved facility in accordance with stringent Federal and State safety guidelines. Both gamma and x-rays can be used to sterilize insects. The effects of radiation are species-specific and must be evaluated in the laboratory to determine the exact dose which results in sterility but will still allow treated insects to be sexually competitive with nonsterilized insects. The effects of irradiation on sterility are the same for both types of radiation and there will be no difference in sterility levels for the same absorbed dose from either type of radiation (Bakri et al., 2005; Mehta and Parker, 2010). Sterilization of insects does not result in radioactivity of the treated insects (Bakri et al., 2005; Whitten and Mahon, 2005).

2. Identification

An important component of the evaluation of a SIT program is the accurate identification of the sterile released insects (Stephens et al., 2008). Marking sterile insects allows for differentiation of the released insect from the wild pest, which provides information that allows for effective management of the control program. Marking sterile moths released in SIT programs is accomplished by mixing an oil-soluble red azo dye (known as Calco Red) into the artificial diet fed to the LBAM larvae during rearing. The dye internally marks the insect so that it is easily distinguished from a wild (unmarked) insect. Several other methods for marking insects are also available; however, the use of Calco Red as an internal marker is the most commonly used method, and it provides a safe and cost-effective marker (Hagler and Jackson, 2001; Qureshi et al., 2004). The marker accumulates in the skin, fat body, and ovaries of adult moths, and results in sterile insects that can be distinguished from wild insects in the field. This dye has been used extensively in SIT programs for marking moths of several pest species, including pink bollworm, codling moth, false codling moth, painted apple moth, and date moth (Graham and Manghum, 1971; IAEA, 2003; Hagler and Jackson, 2001; Stephens et al., 2008).

B. Light Brown Apple Moth

Light brown apple moth (LBAM), *Epiphyas postvittana* (Tortricidae), is a tortricid leafroller moth native to Australia, but now widely distributed in New Zealand, the United Kingdom, Ireland, and New Caledonia. LBAM was reported in Hawaii in the late 1800s; however, LBAM's presence in the mainland United States was first confirmed in March 2007 in Alameda County, California. Over the last 4 years, surveys have been conducted in California to determine the extent of the infestation. LBAM has been detected in 20 counties, 17 of which are currently quarantined (Alameda, Contra Costa, Los Angeles, Marin, Monterey, Napa, San Benito, San Francisco, San Joaquin, San Luis Obispo, San Mateo, Santa Barbara, Santa Clara, Santa Cruz, Solano, Sonoma, and Yolo).

LBAM is of concern because it can damage a wide range of crops and other plants, including ornamentals. The list of agricultural crops which could be damaged by this pest includes grapes, citrus, stone fruit (peaches, plums, nectarines, cherries, and apricots), and many others. The complete host list contains well over 1,000 plant species, including more than 250 fruits and vegetables.[3]

The life cycle of LBAM is continuous, and does not have a winter resting period (Johnson, et al., 2007); however, the colder winter temperatures considerably slow the development of the larval stage (Johnson, et al., 2007). The number of LBAM generations produced in a growing season varies from one to more than four, depending on environmental conditions (Danthanarayana, 1983; Mo et al., 2006a). It is estimated that there may be a potential for as many as five generations to occur in some areas of California.

LBAM egg masses can generally be found on leaves of host plants; however, the egg masses also have been known to occur on the fruit and stems of host plants (Johnson et al., 2007). Once the larvae hatch, they construct a silken shelter and begin feeding on the host plant as they go through up to six stages of growth (Johnson et al., 2007). The larval stages are the only feeding stages for LBAM. Young larvae are pale yellow, while the mature larvae are pale green (Mo et al., 2006b). The larvae reach approximately three-fourths of an inch (18 millimeters (mm)) in length before pupation (Johnson et al., 2007).

Adults emerge after a pupation period of one to several weeks, depending on climate, and mate soon after emergence (Johnson et al., 2007). Both female and male adults are light brown in color; however, the females are distinguished by a dark spot in the center of the front wings when folded

[3] The host list is available at: http://www.cdfa.ca.gov/phpps/PDEP/target_pest_disease_profiles/LBAM_HostList.pdf.

(Johnson et al., 2007). LBAM adults are capable of flying only short distances to find a suitable host. Most moths fly no further than 330 feet (ft) (100 meters), although some may fly as far as 2,000 ft (600 meters) (Suckling et al., 1994). The adult life span is 2 to 3 weeks with longevity influenced by host plant and temperature (Johnson, et al., 2007). Female moths generally deposit egg masses containing 20 to 50 eggs (Johnson et al., 2007). Female LBAM have been known to lay up to 1,496 eggs in their lifetime; however, normally the number of eggs per female LBAM is between 118 to 462 (Johnson et al., 2007).

C. LBAM in California

APHIS and CDFA are working together to control and manage LBAM before it has the chance to spread throughout the State, which would require greater resources to protect agricultural, urban, suburban, and native landscapes. CDFA has established State Interior Quarantine areas where multiple trap captures have confirmed an LBAM population in those areas. Current control efforts focus on the use of mating disruption pheromone dispensers in areas with small LBAM populations. Treatments within the State Interior Quarantine areas have been limited. As such, the LBAM populations have continued to increase and expand their range. Recent research has suggested that SIT may be a tool that could be useful in the LBAM program.

For the last 2 years, LBAM SIT methods development research conducted in the laboratory and in small-scale field studies in California, New Zealand, and Australia have shown promising results. SIT research was initiated because of concern for LBAM's status as an invasive species and the need to control the pest. As a tortricid leafroller, it has similar biology to two other tortricid pest species for which effective sterile insect release tactics have been developed (i.e., codling moth and false codling moth). Similar methods for mass-rearing, handling, sterilization, and release can easily be adapted from methods already developed for these species.

A SIT evaluation study is currently ongoing in the Napa/Sonoma area. This area is agricultural, in nature. The study will identify flight distance, longevity, and dispersion potential of sterile LBAM in agricultural areas. Due to the limited wild LBAM population in the area, there is no data regarding how the sterile moths interact with the wild population.

D. Purpose and Need

APHIS is responsible for taking actions to exclude, eradicate, and/or control plant pests under the Plant Protection Act (7 U.S. Code (U.S.C.) 7701 et seq.). As such, it is important that APHIS take the steps necessary to suppress LBAM from areas in California in order to prevent its spread

to susceptible host plants throughout the State and the United States. The wide range of potential host plants will put agricultural, landscape, and natural resources at risk throughout a large part of California and elsewhere in the United States if LBAM is permitted to spread unchecked.

In order to incorporate SIT into the LBAM program, APHIS needs to conduct additional evaluations to enhance understanding of the interaction between sterile LBAM and wild populations under various settings. In addition, APHIS needs to better understand how SIT will interact with other program tools, such as the LBAM pheromone dispensers. This information will help refine how SIT could be used in the LBAM program in the future.

This EA has been prepared consistent with the National Environmental Policy Act of 1969 (NEPA) and APHIS' NEPA implementing procedures (7 Code of Federal Regulations (CFR) part 372) for the purpose of evaluating how the proposed action, if implemented, may affect the quality of the human environment.

II. Alternatives

This EA will analyze the environmental effects anticipated from two alternatives which are (1) no action, and (2) the proposed evaluation study. Each alternative is briefly described in this section, and the potential environmental effects of each are considered in section IV, Environmental Effects.

A. No Action

Under the no action alternative, APHIS would not conduct additional evaluations of sterile LBAM. APHIS would be limited to data collected from SIT releases in the Napa/Sonoma area to help aid in the development of an SIT program for LBAM. This area consists of a 3-square-mile vineyard which stretches across Napa/Sonoma Counties. The LBAM population in this area is very small, and it has been difficult to evaluate the interactions of sterile LBAM with wild LBAM. Understanding the interactions between sterile LBAM and the wild LBAM is critical to know whether and how SIT could be effective in an LBAM program.

B. Preferred Alternative

Under the preferred alternative, APHIS would conduct evaluation studies of sterile LBAM in both Long Beach and San Diego, California (see appendix A for maps of the two areas). Although these areas have an aggregate area of roughly 14 square miles, evaluation studies will take

place in specific sites suitable for study purposes. Portions of these areas may be used as control areas for the evaluation studies.

APHIS plans to study and evaluate several aspects of the potential LBAM SIT program, including sterile insect releases, dispersal of sterile LBAM, trapping of both male (using pheromone-baited delta traps[4]) and female (using port wine traps[5]) sterile and wild LBAM, and mating assessments. These evaluations will help determine if and how sterile insect releases could be effective as part of an LBAM control and management program.

1. Sterile Insect Releases

Both Long Beach and San Diego will have designated areas where continual releases of sterile LBAM will occur. These releases will occur up to six times per week over the course of the study (early 2011 through winter 2012).

Prior to release, LBAM will be reared in the USDA laboratory in Moss Landing, California. After rearing, the LBAM will be sterilized either at the USDA laboratory in Moss Landing or they will be transported in double containment packaging for secure transport under CDFA permit to the Lawrence Livermore National Laboratory (LLNL). Moths sterilized at Moss Landing will be exposed to x-rays while moths sterilized at LLNL will be exposed to gamma rays.

Once the moths are sterilized, they will be brought either to the Long Beach or the San Diego site for release. The releases will be made either by hand, truck-mounted release machine, or by air. All releases will occur either in the early evening (near dusk) or early morning (sunrise).

Releases made by truck will utilize one truck with a release machine mounted on the back. The truck may release once a day up to 6 times per week, and release no more than 1,400 moths per acre per week. Aerial releases will involve a small aircraft that will fly at an altitude of between 1,500 and 2,400 feet making one pass up to six times per week, releasing no more than 1,400 sterile LBAM per acre per week. Both Long Beach and San Diego will have specific areas where SIT releases will take place throughout the evaluation study.

2. Dispersal Studies

For the dispersal study, sterile LBAM will be released by hand from a central area. Given that most LBAM fly no further than 100 meters, delta traps will be placed at varying distances up to a 500-meter radius from the central release point to assess how far the sterile LBAM moths disperse from the release site. Dispersal studies may be done in either Long Beach or San Diego.

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[4] A delta trap is a triangular shaped trap, much like a tent, with three solid sides and two openings.
[5] A port wine trap uses fermented port wine as a lure to attract insects.

3. Mating Assessment Studies

For the mating assessment study, an immobilized female LBAM will be placed in a mating station to determine if wild males are mating with them. Mating assessment studies will occur in both areas where sterile moths are being released.

4. LBAM Pheromone Dispenser Studies

The program also plans to evaluate how both sterile and wild LBAM react to LBAM pheromone mating disruption dispensers. This will aid the LBAM program in determining how pheromone dispensers can be used together with SIT. CDFA has already deployed pheromone dispensers in San Diego, California; therefore, no additional dispensers will be deployed in San Diego by APHIS during the evaluation study.

5. Trapping

In addition to the studies discussed above, the study will utilize different types of traps to evaluate the LBAM populations in both Long Beach and San Diego. Red delta traps baited with LBAM pheromone will be used to attract both sterile and wild male LBAM. Because female moths are not attracted to the pheromone bait, port wine traps may be used. General light traps may also be used to attract both female and male LBAM. All traps will be serviced at least once per week. Trapping will occur in both evaluation areas.

III. Affected Environment

A. Land Use

1. Long Beach

A map of the evaluation study area in Long Beach is located in appendix A. The evaluation study area is approximately 11 square miles. It is primarily residential in nature, with some commercial, industry, and parks, including Long Beach Public Beach (LB Planning, 2007). Residences consist mostly of single family homes with a number of apartment complexes (LB Planning, 2007). Long Beach has a high population density with 9,171 people per square mile.

The evaluation study area is adjacent to, but does not include, the port of Long Beach; however, Long Beach Airport (also referred to as Daugherty Field) is within the evaluation study area (see appendix A).

2. San Diego

The evaluation study area in San Diego is approximately 3 square miles and is primarily a residential area with Balboa Park and Switzer Canyon Park on the western side of the treatment block (see appendix A). This area is within the San Diego city limits, which has the second highest city population in California (City Planning & Community Investment, 2010). Although the population is high, the population density (4,020 people per square mile) is average for a city, and is less than one-half of the population density of Long Beach, California.

B. Insect Populations

The populations of insects in areas such as San Diego and Long Beach are similar to other urban areas; however, the types and species in a certain area are dependent on the vegetation that exists in and around the setting. The biodiversity of the invertebrate populations in urban environments may not be comparable to natural ecosystems, but they can include high populations of a number of different species due to fewer predators and competitive species (Helden and Leather, 2004; Dreistadt et al., 1990; Rebele, 1994).

There are over 8,000 moth species that live in Western North America (Essig Museum, 2010). The Essig Museum, located on University of California at Berkley campus, has a database that identifies the number of moth species in each county of the State. Of 29,600 specimens at the museum, there are 1,537 different species cataloged from Los Angeles County (6 in Long Beach, California) and 1,339 different species cataloged from San Diego County (162 in San Diego, California). However, these numbers only reflect the different species of moths in these areas and do not denote the population densities or relative abundance of each species. There are no records of population densities of moths in these areas.

1. LBAM in Long Beach

There is currently a small reproducing LBAM population in Long Beach, California, based on finds in traps over the past year. This small population has not been treated with pheromone dispensers because the population is unlikely to spread into areas where damage to crops or nursery stock would occur. Because of the existing reproducing population within the 11-square mile area that is isolated from the generally infested LBAM population in the Bay area, it is an ideal spot to conduct evaluation studies to see how sterile LBAM interact with the wild population. Due to the size of the area, it is possible for the evaluation to also include a control area for comparison.

2. LBAM in San Diego

The LBAM population in the San Diego area is very small and similar to the population in Napa/Sonoma where studies were conducted last year. However, it allows the use of sterile releases to be used in conjunction with pheromone twist ties that have been applied by CDFA. The study of the interaction between these two control methods will help determine if they should be used simultaneously in the same area.

IV. Environmental Effects

A. No Action

Under the no action alternative, the only environmental impacts from not conducting a SIT evaluation study in Long Beach and San Diego, California, would be attributed to the likelihood that the small LBAM populations may establish and continue to grow in these two areas.

1. LBAM in Long Beach

APHIS and CDFA may conduct limited control activities in Long Beach to suppress its small LBAM population; however, eradication in this area is not likely to be conducted because of the lack of nurseries and agriculture growers in the surrounding area. It is likely that the LBAM population in this area would continue to grow and expand; however, any damage from LBAM to ornamental shrubs, trees, and outdoor gardens may be attributed to other pests rather than LBAM.

2. LBAM in San Diego

The population in San Diego is very small and is currently being treated with pheromone dispensers. It is unlikely that there would be any increase in population levels in this area due to the eradication efforts.

3. LBAM Program

Although the impacts listed above are minimal, there could be impacts to the progress of the LBAM program if the evaluations studies are not conducted. Progress in controlling the expansion of LBAM has been very limited due to the lack of tools to treat LBAM populations. Consequently, the population of LBAM has grown both in size and in area since its first detection in April 2007. The extent of the LBAM infestation is likely to continue to expand unless effective tools can be used to suppress the population. The expectation is that SIT could be a key tool; however, without additional evaluations to determine how the sterile moths will interact with wild LBAM populations, SIT cannot be widely used.

Without the proposed study, it will be difficult to learn more information regarding LBAM SIT so that it can be integrated into the control and management activities in the future. The environmental impacts of increasing LBAM populations have been detailed in the document entitled "Use of LBAM Mating Disruption Pheromone Dispensers in the Light Brown Apple Moth Program in California, Environmental Assessment" (USDA–APHIS, 2010).

B. Preferred Alternative

There would be minimal environmental effects from the proposed evaluation study. A discussion of the potential environmental impacts from sterile insect releases, including the rearing, transportation, sterilization, and release of sterile insects, as well as other actions under

the preferred alternative (dispersal studies, trapping, mating disruption, and mating assessments studies) are examined in detail below.

1. Sterile Insects

a. Rearing

There is low environmental risk associated with the insect rearing facility as long as the facility is designed using current biosafety principles and managed according to best practices and standard operating procedures (Dyck et al., 2005). Potential environmental impacts include unintentional release of fertile insects, occupational health risks from exposure to frass, hairs and scales which may cause allergenic responses, and disposal of large quantities of liquid and solid organic wastes (Dyck et al., 2005). Allergic reactions to frass, hairs, and scales are particularly noted from the family Lymantriidae; however, allergic reactions are not known to be associated with the Tortricidae family, of which LBAM is a member (Goddard, 2007).

An LBAM colony is currently being raised in the USDA laboratory in Moss Landing, California. The program uses standard operating procedures that have been proven successful in other SIT programs to ensure that there is no release of any life stages of LBAM from the facility. APHIS has implemented procedures within the laboratory to prevent accidental LBAM releases. The facility has proper filtration systems and waste disposal systems in place to ensure there are no effects to occupational workers or the environment. APHIS has conducted rearing of other sterile insects using the same operating procedures over many years which have resulted in minimal, if any, environmental impacts.

b. Sterilization

The potential environmental impacts from the sterilization of the moths are associated with the facility and its operation rather than the sterilized moth itself. The moths will be sterilized either at the USDA laboratory at Moss Landing or at LLNL.

Moths sterilized at the USDA laboratory at Moss Landing will be exposed to x-rays similar to x-rays used in medical and dental facilities across the nation. X-rays are electronic sources of radiation and require power in order to emit radiation. Once the x-ray machine is removed from the electronic source, it no longer can emit radiation (EPA, 2010). This is different from a gamma ray radiation source which has to adhere to more stringent safety standards to ensure proper disposal. The operation of the x-ray machine at the USDA laboratory will be compliant with permits issued by the USDA Radiation Safety Division within the USDA Office of Homeland Security to ensure the equipment meets all Federal worker safety protection standards under the Ocupational Safety and Health

Administration. This is also being registered with the California Department of Public Health Radiologic Health Branch in compliance with California State laws.

Moths sterilized at LLNL will be sterilized using gamma ray levels between 250 to 325 grays (Gy). LLNL is an approved irradiation facility that conforms to stringent safety guidelines. The U.S. Nuclear Regulatory Commission (NRC) licensing requirements ensure a design that incorporates multiple fail-safe measures, extensive and well-documented safety procedures, and extensive worker training. LLNL's radiological control program ensures that radiological exposures and releases are reduced to as low as reasonably achievable to protect the health and safety of its employees, contractors, the public, and the environment. LLNL activities comply with Federal, State, and local environmental regulations, internal requirements, Executive orders, and the Department of Energy orders, as specified in Contract DE–AC52–07NA27344 (LLNL, 2008).

There could be potential environmental impacts if the moths are not exposed to an effective dose thus resulting in the release of fertile moths at the release site. A system has been designed to guarantee that moths released in this program are sterile. A dosimeter is used to verify that the specified dose is achieved for each treatment. This dose is based on data from other programs in which adult moths were sterilized. It will be tested by breeding treated and untreated moths to ensure 100-percent sterility. Additionally, an indicator tag is attached to each canister containing live moths. These tags turn blue when exposed to radiation of the proper dose, indicating that the insects were treated with a sterilizing dose of radiation. These tags will be checked to ensure that moths to be released have been treated and that the correct dosage has been applied.

Sterilization of insects does not result in radioactivity in the treated insects (Bakri et al., 2005; Whitten and Mahon, 2005); therefore, release of sterile insects will not result in release of radioactive material.

c. Transportation

Transport of fertile moths can result in environmental impacts if the moths were unintentionally released in an environment where they can establish. The routes of transport (for the moths being transported from Moss Landing, California, either to the release site or to LLNL for sterilization) occur in areas where LBAM could establish. Some of these areas already have reproducing populations of LBAM. It is important that procedures are put in place to prevent any unintentional releases. To prevent unintentional release, the adult moths will be transported using a double containment package. This type of packaging should prevent release even in the unlikely case of an accident during transport.

The double containment package is approved and is in accordance with the CDFA plant pest permit. These are sealed containers which are escape and crush proof. In addition, the containers are then placed in plastic ice chests with tight-fitting and sealed lids; contents are maintained at 40 ^{o}F. These methods are well established and will be executed by trained USDA–APHIS employees.

Each release will involve transport of moths through the use of one truck or vehicle (up to six times per week). Only existing roads will be used for the transportation of the LBAM moths. There is a higher risk of environmental impacts if there is an accident on the way to LLNL because the moths are still fertile. However, the double containment packaging should prevent any release even in the unlikely case of an accident during transport. This has been successfully used in other SIT programs without accidental release of fertile insects.

d. Release

The moths will be released up to six times per week in a given area. The weekly rates will vary but will not exceed 1,400 moths per acre per week. As mentioned above, there will be several different release sites within each of the evaluation areas.

The potential environmental impacts from the release of LBAM are minimal. There will be no damage to crops or other plants because the sterile moths are adults and the adults do not feed. Only the larval stage of LBAM feed on crops and other plants causing damage. In addition, because the released adult LBAM will be sterile, they will not produce offspring which could feed on crops and thus cause damage.

Although there have been known incidences of allergic reactions to hairs and scales from high populations of moths (particularly from the family Lymantriidae), this is not known to be associated with the Tortricidae family of which LBAM is a member (Goddard, 2007). These reactions are specifically associated with caterpillars (Goddard, 2007). This field evaluation program will be releasing only sterile adult LBAM which will not produce any offspring. Therefore, no adverse effects to humans, including those that are in the area or the program personnel involved in this study, are expected from the moths.

There will be little to no environmental impacts to nontarget invertebrates and/or pollinators. The total number of moths released (1,400 moths per acre per week or 1,400 moths per 43,560 square feet) will amount to, on average, only 0.032 moths per square foot per week, or about 3 moths per 100 square feet per week (the size of a 10- by 10-foot room). Adult LBAM are more active right after sunset (Suckling and Brockerhoff, 2010), and are unlikely to compete with other pollinators. They inhabit

trees and shrubs, and will not interfere with soil-dwelling organisms. When the moths die, they will fall to the ground and decompose by natural methods without overwhelming natural soil bacteria.

In addition, previously published work has discussed the potential ecological effects to other terrestrial invertebrates in suppressing or eradicating native insects using SIT. Pollinator impacts, as well as parasite/predator effects, have been discussed regarding the eradication of native species which threaten agriculture or human health (Nagel and Peveling, 2005). Because LBAM is an introduced pest in the United States, the use of SIT to suppress and eradicate this pest is not expected to significantly disrupt native insect populations, including pollinators, parasites, and predators. Native insect populations have not adapted to LBAM. Suppression of LBAM populations should not result in any significant effects to existing native invertebrate populations.

The indirect impacts from SIT operations with the hand or truck releases of SIT should be negligible compared to regular activities in both San Diego and Long Beach. Both areas are urban in nature and have regular traffic and high ambient noise levels compared with uninhabited land. Any noise from trucks or the truck-mounted release machine will be limited to release times, and will not exceed normal noise associated with the already existent traffic in the area.

Aerial releases of sterile LBAM are unlikely to result in significant impacts. Of the environmental impacts from aircraft, noise is the effect that is most noted by the public and is the effect that most directly impacts wildlife. Both evaluation sites are within 5 miles of a major airport. The Long Beach SIT area actually contains the Long Beach Airport which operates over 6,000 flights per week (roughly 25,000 flights per month). The San Diego International Airport is within 5 miles of the proposed San Diego treatment area, and operates an average of 3,700 aircraft per week (roughly 16,000 per month). The addition of six flights per week of aerial releases of SIT moths is a negligible increase in air traffic in these areas. In addition, the noise of the aircraft used to release sterile moths is much less than commercial and military aircraft, and is equivalent to the noise of a power lawn mower (Pepper et al., 2003). The addition of six flights per week at an elevation between 1,200 and 2,500 feet from regional airports is unlikely to cause any noticeable effects.

e. Identification

The use of a marking agent is not likely to cause any adverse environmental impacts. The marking agent (dye), known as Calco Red, is fed to the moths during the rearing process; it lines the internal digestive system of the moths. This marker helps to distinguish sterile LBAM from wild LBAM. Given the low levels of dye per moth and the number of

LBAM released into the environment, there are no anticipated effects to terrestrial or aquatic organisms which may consume sterile LBAM. A detailed risk assessment was provided in the Napa/Sonoma LBAM SIT evaluation study EA and is incorporated here by reference (USDA–APHIS, 2009).

2. Other Activites

The other program activities (dispersal study, mating assessment studies, mating disruption studies, and trapping) under the proposed evaluation study utilize various traps and LBAM pheromone mating disruption dispensers. The potential environmental impacts are most notably to nontarget species that may be trapped or affected by the pheromone dispensers and are discussed below.

a. Dispersal Studies

The dispersal studies will use red delta traps with pheromone bait to determine how far the male moths will fly from a central release site. Delta traps will be positioned at various locations within a 500-meter radius of the central release site.

Potential impacts include nontarget insects that may be caught by the delta traps, as well as indirect effects from the setup and monitoring of the traps. Shelly (2009) observed that only 1 to 2 nontarget insects were captured per week in 26 traps baited with synthetic LBAM pheromone. Of these, most were wasps and honey bees. This resulted in less than 0.1 nontarget organisms captured per trap per week. This incidence of nontarget capture compared to population levels is minimal.

In another study, trap color was observed to influence the number of nontargets captured in a trap (Clare et al., 2000). The conclusions of this study suggested that users that were concerned about catching nontarget insects should consider using red or green colored traps rather than the standard white colored traps. APHIS plans to use red delta traps to minimize nontarget captures.

The traps will be placed in urban environments that have average to high population densities for cities. A typical city has a lot of pedestrians, cars, buses, and other human activities occurring on a regular and continuous basis. The indirect effects of conducting the dispersal study and monitoring the evaluation, over time, will be similar to the other activities by residents in the area, and is, therefore, unlikely to cause any noticeable environmental effects.

b. Mating Assessment

The mating assessment study will use a mating attraction station that is baited with an immobilized female LBAM. There should be no

environmental impacts to nontargets as there are no traps involved or chemicals that could harm a nontarget species. The only insect harmed in this study is the immobilized female that will be studied to see if it attracts wild LBAM males.

c. LBAM Pheromone Dispensers

The LBAM pheromone dispenser emits an LBAM-specific pheromone into the air. The pheromone has been isolated and identified as two compounds, (E)-11-tetradecen-1-yl acetate and (E,E)-9,11-tetradecadien-1-yl acetate. Both compounds have been identified in extracts of female moths, and are LBAM-specific when combined (Bellas et al., 1983). The pheromone is contained within a sealed polyethylene tube containing 163.25 mg of (E)-11-tetradecen-1-yl acetate and 6.74 mg of (E,E)-9,11-tetradecadien-1-yl acetate. A wire is fused inside the plastic so that the dispenser can be twisted around a branch. The pheromone is released into the surrounding area and disrupts the ability of male LBAM to locate females. This method of control has been shown to be an effective means of LBAM control in citrus, grapes, apple, and apricot orchards when adequate numbers of dispensers are used (Mo et al., 2006b).

The potential impacts from the use of pheromone dispensers are minimal. These impacts have been fully examined in "Use of LBAM Mating Disruption Pheromone Dispensers in the Light Brown Apple Moth Program in California Environmental Assessment" (USDA–APHIS, 2010), and have been incorporated by reference into this document. In addition, APHIS has used pheromone dispensers in over 95 different treatment sites, and has not experienced any noticeable environmental impacts. All twist ties will be removed after their useful lives (approximately 6 months) eliminating any potential effects from litter of the plastic pheromone dispensers.

d. Trapping

Pheromone-baited delta traps, port wine traps, and light traps will be used in the evaluation studies. Trapping normally captures a few individuals of a wide variety of species that are in the area. The only potential environmental impact from the use of these traps will be the incidental capture of nontarget insects in these traps; however it is unlikely to have a significant impact to non-endangered species populations in one area. The more specific a trap, the less nontarget species will be captured.

The LBAM pheromone-baited red delta traps used in the studies are species-specific and less likely to impact any nontarget insect populations than the other traps that will be used during the proposed studies. Previous trapping studies with LBAM pheromone-baited delta traps suggest less than 0.1 nontarget insects are captured per trap per week

(Shelly, 2009). To even further reduce nontarget species captures, APHIS will use red colored traps which have been shown to attract fewer nontarget species than the standard white traps (Clare et al., 2000).

Port wine traps have been used for trapping female LBAM in New Zealand and Australia; however, they are not species-specific (Suckling et al., 1994). There is no specific information suggesting that fermentation traps, like port wine traps, will have any significant effects on nontarget species, according to the literature and APHIS' experience in California. Port wine trap catches usually are composed of various pest and wild moth species, flies, Western flower thrips, cockroaches and some species of hymenoptera (El-Sayed et al., 2005).

Light traps are even less species-specific than delta and port wine traps, but only attract insects that are nocturnal. The light traps, which are active at night, will attract nocturnal flying insects, including both male and female LBAM. The light traps used in this study are not designed to kill, but only capture insects that fly into them. Any nontarget insects will be released back into the environment. Incidental captures of nontarget insects that do not live until they are released are unlikely to impact insect populations in that area.

The indirect effects of placing and monitoring the traps will result in minimal, if any, impacts. The area where traps will be placed is primarily residential and urban. In general, cities have a lot of pedestrians, cars, buses, and other kinds of traffic. Placement and monitoring of the traps would involve activities, such as walking and vehicle traffic, which occur regularly in these environments. All traps will be removed after completion of the study, once again, involving only activities that are normal and regular in urban and residential environments.

C. Cumulative Effects

The proposed field evaluation projects will have little, if any, impact to the human environment. Based on the analysis above, the preferred alternative may cause effects to individual nontarget insects that are captured in the traps; however, these effects are not likely to cause any impacts to the populations of these species as very few numbers of specific nontarget species will be captured.

Insect trapping by the State, county, or local level for a variety of different types of insects may occur in either the Long Beach or San Diego study areas. These traps may be general traps or baited for a specific insect. The proposed evaluation study will use three different types of traps and will be targeted for LBAM. The number of traps in our evaluation studies within the study area combined with other traps that may be used will not result in significant impacts to any particular species population. Trap

captures include small numbers of individuals from any one given population.

There are no other known projects or activities in the Long Beach and San Diego evaluation areas that are likely to add cumulatively to the impacts of the proposed evaluation studies addressed in this EA. APHIS is aware that CDFA is currently treating two small 200-meter areas in the San Diego evaluation site with LBAM pheromone dispensers. However, no additional LBAM pheromone dispensers will be applied in this area by APHIS, so there will be no cumulative impacts from the two actions. Any additive effects from the application of pheromone dispensers and sterile insect releases will only result in the reduction of the LBAM population in these areas and should not going to impact any nontarget species.

V. Other Environmental Considerations

A. Executive Orders

Consistent with Executive Order (EO) 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," APHIS considered the potential for the proposed action to have any disproportionately high adverse human health or environmental effects on any minority populations and low-income populations. Due to the limited area and minimal environmental and human health effects anticipated from the field evaluation program, APHIS has determined that the field evaluation project is not expected to have disproportionate adverse effects to any minority or low-income populations.

Consistent with EO 13045, "Protection of Children from Environmental Health Risks and Safety Risks," APHIS considered the potential for disproportionately adverse environmental health and safety risks to children resulting from the preferred action. Due to the limited area and minimal environmental and human health effects anticipated from the field evaluation program, and the fact that only field workers and program personnel would be expected in the field, APHIS has determined that there would be no disproportionate effects to children from the implementation of the field evaluation program.

Consistent with the National Historic Preservation Act of 1966, APHIS has examined the preferred action in light of its impacts to national historic properties. APHIS has determined that the proposed action is a type of activity that does not have the potential to cause effects on historic properties. The preferred action will be releasing sterile insects into the surrounding area and evaluating the interactions of the sterile moths with the wild population through the use of traps. The preferred action will not alter the physical environment. Therefore, the preferred action will not

affect any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Sites.

B. Threatened and Endangered Species

Section 7 of the Endangered Species Act 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.

APHIS has reviewed each element of the proposed action and its potential to impact any listed species and/or critical habitat and concluded that the proposed action will have no effect. This conclusion is based on the fact that sterilized LBAM will not interact with any other listed invertebrates; and will not pose a dietary risk to any insectivorous bird, mammal, fish or amphibian species. All trapping and monitoring stations associated with the proposed action will not be operated in any habitat for listed invertebrates and will not attract any listed species. Should any element of the proposed action change in a manner or to an extent not previously considered, APHIS will re-examine the proposed action to determine if there are any impacts not considered herein. Based on this conclusion, no further consultation with the Fish and Wildlife Service or National Marine Fisheries Service is necessary.

VI. Listing of Agencies and Persons Consulted

U.S. Fish and Wildlife Service
Carlsbed Field Office
6010 Hidden Valley Road, Suite 101
Carlsbad, CA 92011

National Marine Fisheries Service
777 Sonora Blvd.
Santa Rosa, CA 95404

U.S. Department of Agriculture
Animal Plant Health Inspection Service
Plant Protection and Quarantine
7697 Hwy. 1, Bldg. 20
Moss Landing, CA 95039

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

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Plant Protection and Quarantine
Emergency and Domestic Programs
Environmental Compliance
4700 River Road, Unit 150
Riverdale, MD 20737

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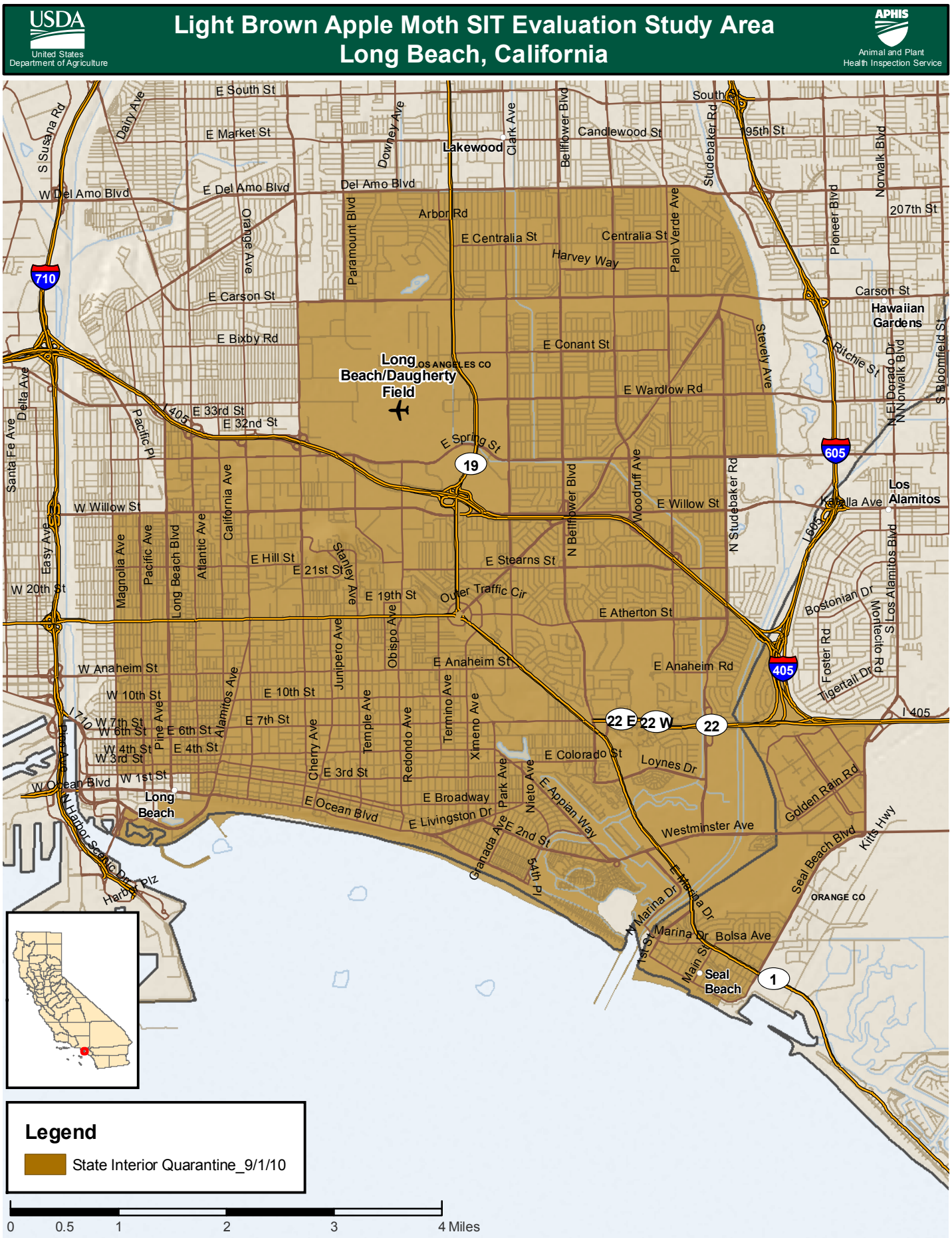
Attachment A: Maps of Evaluation Areas



USDA, APHIS, PPQ
Western Region GIS Specialist
650 Capitol Mall, Suite 6-400
Sacramento, CA 95814

Coordinate System:
CA Teale Albers, NAD 83
Date Created: January 3, 2011
Time Created: 13:51 hrs PST

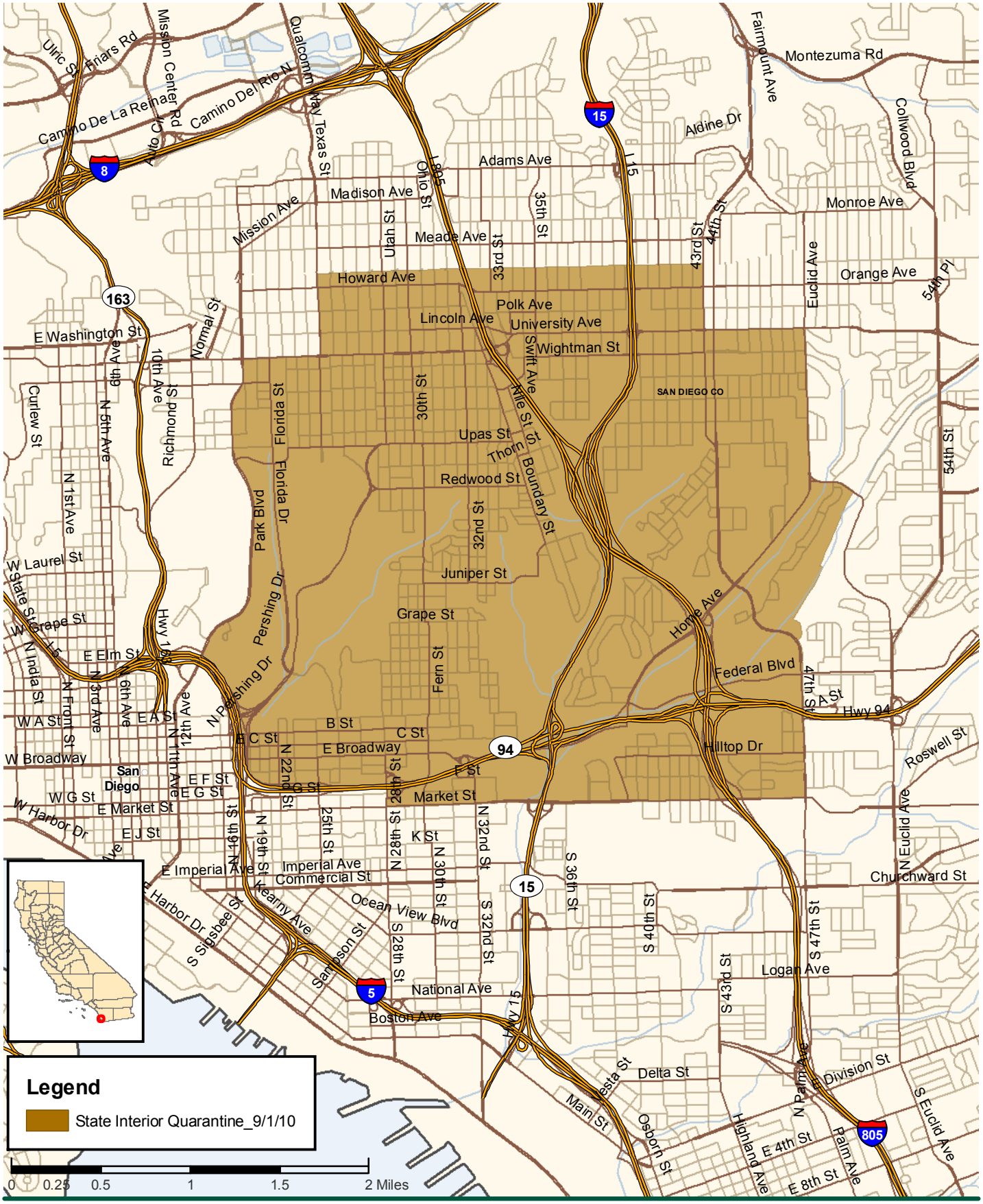
Data Source:
CA Dept of Food and Agriculture
USDA, APHIS, PPQ
TeleAtlas Dynamap

The U.S. Department of Agriculture's Animal and Plant Health Inspection Service collected the data displayed for internal agency purposes only. These data may be used by others; however, they must be used for their original intended purpose.

Light Brown Apple Moth SIT Evaluation Study Area
San Diego, California

USDA
United States Department of Agriculture

APHIS
Animal and Plant Health Inspection Service



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