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Pesticide Use in the Imported Fire Ant Program

Supplemental Environmental Assessment
September 2014

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I. Introduction

The invasive insects, *Solenopsis invicta* Buren (*S. invicta* Buren), and *S. richteri* Forel (*S. richteri* Forel) and their hybrids, collectively known as imported fire ant[1] (IFA) (Hymenoptera: Formicidae) are a health hazard to humans, domestic animals, and wildlife; a nuisance in public and agricultural lands; and can cause infrastructure damage. IFA has become established throughout the southern United States, as well as Puerto Rico. In response to the introduction of IFA to the United States, the Federal government implemented a quarantine in 1958, with periodic revisions, to update expansion of IFA, as well as identify new control measures. In July 2013, USDA APHIS issued a Finding of No Significant Impact (FONSI) based on a March 2012 Environmental Assessment (EA) that updated the list of approved pesticides and expanded the areas in which IFA quarantine activities could be conducted. The update to the approved list of pesticides for use in commercial plant nurseries and grass sod farms (under the Federal IFA quarantine program), as well as an evaluation of the expansion of the quarantine area to determine whether control of IFA is needed in new areas, were needed at that time to prevent further movement of IFA. This EA further updates the list of approved pesticides for use on IFA to include two additional active ingredients, abamectin and metaflumizone and expands the use of existing bait products to include the use of baits on grass sod, as applicable.

A. Distribution and Biology of IFA

The information below on the distribution and biology of IFA was previously provided in the March 2012 EA that added approved pesticides. The same information is provided below; no updates or additions to this section have been made.

Two species of IFA were introduced into the United States from South America at the port of Mobile, Alabama. The black imported fire ant, *S. richteri* Forel, arrived sometime around 1918 and the red imported fire ant, *S. invicta* Buren, in the late 1930s. Both species probably came to the port in soil used as ballast in cargo ships.

Solenopsis invicta is known to infest portions or all of Alabama, Arkansas, California, Florida, Georgia, Louisiana, Mississippi, New Mexico, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and Puerto Rico. In the United States, *S. richteri* is only reported from northeastern Mississippi, northwestern Alabama, and southern Tennessee. A hybrid of *S. invicta* and *S. richteri* has been found from the middle of

[1] The common name for *Solenopsis invicta* is red imported fire ant; for *S. richteri*, black imported fire ant. Synonyms for imported fire ant include red imported fire ant, fire ant, RIFA and IFA.

both Mississippi and Alabama northward, in the southeastern corner of Tennessee, and the northwestern corner of Georgia (Diffie *et al.* 1988).

IFA disperses naturally through mating flights, colony movement (ants can relocate their colony), and sometimes through rafting[2] during periodic floods. Natural spread occurs slowly and within a local area. However, the rapid spread of IFA throughout the southern portion of the United States since the 1950s was likely due to human activities—fire ants can be transported in dirt clods attached to vehicles and machinery; can be moved in soil-containing products, including nursery stock and commercial sod; and can be associated with baled hay and woody ornamental plants used in landscaping. Soil used in construction projects, such as road construction, is also a likely avenue through which fire ants spread (King *et al.* 2009). The infestations in almond groves in Kern County, California likely originated from bee hives transported from infested States for the purpose of pollinating crops (Wojcik *et al.* 2001).

Similar to other ant species, IFA form colonies in which ants have specific roles (also called a socially hierarchical colony). A typical *S. invicta* colony (nest) has one or more queens. Within the colony there are two types of ant groups: worker groups (classified as minims, minors, and majors based on size) comprised of sterile females and sexual groups (Lofgren *et al.* 1975). The percentage of the colony comprised of these two castes varies depending on the time of year and the age of the colony; sexuals are produced primarily in the spring. The female controls the sex of her offspring by fertilizing or not fertilizing an egg (Tschinkel 2006). Males arise from unfertilized eggs while females arise from fertilized eggs (Tschinkel 2006). The number of winged sexuals participating in a nuptial flight (males and females mate in the air) is around 600 to 700 per flight of which around 95 percent of the females will have mated (Tschinkel 2006). A mature colony, on average, participates in around eight to nine flights per year; not all sexuals are released for every flight.

After their nuptial flight, new queens start forming and usually complete their nest within 6 to 7 hours after mating (Lofgren *et al.* 1975). The first eggs are laid within 24 to 48 hours after completing their nest. The time from egg to first adult worker is between 18 to 30 days—the first larvae hatch in about a week and both the larval (4 instars total) and pupal stages last about a week (Lofgren *et al.* 1975, Tschinkel 2006). Queens may live for 6 or 7 years and can produce as many as 1,500 eggs per day using stored sperm from their one-time mating. Males live for approximately 4 days. Workers (sterile females) live between 1 and 6 months (Tschinkel 2006). Within 3 years (considered the colony's maturation point), the colony's population can reach 230,000 workers (which the authors

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[2] Rafting is the process by which IFA form a mass of intertwined ants and float on water during heavy rains or floods (http://www.insectscience.org/11.171/i1536-2442-11-171.pdf)

consider to be a conservative estimate) (Lofgren *et al.* 1975). The colony size does fluctuate throughout the year, being at its highest population levels in late fall and at its lowest population levels in spring (Tschinkel 2006). Colonies die of old age in 5 to 8 years and are replaced by younger colonies (Tschinkel 2006).

Temperature and soil moisture, as well as the physical properties of the soil are important for colony foundation and survival (Lofgren *et al.* 1975). Fire ants are unable to effectively forage when soil temperatures at a 2-centimeter (cm) depth are below 15 °C; they are unable to produce a brood (eggs, larvae, and pupae) when soil temperatures are below 24 °C (Tschinkel 2006). In central and south Florida, brood production can occur year round; at its most northern range, brood production ceases in the wintertime. On average, the seasonal reproductive cycle begins in March and ends in October.

A mature mound can extend 1 meter or more into the ground, reaching the water table in some areas. The size of the mound above ground varies depending on the soil type. There is evidence that large colonies can occupy several mounds. A mature mound may remain viable for several years (Lofgren *et al.* 1975). The density of colonies in the United States averages around 500 mounds/hectare (ha); densities of 1,400 mounds/ha have been recorded (cited in (Allen *et al.* 2004)).

Fire ants are generalist feeders, feeding on plants and domestic and wild animals. Preferred food sources include insects, spiders, myriapods (subphylum of arthropods containing millipedes, centipedes, and others), earthworms, and other small invertebrates (Lofgren *et al.* 1975).

States in which IFAs are present and likely to expand into additional non-infested counties include Arizona, California, New Mexico, North Carolina, and Texas, as well as a northern expansion in Arkansas, Oklahoma, and Tennessee (Korzukhin *et al.* 2001). IFA could potentially spread to and annually survive in portions of Delaware, Hawaii, Maryland, Nevada, Oregon, Utah, Virginia and Washington (Korzukhin *et al.* 2001). In more arid climates, IFA would likely be restricted to areas along water courses and irrigated lands (Korzukhin *et al.* 2001). A map of IFA distribution and expansion in the United States, based on Korzukhin et al., (2001) is available on the U.S. Department of Agricultural Research Service (ARS) website: http://www.ars.usda.gov/Research/docs.htm?docid=9165. Overlaying climate change scenarios on predictive spread models indicate that the range of IFA survival in Oklahoma will likely move northward (and westward) given the increase in air temperatures and wetter climate (Levia and Frost 2004).

B. APHIS Fire Ant Quarantine Program

The information below on the APHIS fire ant quarantine program was previously provided in the March 2012 EA that added approved pesticides. The same information is provided below, incorporating any updates since May 2012.

USDA–APHIS currently conducts regulatory actions to quarantine IFA under the Plant Protection Act (7 U.S. Code (U.S.C.) 7701, et seq.), and the implementing regulations are currently contained in 7 Code of Federal Regulations (CFR) 301 Subpart Imported Fire Ant (301.81–1–301.81–10). The purpose of the Federal quarantine (7 CFR § 301.81) is to prevent the artificial spread of IFA into noninfested areas of the United States by regulating the following articles:

- IFA queens and reproducing colonies of IFA
- Soil, separate or with other articles
    - For example, containerized plants
- Baled hay or straw stored in direct contact with the ground
- Plants and sod with roots and soil attached, except plants maintained indoors in a home or office environment and not for sale
    - For example, balled and burlapped plants, field sod, field grown commodities
- Used soil-moving equipment, unless removed of all noncompacted soil

The Federal IFA quarantine "does not require control or eradication programs" (USDA APHIS PPQ 2010). However, before regulated articles are moved from a quarantine area to a nonquarantine area they must be free of infestation and must be treated according to approved procedures (USDA APHIS 2007), or must be grown or produced in a manner that would ensure freedom from infestation (USDA APHIS PPQ 2010). Regulated articles meeting these requirements must be accompanied with a certificate for interstate movement (USDA APHIS PPQ 2010). Facilities shipping regulated articles must be done either under a compliance agreement or a limited permit (USDA APHIS PPQ 2010).

According to 7 § CFR 301.81 (revised January 1, 2011) and Memo DA-2009–54 (October 28, 2009, http://www.aphis.usda.gov/plant_health/plant_pest_info/fireants/downloads/da-2009-54.pdf), the following areas are under Federal quarantine (figure 1):

- Entire State: Alabama, Florida, Georgia, Louisiana, Mississippi, and South Carolina
- Part of the State: Arkansas, California (one county and part of two others), New Mexico (one county), North Carolina, Oklahoma, Tennessee, Texas, and Virginia
- Territories: Puerto Rico (entire)

The current IFA program involves surveys and quarantine requirements on potentially infested commodities. The quarantine requirements involve the use of chemical treatments on commodities to insure that shipments from nurseries, sod farms, and field-growing nursery facilities are free of IFA.

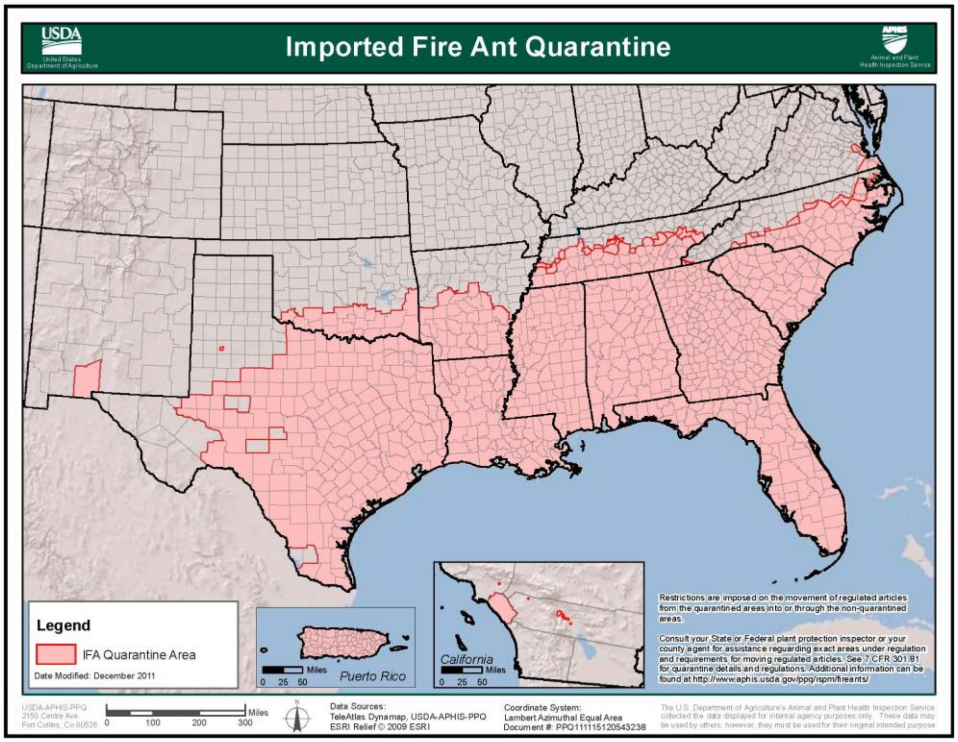

Figure 1. Imported fire ant (IFA) quarantine in the United States as of December, 2011.

C. Purpose and Need for IFA Quarantine Program Changes

The information below on the purpose and need for IFA quarantine program was previously provided in the March 2012 EA that added approved pesticides. The same information is provided below, incorporating any updates since May 2012.

APHIS is responsible for taking actions to exclude, eradicate, and/or control plant pests under the Plant Protection Act (7 U.S.C. 7701 et seq.).

As such, it is important that APHIS take the steps necessary to prevent the artificial spread of IFA from the current infested counties to new areas. APHIS proposes to change its IFA Federal quarantine program regulations by revising the list of approved pesticides to include two new active ingredients and expanding the use of existing bait products to include the use of baits on grass sod, as applicable.

APHIS has determined that under the provisions of the National Environmental Policy Act (NEPA) (see 42 U.S.C. 4321 et seq.) and APHIS' National Environmental Policy Act (NEPA) implementing procedures (see 7 CFR part 372), an environmental assessment (EA) should be prepared for these proposed actions. The availability of this EA and a 30-day comment period will be announced by publishing a notice in the *Federal Register*. APHIS' decisionmaker for the actions described in this EA will take appropriate action after reviewing the EA, its associated analyses, public comments received, and other relevant responses and recommendations. If major changes to the proposed actions in this EA occur as a result of this process, or if APHIS' decision is a finding of no significant impact (FONSI), APHIS will prepare a similar announcement to notify the public of the decision being made. APHIS has prepared three other EAs that are relevant to this EA: Pesticide Use in the Imported Fire Ant Program, March 2012, Imported Fire Ant Regulatory Program, January 1999, and Imported Fire Ant Regulatory Program, February 1992.

APHIS needs to revise the approved list of pesticides and uses for bait products because options for chemical control of IFA through the use of insecticides continue to evolve over time. Changes in availability of insecticides that are effective against IFA, as well as ensuring a range of pest management options requires APHIS to periodically evaluate new treatment options. In addition, the U.S. Environmental Protection Agency (EPA) regulates the registration, distribution, sale, and use of pesticides under its Federal Insecticide, Fungicide and Rodenticide Act (FIFRA; 7 U.S.C. §136 et seq. (1996)) regulations. As pesticide registrations change, the chemicals available for use to control IFA also change. USDA–APHIS needs to evaluate the current pesticide options for IFA control and determine their applicability, and human health and environmental impacts resulting from use in the Federal quarantine program.

In addition, IFA continues to pose a threat to human health, domestic animals, wildlife, public and agricultural lands, and property so there is a need to ensure effective control methods are available.

From a human health perspective, an estimated 14 million people are stung annually (Drees 2002). "Approximately 30% of the people living in infested areas are stung each year; of these, approximately 1% may develop hypersensitivity to the ant's venom" (Vinson, 1997 cited in (Wojcik *et al.* 2001)). In 1998, approximately 33,000 people sought medical treatment for IFA bites in South Carolina at an estimated cost of $2.4 million (Caldwell *et al.* 2009).

Adverse economic impacts caused by IFA are mostly attributed to control programs rather than from direct impact from IFA. Sources of economic impact include the cost of treatment on agricultural lands to protect livestock and farm workers, and on public lands to protect people and wildlife; cost of treatment on residential property; cost to regulatory agencies; infrastructure damage to highways, telephone and cable lines; cost of medical treatment for both humans and animals; reduction in economic profit to industries restricted from shipping materials that are under quarantine; and funding costs for research. Annual cost of $1.3 billion and $1.2 billion are estimated for the States of Florida and Texas, respectively (Lard *et al.* 2006). Establishment of IFA in California could cost the State between $387 million and $989 million per year (Jetter *et al.* 2002); in Hawaii, $211 million per year (Gutrich *et al.* 2007). Lard et al. (2006) estimates IFA costs the United States, including Puerto Rico, ca. $6 billion annually. The range of fire ants is expected to expand and with it the economic impacts will likely increase as control programs are implemented in new areas.

Numerous papers on the mortality to vertebrates and invertebrates caused directly or indirectly by IFA are published in scientific literature. In addition, IFA is harmful to species designated as threatened or endangered at the Federal level, State level, or both (appendix 1 lists a few examples). IFA is considered a culprit in the extinction in the wild of the Stock Island tree snail (*Orthalicus reses reses* (Say)) (Wojcik *et al.* 2001). Diffie et al. (2010) estimate that over 246 reptilian species reside in areas in which fire ants inhabit, all of which can be impacted by IFA. Research is underway to determine the impact of IFA on the Schaus swallowtail, *Papilio aristodemus onceanus* Schaus, a federally listed endangered species whose population has been in decline (Wojcik *et al.* 2001).

IFA can negatively impact native arthropod communities through predation and competition, resulting in loss of ecological communities (including loss of species diversity and trophic simplification) (Allen *et al.* 2001, Epperson and Allen 2010). Arthropods are an integral part of ecosystem functions, including nutrient cycling, seed dispersal, decomposition, and pollination (cited in (Epperson and Allen 2010)). Native ant species diversity and richness are greater in areas treated for IFA, indicating that arthropod communities are negatively impacted by IFA (Allen *et al.* 2001, Epperson and Allen 2010).

D. Scope of Analysis

The information below on the scope of analysis was previously provided in the March 2012 EA that added approved pesticides. The same information is provided below, incorporating updated information on the proposed action.

This EA will analyze the human health and environmental impacts that can be reasonably expected to occur if the proposed action to update the approved pesticide list for IFA quarantine activities is implemented. These activities will only take place in commercial plant nurseries that produce container-grown, balled and burlapped, field grown plants and/or sod within the IFA quarantine and wish to ship to areas outside of the quarantine.

Current IFA infestations and associated quarantine areas are documented in all or part of Alabama, Arkansas, California, Florida, Georgia, Louisiana, Mississippi, New Mexico, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and Puerto Rico. The areas requiring quarantine activities are likely to expand due to the effects of climate change. Maps depicting the potential expansion of the pest are available on the USDA Agricultural Research Service (ARS) Website at www.ars.usda.gov/Research/docs.htm?docid=9165.

This EA will analyze quarantine activities in the current quarantine area (figure 1), as well as activities that may be carried out in expanded quarantine areas as the detection of IFA in new areas could occur. The geographical region covered in this EA includes the current IFA quarantine area, as well as the remainder of the counties in the States of Arkansas, North Carolina, Oklahoma, Tennessee, Texas, and Virginia. In California, five additional counties are included in the scope (San Bernardino, Ventura, Santa Barbara, San Diego, and Imperial) and the counties of Los Angeles and Riverside are included entirely. Published data on the potential expansion of IFA demonstrate a much larger area for expansion than what is covered in the scope of this EA. The selection and addition of counties to the scope of analysis in this EA was based on a combination of factors, such as the current areas of IFA infestation, where recent expansion of IFA has been observed, and the published literature regarding potential areas of expansion.

II. Alternatives

This EA will analyze the potential environmental and human health effects anticipated from two alternatives in response to the need—(1) no action, and (2) the preferred alternative, adding certain IFA pesticides to the list of approved chemicals in the IFA quarantine program and expanding the use of existing bait products to include the use of baits on grass sod, as applicable.

A. No Action

Under the no action alternative, the chemicals which are currently authorized by APHIS for the treatment of sod, field grown plants, container grown plants, and balled and burlapped plants under the IFA quarantine (table 1–1) would continue to be used within the area under quarantine as long as they are registered for use by EPA.

Table 1–1. Preferred Insecticides and Use Patterns for IFA Quarantine.

Active Ingredient	Formulation Name	Formulation Type+	Commodity			
			Container	Field-grown	B&B[3]	Grass sod
Bifenthrin	Talstar®, Bifenthrin Pro®, Onyx Pro®	G, F, EC	X	X	X	X
Chlorpyrifos	Dursban®, Chlorpyrifos	EC, WP,G	X	X	X	X
Fenoxycarb	Award®	Bait		X		
Fipronil	Chipco®Choice™, Chipco® Top, Choice™	G	X	X[1]		X
Hydramethylnon	Amdro®Pro, Siege®Pro	Bait		X		
Methoprene	Extinguish®	Bait		X		
Pyriproxyfen	Distance®	Bait		X		
Bifenthrin + Cypermethrin	Talstar® Xtra	G	X	X		X
Bifenthrin + Clothianidin	Aloft®	SC		X		X
Bifenthrin + Imidacloprid	Allectus®	G, SC			X	
Permethrin[2]	GardStar®	EC				
Imidacloprid + Cyfluthrin	Discus™	G		X	X	X
λ-cyhalothrin	Scimitar®	G, SC	X	X	X	X

[1] Approved by 24C in state of Tennessee for field grown use
[2] Use on/around hay and bees as a soil drench treatment for ants
[3] B&B = Balled and burlapped plants
+ WP = wettable powder, EC = emulsifiable concentrate, G = granular, F = flowable, SC = suspension concentrate

B. Preferred Alternative

Under the preferred alternative, APHIS is proposing to add two additional insecticides and use patterns to the list of chemicals already allowed in the IFA program and listed in the no action alternative (table 1–2). The additional insecticides are being added to provide a broader range of chemical treatment options and are not being proposed as additional treatments beyond what is currently required in the quarantine program. Both products have residential and/or commercial uses in nurseries.

APHIS also proposes to expand the use of both preferred alternative and new insecticide bait products to sod grass as applicable and allowed on current product labels to provide the ability to apply pesticides at lower rates, resulting in lower costs for IFA control and potentially lower environmental impacts.

Table 1–2. Preferred Insecticides and Use Patterns for IFA Quarantine.

Active Ingredient	Formulation Name	Formulation Type+	Commodity			
			Container	Field-grown	B&B[1]	Grass sod
Fenoxycarb	Award®	Bait		X		X
Hydramethylnon	Amdro®Pro, Siege®Pro	Bait		X		X
Methoprene	Extinguish®	Bait		X		X
Pyriproxyfen	Distance®	Bait		X		X
Abamectin	Award® II	Bait	X	X		
Metaflumizone	Siesta™	Bait	X	X		X

[1] B&B = Balled and burlapped plants

In summary, the changes that would result if the preferred alternative is implemented are as follows:

- For fenoxycarb, bait formulation use on grass sod would be added to the options available for IFA control;
- For hydramethylnon, bait formulation use on grass sod would be added to the options available for IFA control;
- For methoprene, bait formulation use on grass sod would be added to the options available for IFA control;
- For pyriproxyfen, bait formulation use on grass sod would be added to the options available for IFA control;
- For abamectin, a bait formulation for use on container-grown plants and field-grown plants would be added to the options available for IFA control;

- For metaflumizone, a bait formulation for use on container-grown plants, and field-grown plants and grass sod would be added to the options available for IFA control;

No changes to the uses for any of the insecticides implemented as part of the March 2012 EA and July 2013 FONSI are proposed in this supplement.

The Program would add other treatment(s) that may become available in the future for the IFA program to currently approved treatments, referred to as Adaptive Management. A new treatment would be available for use upon the agencies' finding that the treatment is registered by the U.S. EPA for use to control IFA and poses no greater risks to human health and nontarget organisms than the currently approved treatments. The protocol for making the necessary finding that a treatment is authorized by this alternative is as follows:

1. Conduct a human health and ecological risk assessment (HHERA). In this risk assessment review scientific studies for toxicological and environmental fate information relevant to effects on human health and nontarget organisms. Use this information to estimate risk to human health and nontarget organisms. Include these four elements in the HHERA: (a) hazard evaluation, (b) exposure assessment, (c) dose response assessment, and (d) risk characterization. The HHERA will do the following:
    - Identify potential use patterns, including formulation, application methods, application rate, and anticipated frequency of application.
    - Review hazards relevant to the human health risk assessment, including systemic and reproductive effects, skin and eye irritation, dermal absorption, allergic hypersensitivity, carcinogenicity, neurotoxicity, immunotoxicity, and endocrine disruption.
    - Estimate exposure of workers applying the chemical.
    - Estimate exposure of members of the public.
    - Characterize environmental fate and transport, including drift, leaching to groundwater, and runoff to surface streams and ponds.
    - Review available ecotoxicity data including hazards to mammals, birds, reptiles, amphibians, fish, and aquatic invertebrates.
    - Estimate exposure of terrestrial and aquatic wildlife species.
    - Characterize risk to human health and wildlife.

2. Conduct a risk comparison of the human health and ecological risks of a new treatment with the risks identified for the currently authorized treatments. This risk comparison will evaluate quantitative expressions of risk (such as hazard quotients) and qualitative expressions of risk that put the overall risk characterizations into perspective. Qualitative factors include scope, severity, and intensity of potential effects, as well as temporal relationships such as reversibility and recovery.
3. If the risks posed by a new treatment fall within the range of risks posed by the currently approved treatments, publish a notice in the Federal Register of the agencies' preliminary findings that the treatment meets the requirements of this Alternative. The notice must provide a 30-day public review and comment period and must advise the public that the HHERA and the risk comparison are available upon request.
4. If consideration of public comment leads to the conclusion that the preliminary finding is correct, publish a notice in the Federal Register that the treatment meets the requirements of this Alternative and, therefore, is authorized by this Alternative for use in the IFA quarantine program. APHIS will make available to anyone, upon request, a copy of the comments received and the agencies' responses.

III. Affected Environment

The information below on affected environment was previously provided in the March 2012 EA that added approved pesticides. The same information is provided below, incorporating updated information on the proposed action.

The area under the Federal IFA quarantine is broad (impacting 14 States and one territory) and has a diversity of soil types, animals (vertebrates and invertebrates), plants, and climatic factors. Although the quarantine area is broad, IFA program activities, namely the application of pesticides at facilities that commercially produce or sell regulated articles for distribution outside of the quarantine area, will not impact the entire quarantine area; only those areas under or near treatment.

The nursery and grass sod industry in the United States, including those located in the region covered in this EA, implement pest management in their facilities, and the use of pesticides may be one of the management options utilized. In conventional growing practices for nursery plants and grass sod, pesticides, including those belonging to the amidinohydrazone, carbamate, insect growth regulator, neonicotinoid, organophospate, phenylpyrazol, and pyrethroid pesticide classes may be used to control a range of insect pests, not just IFA. Pesticide formulations belonging to these classes are also used in conventional agricultural crop production to control insect pests; used in animal production to control nuisance pests to livestock; and for residential use to control garden or infrastructure pests, or even pests on pets.

The discussion below provides an overview of the affected environment, including ecological resources and air and water quality for areas under the current IFA quarantine, and the expanded areas described in this EA.

A. Land Use and Ecological Resources within the Geographic Area

There are 11 land resource regions that overlap with the geographic areas covered in this EA (appendix 2). Land resource regions are "geographically associated major land resource areas which approximate broad agricultural market regions" (USDA NRCS 2006). For a detailed description of the land resource regions, please see the Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin available on the U.S. Natural Resources Conservation Service Website (ftp://ftp-fc.sc.egov.usda.gov/NSSC/Ag_Handbook_296/Handbook_296_high.pdf).

Every 5 years, the USDA–Economic Research Service compiles a report on the major uses of land in the United States; the latest report available is based on data from 2007. Approximately 48 percent of land use in the region covered in this assessment is for cropland and grassland, which includes pasture and range. This is a slight overestimate because only eight counties in California and one county in New Mexico are included in the geographic scope; removing these States from land use calculations brings the estimated total to 46 percent. Appendix 3 provides a summary of land use in the States covered in the scope of this assessment.

National, State, county, and city parks, as well as National Wildlife Refuges are located within the geographic area described for this assessment. The estimates of acres dedicated to special-use areas available in appendix 3 include these lands. Parks are considered mixed-use and are used for recreational purposes, as well preservation of animal habitats and ecological resources. National Wildlife Refuges are managed by the U.S. Fish and Wildlife Service and are areas set aside to conserve fish, wildlife, and plants. A wide diversity of terrestrial and aquatic habitats occurs within the geographic boundary considered in this EA. These habitats support a wide diversity of fish and wildlife species, with many rare and endangered species. Approximately 606 species listed as threatened or endangered under the Endangered Species Act occur within the boundary defined in this EA. Natural habitats may have IFA infestations; however, the quarantine program is directed solely at treatments within commercial nurseries. These are highly disturbed areas that may have some use by wildlife, but would not be preferred habitats to support wildlife populations. Similar to soils in agricultural production, nurseries and sod farms are disturbed creating preferred habitat for IFA (Tschinkel 2006).

There are approximately 9 dominant soil orders (of a total of 12 orders) and 44 dominant soil suborders (of a total of 64 suborders) in the land resource regions that are encompassed within the geographic area of this EA (appendix 2). Soil orders "are differentiated by the presence or absence of diagnostic horizons or features that reflect soil forming processes." (USDA NRCS 1999). The criteria for differentiating suborders vary between soil orders. For example, a suborder under one soil order is differentiated based on its wetness, while a suborder under another soil order is differentiated based on its dominant temperature regime. The physical properties of soil influence water holding capacity and runoff, as well as the binding affinity of various pesticides. Both the physical properties of soil as well as soil moisture are important for IFA colony formation and survival (Lofgren *et al.* 1975). Disturbed soils that would support IFA colony formation will have different physical characteristics compared to any surrounding undisturbed soils. Soils become disturbed through various agricultural practices, including planting, harvesting, tilling, and application of organic and inorganic amendments.

B. Air Quality within the Geographic Area

Based on 2011 air quality reports, there are 86 counties in the current quarantine area and expanded area described for this EA that are designated as nonattainment areas, meaning the air pollution levels persistently exceed the national ambient air quality standards set by EPA (appendix 4). Counties may reach nonattainment for more than one air pollutant, as is the case for several counties in the IFA quarantine area. Forty-nine counties are designated as nonattainment areas due to their particulate matter levels (combining county listings for both the 1997 and 2006 standards). PM-2.5 is fine particles of both solid particles and liquid droplets, and are believed to pose the largest health risks. Sources of fine particles include motor vehicles, power plants, wood burning and certain industrial processes (EPA 2011c). Five counties are designated as nonattainment areas due to their lead levels. Sources of lead emissions include ore and metals processing, and certain aircraft operating on leaded gasoline (EPA 2011c). Sixty-one counties are designated as nonattainment areas due to their ozone levels. The active ingredients, including byproducts, evaluated in this assessment are not classified as ozone producers or depleters, and are not expected to contribute to ozone air pollutants. APHIS recognizes that the potential exists for some incremental increase in ozone production, as well as some other types of air pollutants due to the use of combustion engines in the course of application of the pesticides under the preferred alternative. However, any increase would be minimal when compared to the use of combustion engines as part of normal agricultural practices.

C. Water Quality within the Geographic Area

Several hundred watersheds are within the current quarantine area and expanded area described in this EA (appendix 5). A watershed is an area that drains to a common waterway, such as a stream, wetland, aquifer, ocean, and so on. American Heritage Rivers, created by Executive Order 13061 (September, 11, 1997) with selection criteria developed by the Council on Environmental Quality (CEQ) are designated by EPA, and are rivers that represent natural, cultural, and historic resources. Five rivers designated as American Heritage Rivers flow through areas evaluated in this EA (appendix 5).

The Clean Water Act provides a structure for regulating the discharge of pollutants into waters and regulates quality standards for surface waters. Section 303(d) of the Clean Water Act requires States to develop lists of its impaired and threatened waters (stream/river segments, lakes) (EPA 2011f). Causes for impairment are numerous and include categories such as pathogens, metals, salinity, sediments, pesticides, trash, and other organic and inorganic compounds. Most of the watersheds for States and their respective counties that are considered in this EA have one or more impaired waters, meaning that the water is not meeting one or more of its designated uses (based on 2010 watershed data except for Virginia where data was from 2008; data for Mississippi was poor) (EPA 2011f). Chemicals currently used in the IFA Quarantine Program including bifenthrin, chlorpyrifos, and fipronil are found in one or more of these impaired waters. Not all waters have been assessed in all watersheds.

IV. Environmental Effects

The information below on environmental effects was previously provided in the March 2012 EA that added approved pesticides. The same information is provided below, incorporating updated information on the proposed action.

This section of the EA will evaluate the potential impacts of the no action and preferred alternative. Risks to human health and the environment of each insecticide are summarized in the following sections. The proposed insecticides for the IFA quarantine are also used in nurseries to control insect pests other than IFA. The potential for impacts to human health are going to be greatest for workers and applicators in the IFA program. The use of insecticides in the IFA program are restricted to established nurseries and sod farms that want to ship commodities out of the current quarantine zone. There is the possibility for exposure to the public once the treated plants are shipped out of the nursery and delivered for planting. Because some of the treated plants could be used in landscaping, there is a potential for some exposure to the public by handling treated plants during and after planting. Incidental dermal or dietary exposure could occur in these situations; however, the risk is reduced by weathering and degradation of insecticides during holding and transport, as well as binding of program insecticides to soil particles. In addition, treated commodities do not include any plants that would typically be eaten by humans; therefore, risk to the general public through this route of exposure would be low. However, the potential for dietary risk from exposure to program insecticides through drinking water are discussed for each pesticide. Dermal and inhalation risks to the general population would be greatest during the time of application but would be very low because treatments would only occur in nurseries where the public would not be present during application. A review of the labels for each insecticide offers a range of requirements for personal protective equipment, based on the potential risk of each insecticide. All applications made in nurseries to comply with the IFA quarantine will be done by qualified individuals and in compliance with all label recommendations to ensure applicator and worker exposure and subsequent risk is minimized. In some cases, use patterns for some formulations proposed in the preferred alternative are not currently registered for that particular use; however, APHIS is working with the registrants to expand labels for those formulations so that they can be incorporated into the quarantine program and nursery treatment program. In the interim, only those pesticides labeled for a particular use pattern will be used in the IFA quarantine program.

From an environmental perspective, all treatments are focused on making applications to soil whether that occurs in containerized plants or in more open areas, such as sod. A majority of the insecticides used in the IFA program are nonsystemic[3] in nature; therefore, no insecticide plant residues would be anticipated for most of the treatments, with the exception of treatments using imidacloprid and clothianidin which are systemic insecticides. The potential for risks to nontartget organisms

[3] Nonsystemic means that the pesticide remains on the outside of the plant that is treated. By comparison, a pesticide that is systemic gets incorporated into the plant that is treated.

consuming residues from plants and insects from a broadcast application[4] are discussed in the following summaries.

A. No Action

1. Bifenthrin

a. Human Health

Bifenthrin is a synthetic pyrethroid insecticide that acts on the peripheral and central nervous system impacting axons, and is effective as a contact or ingested compound. Bifenthrin can be used in multiple formulations in the IFA program, is incorporated into soil media for containerized plants, and is not used for any other use patterns. Bifenthrin has moderate acute oral toxicity but low dermal toxicity. The reported median lethality value (LD_{50}) in mammals ranges from 53.8 to 70.1 mg/kg. Bifenthrin is not considered to be a dermal sensitizer or an eye or skin irritant (Wassell *et al.* 2008). Acute effects of the currently used formulations appear to be similar or less than the technical active ingredient, based on available data on the material safety data sheet for each formulation. Bifenthrin is not considered to be a reproductive or developmental toxicant; however, it is considered a potential carcinogen, based on the formation of urinary bladder tumors when administered at high doses to mice. Risk to ground and surface drinking water resources are not expected to be significant for the proposed use pattern, based on label restrictions regarding the protection of surface water and the environmental fate properties for bifenthrin which demonstrate low solubility and a high affinity for binding to soil.

b. Ecological Resources

Bifenthrin has low to slight toxicity to birds, and moderate acute toxicity to wild mammals. Significant exposure and risk to nontarget terrestrial vertebrates are not expected due to low toxicity and the fact that applications are restricted to soil media in containerized plants where nontarget organisms would not be expected to forage. Impacts to terrestrial invertebrate populations in the environment surrounding the commercial nurseries from bifenthrin treatments are not anticipated as treatments are made to soil within the containers. Any incidental contact by terrestrial invertebrates in these containers could result in toxicity because pyrethroid insecticides are toxic to most terrestrial invertebrates. Bifenthrin is considered highly toxic to honey bees by oral and contact exposure.

[4] Broadcast application means the uniform application of a pesticide in an area, typically accomplished using a spreader, sprayer, or other type of application technique.

Similar to other pyrethroid insecticides, bifenthrin is considered highly toxic to fish and aquatic invertebrates. Toxicity values for both groups of organisms range from the low parts per trillion (ppt) to the low parts per billion (ppb), depending on the test species and conditions (Solomon *et al.* 2001, Meléndez and Federoff 2010). Offsite transport of bifenthrin to aquatic habitats is not expected to occur because treatments are restricted to containerized media. Any bifenthrin that could move through the containerized media would not be at concentrations that could move offsite and result in adverse impacts to aquatic resources. Bifenthrin binds tightly to soil and has very low solubility, reducing the potential for transport and exposure to aquatic organisms.

c. Environmental Quality

Bifenthrin impacts to soil are not anticipated under the current use pattern because it is applied only to containerized plants subject to quarantine treatment. Due to the method of application bifenthrin is also not expected to runoff or drift from the point of application in quantities that could impact aquatic resources because treatments occur only to containerized media. Any bifenthrin that could move offsite would not be expected to impact surface or groundwater. Bifenthrin has extremely low solubility and mobility in soil, suggesting that it would not be a threat to ground water (Meléndez and Federoff 2010). Bifenthrin does degrade slowly in soil and sediment, based on field terrestrial and aquatic dissipation data (Gan *et al.* 2008, Meléndez and Federoff 2010). Dissipation half-lives range from approximately 80 days to greater than 1 year under different soil and sediment conditions. Impacts to air quality from volatilization are not expected due to the low vapor pressure for bifenthrin. Some bifenthrin could occur in the atmosphere during application, but will be restricted to the area of treatment because applications are made using ground sprayers with a large coarse droplet size that will minimize drift.

2. Chlorpyrifos

a. Human Health

Chlorpyrifos is an organophosphate insecticide with a mode of action that occurs primarily through the inhibition of the cholinesterase enzyme. Chlorpyrifos is used as an emulsifiable concentrate or wettable powder formulation for the treatment of containerized and balled and burlapped plants. It may also be used in treating field-grown plants and grass sod prior to shipment. Acute oral toxicity is moderate based on median lethality values ranging from 60 to 1,000 mg/kg, depending on the test species. Dermal toxicity is considered low, and the formulations can cause moderate eye and moderate to severe skin irritation, depending on the formulation being used. Chlorpyrifos is not considered mutagenic, teratogenic, or carcinogenic in studies submitted to support registration (USDA APHIS 2005). Exposure to humans from the contamination of groundwater resources is not expected, based on the environmental fate of chlorpyrifos and label requirements. Labeled ground application buffers of 25 feet from surface water and spray drift mitigation language on chlorpyrifos labels for IFA will reduce the potential for contamination of surface drinking water. Spray drift mitigation measures include restrictions on droplet size, sprayer boom height, and wind speed restrictions.

b. Ecological Resources

Chlorpyrifos is considered to be moderately to highly toxic to birds, depending on the test species (USDA APHIS 2005, EPA 2011a). Symptoms of nonfatal exposure to birds include cholinesterase depression (ChE), weight loss, reduced egg production, and reduced hatchling survival. Indirect impacts to mammals and birds that depend on insects as part of their diet could occur for those species that forage exclusively in areas where chlorpyrifos may be broadcast applied, such as field grown plants and sod fields. These types of areas are highly disturbed areas, particularly grass sod, which is removed after treatment. Wild mammals and birds would forage outside of these disturbed areas, therefore, indirect impacts would be expected to be minimal. Impacts to terrestrial invertebrates, such as worker honey bees, are expected in areas where treatment would occur; however, impacts to pollinators is expected to be minor as applications are made using ground equipment and to plants that would not have flowers present where pollinator exposure would be more likely to occur.

Chlorpyrifos is highly toxic to fish and aquatic invertebrates with acute median lethality values ranging from the low ppt to low ppb range, depending on the test species (USDA APHIS 2005, EPA 2011a). Exposure and risk to aquatic species will be reduced by adherence to label requirements to reduce drift, and by the application of 25-foot buffers from aquatic resources.

c. Environmental Quality

Potential effects of chlorpyrifos on air, soil, or water quality would be restricted to areas near the site of application. Chlorpyrifos can persist in soil and water for several months under certain conditions; however, the persistence is generally only for a month or less. This is dependent on the organic content of the soil. Chlorpyrifos degrades quickly in the presence of light, with a half-life of approximately 3 hours. In water, it will bind readily with sediment with aqueous half-lives ranging from 7 to 28 days. Labeled application buffers prohibiting treatment in proximity to water bodies and spray drift mitigation restrictions will reduce the potential for contamination of surface water habitats. Chlorpyrifos can volatilize into the atmosphere; however, its persistence is expected to be short, with a half-life of only a few hours because of its photolytic sensitivity (Racke 1993). Chlorpyrifos can impact air quality through drift from broadcast ground applications. These impacts would be restricted to areas within the nurseries with offsite transport reduced by adherence to label requirements regarding the minimization of drift.

3. Fenoxycarb

a. Human Health

Fenoxycarb is a juvenile hormone agonist that is classified as an insect growth regulator. Juvenile hormone is produced naturally by insects and is important in their development and reproduction. In this case, fenoxycarb prevents the larval insects from maturing to an adult. Its use in the IFA program is as a bait formulation called Award® that is used for making ground-based field applications; it is not used on container-grown and balled and burlapped plants or in grass sod production. The current registration for fenoxycarb and all associated uses expired in December 2012, at this point only reserves in commerce are available for use (EPA 2011b). The technical active ingredient is practically nontoxic to mammals in oral, dermal, and inhalation exposures (Sullivan 2000a). The formulated material is slightly more toxic than the technical material with an oral LD_{50} value of 4,921 mg/kg, and would be classified as slightly toxic. Formulation dermal and inhalation toxicity is considered practically nontoxic, with median values greater than the highest test concentration. The potential for eye and skin irritation is considered minimal to slight for the Award® formulation, and it is not considered a skin sensitizer. Fenoxycarb is not a developmental or reproductive toxicant, and has not been shown to be mutagenic. Fenoxycarb does show evidence of carcinogenicity, based on liver and lung tumors in subchronic and chronic studies using mice (NIH 2011).

b. Ecological Resources

Toxicity to terrestrial vertebrates, such as wild mammals and birds, is expected to be low, based on available data for fenoxycarb. Mammalian toxicity data used to evaluate the potential for human health impacts demonstrates low toxicity, as well as the oral and dietary toxicity data for birds (EPA 2011a). Data for the northern bobwhite and mallard duck show no lethal impacts occurring at concentrations greater than the highest test concentration in each study. Acute toxicity studies demonstrate low toxicity to pollinators, such as adult or larval honey bees (Aupinel *et al.* 2007, EPA 2011a). Studies designed to evaluate sublethal impacts to honey bees have shown impacts to honey bees; however, treatments were made using a liquid formulation under the assumption that applications would occur to flowering plants (Thompson *et al.* 2005, Aupinel *et al.* 2007, Heylen *et al.* 2010). Fenoxycarb applications in the IFA program are made using a ground bait formulation where exposure to honey bees through foraging on treated flowering plants is not anticipated. There could be some impacts to other terrestrial invertebrates, in particular during development; however, these impacts would be restricted to the area of treatment within a nursery.

Fenoxycarb toxicity to fish is moderate to high with median lethality values ranging from the mid ppb to low part per million (ppm) range for warm water and freshwater species (EPA 2011a). Acute toxicity to aquatic invertebrates varies in the mid ppb to low ppm range based on available data for freshwater and marine invertebrates. Comparative chronic toxicity between fish and aquatic invertebrates is significantly greater with effect concentrations in the low ppt range for invertebrates compared to ppb for fish. Chronic studies using various freshwater cladocerans as test organisms have shown impacts to reproduction and increased male production (Oda *et al.* 2005, Tatarazako and Oda 2007, Matsumoto *et al.* 2008). Current label requirements regarding restrictions on applications near water and the method of application in the IFA program reduce risks to aquatic species. Applications are made using a bait formulation, which will minimize drift and any runoff of fenoxycarb from treated areas. Any fenoxycarb that would move offsite would be primarily as material bound to soil, reducing bioavailability and risk to water-column organisms.

c. Environmental Quality

Fenoxycarb impacts to soil, water, and air are expected to be minor and restricted to the area of treatment because of the formulation used in the IFA program and the environmental fate of the insecticide. Fenoxycarb degradation in soil appears to be bi-phasic with primary half-lives of less than 10 days, and secondary half-lives greater than 80 days under aerobic conditions (Sullivan 2010). Fenoxycarb has moderate solubility in water but has a strong affinity to bind to soil and sediment, with organic partitioning coefficient values ranging from 1,251 to 2,599, depending on soil types (Sullivan 2010). The tendency to adsorb to soil and sediment reduces the risk to surface and groundwater resources with any fenoxycarb entering surface water primarily bound to soil in runoff. The primary environmental metabolite of fenoxycarb, however, does have greater mobility in soil and could impact surface and groundwater resources. Any fenoxycarb that may enter surface water is susceptible to microbial degradation. The reported aquatic half-life of fenoxycarb under aerobic conditions is 19 days, while under anaerobic conditions it is greater than 1,000 days (Sullivan 2010). Volatilization into the atmosphere from water or soil is not expected to occur in quantities that could impact air quality. Fenoxycarb is applied as bait consisting of large particles that would not be susceptible to drift. The chemical characteristics that determine the potential for volatilization show that concentrations in the air would be very low. Any material that would volatilize would degrade in less than 6 hours (Sullivan 2010).

4. Fipronil

a. Human Health

Fipronil is a phenyl pyrazole insecticide that acts by interfering with chloride ions passing through the chloride channel resulting in overstimulation of the central nervous system. Fipronil is used in the IFA program as a granular formulation (i.e., Chipco®) for treatment of containers and grass sod. Applications to field grown plants are also allowed under a Special Local Need (FIFRA Section 24(c)) pesticide approval in Tennessee. It is not used on balled and burlapped plants. The technical grade material is moderately toxic to mammals in oral and inhalation acute toxicity studies with median lethality values of 92 and 354 mg/kg, respectively (Drew *et al.* 2009). Fipronil is considered practically nontoxic in dermal exposures. The formulations proposed for use in the IFA program are considered practically nontoxic in oral, dermal, and inhalation exposures, based on available data. Eye and skin irritation varies from slight to moderate. Fipronil is not mutagenic, however, it is a possible human carcinogen because of an increase in thyroid follicular cell tumors in the rat. Developmental and reproductive toxicity studies report no observable effect levels (NOELs) ranging from less than 0.10 mg/kg/day to 20 mg/kg/day. Fipronil is neurotoxic to dogs and rats in acute and subchronic studies (Drew *et al.* 2009). Exposure to workers and applicators will be reduced by using a granular formulation. Threats to groundwater are not anticipated due to the environmental fate of fipronil which does not indicate mobility or leaching. There is the potential for surface water contamination; however, adherence to label restrictions, including application buffer zones, will minimize the potential for contamination of surface water used for drinking water.

b. Ecological Resources

The acute toxicity of fipronil to wild mammals is moderate based on available data for studies used to support human health assessments. Fipronil toxicity to birds is highly variable. Acute oral toxicity is considered low to mallards with LD_{50} values exceeding 2,000 mg/kg while the equivalent endpoint for the northern bobwhite is 11.3 mg/kg suggesting high toxicity to upland gamebirds. A similar trend is seen in subacute dietary studies where the toxicity is much higher for the northern bobwhite compared to the mallard (Tingle *et al.* 2003). Toxicity to terrestrial invertebrates is also variable depending on the test species. Fipronil appears to have low toxicity to earthworms however it has been shown to be toxic to some beneficial insects (Tingle *et al.* 2003).

Impacts to sensitive terrestrial invertebrates would be expected in commercial sod applications. These impacts would be restricted to the areas of application that are already highly disturbed because the sod is grown and then removed for shipment. Risks to wild mammals and birds that could forage in these areas would be greatest after treatment but prior to harvest. Indirect risks to wild mammals and birds that depend on terrestrial invertebrates would not be expected to occur because they would forage in areas other than the treated areas which are intensively managed for sod production and then harvested prior to shipment.

Fipronil and its degradates are highly toxic to aquatic species. Median lethality values for the parent material to fish range from approximately 42 to 248 ppb in acute exposures (Tingle *et al.* 2003). Sensitivity to aquatic invertebrates is more variable however fipronil is highly toxic to aquatic invertebrates with LC_{50} values ranging from low ppt for midge larvae to the low ppb for the freshwater cladoceran (Tingle *et al.* 2003). Sediment toxicity is also high for the midge in exposures to fipronil and associated metabolites (Maul *et al.* 2008). Applications adjacent to water bodies could result in runoff that could impact aquatic resources. Risk to aquatic resources would be greatest for sod applications compared to treatments to containerized plants. Label restrictions regarding the protection of water bodies with application buffers ranging from 15 to 60 feet will reduce risk to aquatic resources. In the case of the protection of freshwater resources, the application buffer must contain groundcover that will also reduce the flow of fipronil-contaminated water from areas of treatment to aquatic areas, as well as trap sediment bound fipronil particles.

c. Environmental Quality

Reported values for field dissipation half-lives are 33 to 75 days for bare soil and 12 to 15 days in turf. Under aerobic conditions, organisms present in the soil gradually breakdown fipronil. Aerobic soil metabolism studies reported the half-life of fipronil in sandy loam to be 122 days with the amide and sulfone metabolites accounting for 27 to 38 percent, and 14 to 24 percent of the total amount of pesticide applied, respectively (Tingle et al., 2003). Fipronil binds tightly to soil so runoff from treated fields would contain most of the insecticide bound to soil particles. In water, the reported solubilities for fipronil are 2.0 to 2.4 ppm (Tingle et al., 2003). The reported half-life for fipronil under aerobic aquatic conditions was 14.5 days. The major metabolite (a sulfide degradate) typically represents 74 percent of the total residue after 30 days. Fipronil has a relatively low vapor pressure indicating it does not readily volatilize. Consequently, drift would be the only expected pathway for movement into the air which would be minor because all proposed formulations are granular and would not be anticipated to drift from areas of application.

5. Hydra-methylnon

a. Human Health

Hydramethylnon is an amidinohydrazone insecticide that binds to cytochrome in the electron transport system of mitochondria. Hydramethylnon works as a metabolic inhibitor by blocking the biological process in the insect that makes adenosine triphosphate (ATP). ATP is a compound required by most biological processes to provide energy for life. Hydramethylnon is used in the IFA program on field-grown plants; it is not used on container-grown and balled and burlapped plants or in grass sod production. It is selectively toxic to insects with chewing or sponging mouthparts, and functions as a slow acting stomach toxicant. It is relatively nontoxic to insects that use other modes of feeding and to insects where exposure is limited to cuticular contact. Toxicity of the technical active ingredient is considered moderate in oral exposures with median lethality values ranging from 817 to 1,502 mg/kg. Acute toxicity from dermal and inhalation exposures are low with a reported inhalation median lethality value of 2.9 mg/L, and a value of greater than 2,000 mg/kg for dermal exposure (EPA 1998). The formulation proposed in the IFA program is granular bait which is considered practically nontoxic in acute, oral, dermal, and inhalation exposures. The formulation is also not considered to be an eye/skin irritant or skin sensitizer. Hydramethylnon is not considered to be mutagenic, teratogenic, or a developmental toxicant based on studies to support registration that were conducted using the technical ingredient.

Hydramethlynon is classified as a possible carcinogen based on an increased incidence in lung adenomas in long-term exposure studies using mice. Similar results were not observed in studies using the rat; however, impacts to male rats included a decrease in size and atrophy of testes (EPA 2003a).

b. Ecological Resources

Hydramethylnon has low toxicity to wild mammals, based on mammalian data submitted to support human health assessments. Avian toxicity is low determined from available oral and dietary data. The northern bobwhite is more sensitive in acute and subacute exposures compared to the mallard (EPA 1998). No chronic toxicity data appears to be available for birds. Toxicity to terrestrial invertebrates, such as pollinators, is low based on contact studies (EPA 2011a). Apperson et al. (1984) showed minimal impacts to native ant populations after treatment for IFA with the formulation proposed for use in the IFA program. Other field studies have shown some impacts to native ant populations, as well as ground-dwelling pests, such as cockroaches and crickets (Plentovich *et al.* 2010). Impacts to select terrestrial invertebrates are possible; however, these impacts will be minimized by the use of granular bait and would occur only in the area of treatment. These impacts are not expected to have indirect effects to other animals that depend on insects for prey. The selective nature of the bait formulation and the active ingredient will minimize population level impacts.

Available aquatic toxicity data for hydramethylnon demonstrates high toxicity to most species. Fish median lethality values range from 100 µg/L for channel catfish to 1.7 mg/L for the bluegill sunfish (EPA 2011a). Acute toxicity to invertebrates ranges from the low ppb for the mysid shrimp to greater than1 ppm for the freshwater cladoceran (EPA 2011a). Chronic toxicity of the formulation and technical active ingredient is high to aquatic invertebrates (EPA, 2011). Hydramethylnon is also considered highly toxic to aquatic plants. Risk to aquatic resources could occur in cases where applications are made adjacent to shallow water bodies. The bait formulation is a granule which will reduce the offsite transport of drift. Also, there are label restrictions designed to protect aquatic nontarget organisms. This includes wind speed restrictions and avoiding conditions which could result in movement into sensitive areas.

c. Environmental Quality

The formulation proposed in the IFA program and the environmental fate of hydramethylnon suggest that any impacts to soil, water, or air will be restricted to the area of application. On soil surfaces, hydramethylnon degrades quickly due to its sensitivity to light. Half-lives of less than 4 days have been reported for soil in biphasic reactions while the photolytic half-life in water is less than one day. In the absence of light, microbial degradation is slow with reported half-lives greater than 1 year (EPA 1998). Any material that does not degrade will bind tightly to soil from the available data suggesting that hydramethylnon is not mobile and expected to impact water quality. Impacts to air quality are not expected because the formulation is a granule applied by ground equipment which will reduce the potential for drift. Hydramethylnon is also not expected to volatilize into the atmosphere from soil or water, based on available product chemistry data (EPA 1998).

6. Methoprene

a. Human Health

Methoprene is an insect growth regulator that mimics the insect juvenile hormone which is critical to insect development. Methoprene is used in the IFA program on field-grown plants; it is not used on container-grown and balled and burlapped plants or in grass sod production. Technical methoprene is considered practically nontoxic to mammals in acute oral, dermal, and inhalation exposures. Median acute lethality values range from 5,000 to 34,000 mg/kg, and dermal and inhalation values are greater than 2,000 mg/kg and 20 mg/L, respectively (EPA 1991). The technical ingredient is also not considered an eye or skin irritant, and is not a skin sensitizer.

Data for the formulation proposed in the IFA program does not appear to be available; however, based on data for the technical active ingredient and the granular formulation proposed in the IFA program, the toxicity is not anticipated to be significantly greater than the technical material. Methoprene is not considered to be a mutagenic or carcinogenic compound, and in chronic dosing studies no observable effect levels (NOELs) were observed at the upper dosing range in studies designed to evaluate reproductive and developmental impacts. Risks to workers are low because the toxicity is low and the granular formulation will reduce exposure.

Methoprene is not expected to impact water resources that could be used as drinking water. Methoprene is not mobile; therefore leaching into groundwater is not anticipated. Threats to surface water are reduced by the formulation proposed for use which will minimize drift. Low solubility and selective partitioning to soil and sediment will reduce the likelihood of methoprene residues in surface water that could be used for drinking water.

b. Ecological Resources

Toxicity of methoprene to wild mammals is low, based on data submitted for human health assessments. Methoprene is also considered practically nontoxic to birds in acute and subacute exposures with median lethality values greater than the highest test concentration (EPA 2011a). Long-term avian reproductive studies show effects at 30 ppm for the mallard, but not the northern bobwhite where no chronic reproductive effects were noted. Methoprene has selective toxicity to terrestrial invertebrates due to the mode of action and when an insect may be exposed. Impacts to some soil-borne terrestrial invertebrates have been noted and may occur in this program; however, based on the method of application and formulation used in the IFA program, impacts would be restricted to areas where the bait is used for field grown plants (Campiche *et al.* 2007).

Pollinator impacts are not anticipated due to the lack of a significant exposure pathway to insects, such as honey bees, because applications are made to the ground using a granular formulation. In addition, available data shows that impacts to honey bees, including sublethal impacts, occur at doses that would not be expected to occur in the IFA program or through the method of application used in those studies (Robinson 1985, Deng and Waddington 1997).

Median lethality values for methoprene toxicity to fish range from the low ppm for cold water species, such as the trout, to greater than 100 ppm for channel catfish suggesting that methoprene is slightly to practically nontoxic to fish (EPA 2001, 2011a). Methoprene varies in toxicity to aquatic invertebrates depending on the test species. Median lethality values range from the low ppb to low ppm which would be classified as slightly to highly toxic. Several studies have been published regarding the potential impacts of methoprene and its metabolites to amphibians from its use as a mosquitocide. A summary of acute toxicity data for methoprene shows that toxicity to amphibians is low with values greater than the highest test concentration which ranged from 1.0 to 10 ppm with no other adverse effects noted (EPA 2001). Studies designed to assess the effects of methoprene and its metabolites on the development of amphibians have shown impacts occurring above the solubility for methoprene in water, or at concentrations that could not occur from applications in the IFA program (Degitz *et al.* 2003, Henrick 2007).

c. Environmental Quality

Methoprene degrades quickly in soil under aerobic and anaerobic conditions, with half-lives ranging from 10 to 14 days. Methoprene also binds tightly to soil and sediment and, due to its low solubility, will partition to sediment in cases where it moves offsite from drift or runoff to aquatic habitats. In water, methoprene is resistant to hydrolysis but breaks down quickly in the presence of light, with half-lives less than 13 days (EPA 1991). Methoprene does exhibit properties that suggest a slight potential for volatilization into the atmosphere from soil and water (Csondes 2004). This effect is reduced by the preference of methoprene to bind to soil and water, and any methoprene that will volatilize is susceptible to degradation by sunlight. Movement of methoprene from the site of application from drift will be minimal because it is applied as bait and not susceptible to drift when compared to a liquid formulation.

7. Pyriproxyfen

a. Human Health

Pyriproxyfen is part of a group of insecticides (known as insect growth regulators) that act as a juvenile hormone analog. Juvenile hormone is critical in the development, reproduction, and diapause of insects. It is used as an insecticide to prevent larval insects from maturing to adults. The product currently used in the IFA program is Distance® which is a bait formulation used in field-grown plants; it is not used on container-grown or balled and burlapped plants or in grass sod production. Acute toxicity data for the pyriproxyfen active ingredient and the proposed formulation demonstrate very low toxicity from oral, dermal, or inhalation exposures. Median lethality values (LD/LC_{50}) for all three exposure pathways are greater than the highest test concentrations suggesting that the formulation is practically nontoxic in acute exposures. Handling the formulated product can result in minor eye irritation, but is not a skin irritant or skin sensitizer.

In longer term studies, pyriproxyfen has been shown to have low toxicity with NOELs well above any exposures scenarios that could occur in the IFA program (Hanson 2009). Pyriproxyfen and its associated metabolites are not considered to be carcinogenic or mutagenic, as demonstrated in available mammalian studies to support registration of the active ingredient (Bayoumi *et al.* 2003, Hanson 2009). Available mammalian toxicity data that has been submitted for registration of pyriproxyfen does not indicate any effects related to endocrine disruption. The greatest risk of exposure will be to workers during application. Applications will only be made by certified personnel following all label recommendations regarding worker safety.

b. Ecological Resources

Proposed pyriproxyfen applications are not expected to have adverse impacts to fish or wildlife, based on the method of application, the low toxicity of the insecticide to most organisms, and program mitigations to reduce exposure and risk. Pyriproxyfen has low toxicity to wild mammals and birds suggesting little direct risk and, based on the mode of action of pyriproxyfen and the small areas of treatment, would not be expected to have adverse impacts for those terrestrial organisms that depend on insects as prey items. Pyriproxyfen will have some impacts to nontarget terrestrial invertebrates; however, these impacts will be restricted to the area of treatment and will only impact some invertebrates because of the selective nature of the insecticide. Available acute contact toxicity data for pollinators shows that pyriproxyfen is practically nontoxic to adult honey bees (EPA 2011a). Also, no toxicity has been observed in adult bumblebees or to male production and brood production. However, pyriproxyfen may impact larval bumblebee mortality at concentrations higher than the application rates used in this program (Mommaerts *et al.* 2006).

Pyriproxyfen toxicity to aquatic organisms is variable with acute toxicity above water solubility (0.367 mg/L) for most fish species, suggesting low acute risk to aquatic vertebrates (EPA 2011a). Sublethal impacts in acute and chronic exposures can occur at concentrations in the low ppb range for fish, and in the ppt range for aquatic invertebrates (Sihuincha *et al.* 2005, Matsumoto *et al.* 2008, EPA 2011a). Median lethal acute effects to aquatic invertebrates vary from the middle to upper ppb range, depending on the test species (EPA 2011a). Direct or indirect risk to aquatic organisms through loss of food items is expected to be low because of the application method previously described that will reduce the likelihood of offsite drift and runoff.

c. Environmental Quality

Impacts to soil quality from pyriproxyfen applications are not expected, because of the location of the treatments and the fate of pyriproxyfen in soil. Any contact with soil will be localized and not expected to persist, based on field dissipation half-lives ranging from 3.5 to 16.5 days, and aerobic soil metabolism half-lives of less than 2 weeks (Sullivan 2000b). Pyriproxyfen is not anticipated to have impacts to air quality due to the proposed method of application and environmental fate for the insecticide. Pyriproxyfen has a low vapor pressure suggesting that volatilization into the atmosphere from plants and soil will be minimal. Because it is applied as bait, movement out of the area of treatment due to drift is not anticipated. Impacts to surface or groundwater are also not anticipated due to the low solubility of pyriproxyfen in water, as well as its preference to bind to soil and sediment. This will also reduce the potential for volatilization from water into the atmosphere, which is considered moderate for pyriproxyfen, based on available fate data (Sullivan 2000b).

8. Cypermethrin

a. Human Health

Cypermethrin is a pyrethroid insecticide that effects the axon of the nerve resulting in paralysis (EPA 2005b). Cypermethrin has several agricultural and nonagricultural uses to control a variety of insect pests. For the IFA program, its proposed use is to treat containers, field-grown plants, and grass sod in a formulation that also contains bifenthrin.

The technical active ingredient, cypermethrin, and the proposed formulation, Talstar® Xtra, is moderately toxic in oral exposures, but is considered practically nontoxic in dermal and inhalation exposures. The formulated material is severely irritating to the eye and moderately irritating to the skin. It is also considered a mild skin sensitizer.

Cypermethrin is not considered mutagenic or teratogenic; however, it is considered a possible carcinogen because of results from a chronic mouse study where benign lung tumors were observed at the highest dose level. These levels are well above those expected in this program. Similar effects were not observed in other test species in chronic studies (McNeilly and Wang 2007). There is data that demonstrate endocrine-related impacts in vertebrates, but at residues that would not be expected to occur in this program. Jin et al. (2011) observed a decrease in testosterone levels in male mice dosed at 20 mg/kg of body weight. Wang et al. (2011) also observed effects to mice after maternal exposure during lactation to male offspring. Doses of 25 mg/kg resulted in reduced serum and testicular testosterone levels in male mice that returned to normal as they reached maturity; however, a reduction in testicular weights and tissue effects remained unchanged. These values are in the effect range for studies that have been submitted to support the registration of cypermethrin. Risk to human health, and in particular workers and applicators, will be low due to the toxicity of cypermethrin and the granular formulation proposed for use. Exposure to cypermethrin in drinking water is not anticipated.

The proposed formulation is a granule which will minimize the potential for offsite drift. Cypermethrin has very low water solubility and preferentially binds to soil and sediment, suggesting that it would not be susceptible to leaching into groundwater and would not be present in any runoff to surface water bound to soil particles.

b. Ecological Resources

Cypermethrin has low acute and chronic avian toxicity with reported acute median lethal doses and chronic no observable effect concentrations (NOECs) greater than the highest test concentration (EPA 2005b). Toxicity is high to most terrestrial invertebrates, including honey bees; however, the granular formulation proposed for use in the IFA program will reduce potential offsite impacts due to the low drift potential. Broadcast applications would be expected to have impacts to some terrestrial invertebrates; however, these impacts would be restricted to the area of application and, in the case of soil-borne invertebrates, would be minimized by the affinity for the insecticide to bind to soil, reducing bioavailability over time (Hartnik and Styrishave 2008). The impacts that could occur to some terrestrial invertebrates from IFA treatment with cypermethrin is not expected to pose an indirect risk to terrestrial vertebrates that depend on invertebrates for prey, in particular for container treatments. In the case of field applications, vertebrates would be expected to forage over areas greater than the area of treatment.

Cypermethrin is considered highly toxic to aquatic invertebrates and vertebrates with reported median lethality values in the low ppt to low ppb range, depending on the test species, although fish were slightly less sensitive when compared to aquatic invertebrates (Solomon *et al.* 2001, EPA 2005b). Acute and chronic risk to aquatic habitats is low because of the granular formulation proposed for use which reduces the potential for drift. Runoff will also be low because cypermethrin has low water solubility and will bind to soil and sediment reducing bioavailability to aquatic organisms. In addition, label language regarding the protection of aquatic habitats will reduce the risk to aquatic biota.

c. Environmental Quality

Cypermethrin is not expected to cause adverse impacts to soil, water, or air quality due to the method of application and the environmental fate of the insecticide. Cypermethrin breaks down in soil under aerobic and anaerobic conditions, with half-lives of less than 65 days (EPA 2005b). As discussed previously, there is the potential for impacts to soil-borne invertebrates; however, this will be restricted to the area of treatment because of the granular formulation proposed for use. Cypermerthrin has very low water solubility and a high binding affinity to soil and sediment that would result in a very low probability of surface or groundwater contamination. Cypermethrin that would move offsite as drift and enter surface water would dissipate quickly from the water column due to its low water solubility and affinity for sediment particles. The rapid partitioning of pyrethroid insecticides from water to sediments has been observed in field applications, as well as laboratory data (Crossland 1982). In the field, half-lives are less than a day under a variety of conditions (Roessink *et al.* 2005, He *et al.* 2008). Physical and chemical characteristics of cypermethrin preclude significant volatilization into the atmosphere. Cypermethrin would also not be present in the atmosphere as drift because the proposed formulation is a granule and would not be expected to remain in the atmosphere after application.

9. Clothianidin

a. Human Health

Clothianidin is a systemic pesticide that belongs to the neonicotinoid insecticide class which acts on the nicotinic acetylcholine receptor affecting the central nervous system in insects. Clothianidin is proposed for use in this program using the formulation, Aloft® SC, which also contains the insecticide bifenthrin. It will be used to treat field plants and sod, but not container-grown or balled and burlapped plants. Clothianidin has low acute oral toxicity to rats but is moderately toxic to mice, with a reported median lethality value of 425 mg/kg (EPA 2003b). Acute dermal and inhalation toxicity of the active ingredient and the proposed formulation is low with median lethality values exceeding the highest concentration tested. Clothianidin is not considered to be teratogenic, mutagenic, or carcinogenic, based on available mammalian studies. The formulation proposed for use in this program is a slight to moderate eye irritant and slight skin irritant and is considered a skin sensitizer, based on data available on the material safety data sheet.

Clothianidin does exhibit chemical fate properties that suggest mobility in soil and could contaminate drinking water. Conservative estimates of exposure from surface and groundwater contamination do not present any risk to the general population. Risk to groundwater is further reduced by avoiding applications in areas with a high water table and/or permeable soils. Risk to surface water will be reduced by following label restrictions regarding application buffers from surface water resources.

b. Ecological Resources

Clothianidin has low to moderate toxicity to wild mammals and is considered practically nontoxic to birds, based on oral and dietary exposures (EPA 2003b, 2011a). Conservative assumptions regarding the ingestion of contaminated prey items, such as insects, demonstrate very low risk to wild mammals and birds that may forage on treated field-grown plants in nurseries. Indirect risk to vertebrate populations from the loss of prey items is not anticipated from the treatment of fields because they are not typically large areas, they are already disturbed due to other activities, and not exclusive habitats for foraging. Clothianidin is toxic to honey bees and, because of its systemic action, may impact pollinators due to residues in pollen and nectar. Studies designed to assess these types of impacts in bumblebees have shown that maximum clothianidin residues measured in the field had no observed effects on foraging ability or colony health (Franklin *et al.* 2004). Clothianidin was linked to a 2008 bee death incident in Germany. The combination of conditions that occurred in that incident (i.e., application method, weather, use pattern) are not expected in this program; therefore, that type of exposure and risk to honey bees and pollinators are not likely to occur. Label restrictions also reduce bee exposure by restricting applications on blooming, pollen, shedding, and nectar-producing parts of the plant if bees are anticipated to forage in the area within a 5-day window after treatment.

Acute toxicity to fish is low with median lethality values greater than the highest test concentration. Acute toxicity to aquatic invertebrates is more variable with median lethality values ranging in the low ppb range for some freshwater and marine invertebrates, such as mysid shrimp and chironomids (i.e. midges) to greater than 100 ppm for standard test species, such as the freshwater cladoceran (EPA 2003b, 2011a). Adherence to label precautions, including a 25-foot buffer, will reduce the risk to aquatic biota.

c. Environmental Quality

Clothianidin applications to field-grown plants and grass sod are not expected to have adverse impacts to soil, water, or air quality beyond the area of treatment. Clothianidin degradation in soil is slow with laboratory and field studies documenting half-lives of approximately 148 days to greater than two years. Clothianidin used in combination with bifenthrin as proposed in this program would result in impacts to soil invertebrates; however, these impacts would be restricted primarily to the areas of application which are managed nurseries. Clothianidin is considered to be highly mobile in soil and could contaminate water in areas where applications are made in close proximity to surface water or to permeable soils with a high groundwater table. The label for the formulation proposed in this program requires a 25-foot application buffer from various water bodies. Avoiding applications to soils that are permeable will also reduce the likelihood of groundwater contamination. Any clothianidin that would reach water would be susceptible to degradation by light with a reported half-life of less than 1 day. Degradation of clothianidin from hydrolysis or biological factors is slower because clothianidin is resistant to hydrolysis and has an aquatic metabolism half-life value of approximately 1 month (EPA 2003b). Impacts to air quality are not anticipated due to the low vapor pressure of clothianidin and method of application which includes the use of ground equipment.

10. Permethrin

a. Human Health

Permethrin is a pyrethroid insecticide that has a varied toxicology profile. Proposed use in the IFA program is on and around hay and beehives, but not for treatment of container-grown, field-grown, or balled and burlapped plants and grass sod. Acute mammalian toxicity of permethrin is variable for the active ingredient with oral LD_{50} values ranging from approximately 40 mg/kg to greater than 3,580 mg/kg. Dermal toxicity is considered low with LD_{50} values of greater than 2,000 mg/kg for the rabbit and rat (Kinard *et al.* 2005). Acute inhalation is also low (LC_{50} >23.5 mg/L), as is the potential for acute eye and dermal irritation (Kinard *et al.* 2005). The formulation proposed for use, Gardstar®, has moderate acute oral toxicity to mammals with a median lethality value of 1,490 mg/kg. Similar to the technical active ingredient, dermal and inhalation toxicity is very low with values reported as greater than the highest concentration tested in those studies. The formulation is considered slightly irritating to the skin but is not a skin sensitizer; however, it is corrosive to the eye according to data on the material safety data sheet. Chronic toxicity studies of permethrin have demonstrated low toxicity in prenatal developmental and reproductive studies. Based on the review of studies submitted to EPA for reregistration, the no observable adverse effect level (NOAEL) in these types of studies ranged from 50 mg/kg/day to 600 mg/kg/day (Kinard *et al.* 2005). Long-term toxicity studies that assessed carcinogenicity using the dog, rat, and mouse reported NOAEL values ranged from 36.9 to 316.1 mg/kg/day, depending on species and endpoint. Permethrin has been established as a possible human carcinogen by EPA; however, the exposure levels where those types of effects occurred were high, and the effect was only seen in mice, not rat or dog studies.

b. Ecological Resources

Nontarget terrestrial vertebrates, such as birds, do not appear to be sensitive to permethrin exposure, based on the low LD_{50} toxicity values for several bird species that range from greater than 2,000 to greater than 23,000 mg/kg (Rexrode and Meléndez 2005). Chronic toxicity to birds is also low with NOEC values ranging from 25 to 500 ppm, which were the highest test concentrations used in each study. Permethrin is toxic to honey bees, as well as other beneficial insects; however, the risk will be localized because proposed applications will occur as a soil drench around hay bales and adjacent to beehives.

Aquatic organisms are more sensitive to permethrin than other test organisms, based on the range of toxicity values to marine and freshwater fish and invertebrates (EPA 2011a). A large number of freshwater and marine aquatic toxicity studies have been conducted using permethrin with a result of high acute and chronic toxicity to aquatic fauna. Generally, fish are less sensitive than invertebrates with fish LC_{50} values ranging from the high ppt to mid ppb range, depending on the species and respective life stage, study duration, and test conditions. The marine and freshwater aquatic invertebrate toxicity range is lower with reported LC_{50}/EC_{50} values ranging from the low ppt to low ppb range (Solomon *et al.* 2001, Rexrode and Meléndez 2005). Permethrin chronic toxicity to fish and aquatic invertebrates is also high, with NOEC values ranging from the low ppt to low ppb range for fish and aquatic invertebrates, respectively. The proposed use of permethrin in this program as a soil drench to small localized areas around hay bales and in proximity to bee colonies will reduce the potential amount of permethrin that could runoff or drift into aquatic areas. As a soil drench, large droplets can be used that will mitigate drift concerns. Runoff to aquatic areas will be minimized due to the preferential binding affinity of permethrin to soil and sediment, and label restrictions regarding surface water protection.

c. Environmental Quality

The potential for impacts to soil, water, and air quality beyond the site of application are not anticipated for the proposed use of permethrin in the IFA program. There would be potential impacts to soil-borne terrestrial invertebrates in the area where the soil drench would occur; however, because these would not be broadcast applications the impacts would be localized at the point of treatment. Degradation half-lives in soil under aerobic conditions are typically less than 40 days; however, under anaerobic conditions may exceed 204 days (Rexrode and Meléndez 2005). In water, similar differences in half-lives occur between aerobic and anaerobic conditions. Permethrin has low water solubility and a strong affinity for binding to soil and sediment. Risk to groundwater is not anticipated, based on the fate of permethrin in water and the proposed application methods for the IFA program. Permethrin may impact surface water from drift; however, the use of large droplets and localized treatments will minimize the potential for drift. Permethrin that may enter surface water from runoff will be bound to soil particles or, once in the water, will rapidly bind to sediment. This is reflected in the aquatic field dissipation data for permethrin with reported half-lives of approximately 3 days or less in studies conducted using pond water. Impacts to air quality are not anticipated because applications will be made using large droplets that would not be expected to remain in the atmosphere. In addition, the chemical fate information for permethrin, in particular the vapor pressure value, indicates that permethrin would not be expected to volatilize into the atmosphere in quantities that could result in negative impacts to air quality (Rexrode and Meléndez 2005).

11. Imidacloprid

a. Human Health

Imidacloprid belongs to a class of insecticides called neonicotinoids which act by binding directly to the acetylcholine binding receptor. Technical and formulated imidacloprid has low to moderate acute oral mammalian toxicity with median toxicity values ranging from 400 to greater than 2,000 mg/kg. The technical material, as well as several formulations, are considered practically nontoxic from dermal or inhalation exposure (Anatra-Cordone and Durkin 2005). Acute lethal median toxicity values are typically greater than 2,000 mg/kg and 2.5 mg/L for dermal and inhalation exposures, respectively. Its proposed use in the IFA program is in two different formulations that are premixed with other active ingredients. The first formulation, Allectus®, is proposed for use in balled and burlapped plants with bifenthrin, and in the second formulation, Discus™, it is premixed with cyfluthrin and would be used in field-grown plants, balled and burlapped plants, and grass sod; neither formulation would be used in container-grown plants. The toxicity and risk of bifenthrin and cyfluthrin are discussed individually elsewhere in this section. Available acute toxicity data for formulations similar to those proposed in the IFA program but with higher percentages of each active ingredient suggest low acute oral, dermal, and inhalation toxicity. Both formulations are not considered to be a skin sensitizer, and have low risk as a skin and eye irritant. Available data for imidacloprid and associated metabolites suggest a lack of mutagenic, carcinogenic, or genotoxic effects at relevant doses. Developmental-, immune-, and endocrine-related effects have been observed in some mammal studies. In all cases, the noted effects were observed at doses above maternal effects in the case of developmental studies, and at concentrations and durations not expected in the IFA program (Anatra-Cordone and Durkin 2005).

Potential risks to human health are restricted, primarily, to applicators. As proposed in this program, the use of granular formulations will minimize oral, dermal, and inhalation exposure during application. Adherence to label language regarding personal protective equipment and the low oral, dermal, and inhalation toxicity of these two formulations will minimize risk to workers who would be making applications with either formulation. Imidacloprid does have chemical properties that suggest it could be a threat to groundwater. Avoiding applications in areas where a high water table is present and soils that are highly permeable will reduce the potential for groundwater contamination.

b. Ecological Resources

Imidacloprid is considered to have moderate toxicity to wild mammals and is considered toxic to birds, with acute oral median lethal toxicity values ranging from 41 to 152 mg/kg. Concerns have been raised about potential lethal and sublethal effects to honey bees and other pollinators. Median lethal toxicity values of imidacloprid have been based upon oral or contact exposure. Laboratory and field studies of honey bees indicate a lack of adverse effects at test concentrations comparable to realistic exposure scenarios, and adverse health impacts to hives only with greater exposures (USDA APHIS 2008). However, recent laboratory studies assessing sublethal impacts of imidacloprid have demonstrated impacts to honey bees when exposed to lower levels of imidacloprid and the insect pathogen, *Nosemia* spp. (Pettis *et al.* 2012). Broadcast applications of Discus™ would pose the greatest risk to pollinators and other sensitive terrestrial invertebrates due to the method of applications and presence of the broad spectrum insecticide, cyfluthrin. Labeled restrictions regarding the protection of honey bees during application will help reduce exposure and risk. Exposure is further reduced in sod treatments as honey bees would not be expected to be attracted to these areas due to a lack of flowering plants.

Exposure to wild mammals and birds from applications of imidacloprid and associated residues is not expected to occur at levels that could result in significant risk. The terrestrial insects that feed upon vegetation of those host plants that have been treated with these applications are likely to be impacted, but the effects would be restricted to the areas of treatment. Indirect impacts to vertebrate populations that depend on insect prey are not anticipated. All treatments take place in commercial nurseries. Areas of sod that could be treated with the Discus™ formulation would be expected to have some impacts to nontarget terrestrial invertebrates; however, the impacts would be restricted primarily to areas of treatment where sod would be removed for shipment. Vertebrates that might forage in these areas would also forage outside of the treatment area since their foraging range would not be restricted to highly disturbed areas within the nurseries.

Imidacloprid has low toxicity to aquatic organisms including fish, amphibians, and some aquatic invertebrates. Acute toxicity to fish and amphibians is low with acute median lethal concentrations typically exceeding 100 mg/L (Anatra-Cordone and Durkin 2005, EPA 2011a). Chronic toxicity to fish is in the low ppm range, depending on the test species and endpoint. Aquatic invertebrates are more sensitive to imidacloprid when compared to fish, with acute median toxicity values in the low ppb range to greater than 100 mg/L, depending on the test species (Anatra-Cordone and Durkin 2005, EPA 2011a). Aquatic vertebrates and invertebrates can be exposed through runoff or drift from the site of application. Drift is not considered a significant route of exposure because the formulations proposed for use are granules. Runoff could occur and would be greatest for the Discus™ formulation because it is proposed for field use. Conservative estimates of potential residues that could runoff from the proposed applications are not expected to have any direct impacts to aquatic vertebrate populations. Indirect risk through the loss of aquatic prey items is also not anticipated, based on the potential range of concentrations and toxicity data for aquatic invertebrates.

c. Environmental Quality

Imidacloprid persistence in soil can range from 27 to 229 days, based on field dissipation studies (Anatra-Cordone and Durkin 2005, Fossen 2006). Imidacloprid does not adsorb strongly to soil particles. Imidacloprid is soluble in water and has a half-life under natural light of less than 5 hours in water, but is stable to hydrolysis. Based on the chemical properties of imidacloprid, there is the potential for leaching into groundwater resources. Adherence to label requirements, as well as the avoidance of applications to permeable soils and/or areas where the water table is high will ensure the protection of groundwater. Imidacloprid is not expected to impact air quality because the method of application will not result in significant drift. Volatilization to the atmosphere is also not anticipated, based on the chemical properties of imidacloprid.

12. Cyfluthrin

a. Human Health

Cyfluthrin is a synthetic pyrethroid insecticide with broad spectrum activity. The mode of toxic action occurs by causing the sodium channels to stimulate nerves to produce repetitive discharges. Muscle contractions are sustained until a block of the contractions occurs. Nerve paralysis can occur at high levels of exposure. The Discus™ formulation, which is a mixture of imidacloprid and cyfluthrin, will be used on field-grown plants, balled and burlapped plants, and grass sod, but not in container-grown plants, as discussed in the previous section of this document on imidacloprid. The acute oral median lethal toxicity of cyfluthrin is considered to be low to moderate in mammals. Inhalation and acute dermal toxicity are considered to be low. The formulation of cyfluthrin to be used in the program is of comparable or lower acute toxicity than the active ingredient. The program applications pose no evident dermal irritation or sensitization, but may result in mild eye irritation. An acute neurotoxicity study using the rat resulted in a decrease in motor activity at 10 mg/kg/day, with a resulting NOEL of 2 mg/kg/day (EPA 2005a).

Reproductive and developmental toxicity studies in rats found a maternal NOEL of 3 mg/kg/day, and a developmental NOEL of 10 mg/kg/day. Cyfluthrin is not considered to pose mutagenic or carcinogenic risks (EPA 1997). Cyfluthrin risk to surface or groundwater will be reduced due to the formulation proposed for use and the environmental fate of pyrethroids. Drift is not anticipated because the formulation is a granule, and movement into groundwater is unlikely due to the very low mobility and solubility of cyfluthrin. The Discus™ formulation proposed for use in the IFA program contains the active ingredient imidacloprid which does have chemical properties that suggest mobility in soils and possible leaching into groundwater. Avoiding applications to permeable soils or in areas where a high water table is present will reduce the risk to groundwater that could be used as drinking water.

b. Ecological Resources

The acute oral median lethal toxicity of cyfluthrin is considered to be low to moderate for mammals. Inhalation and acute dermal toxicity are considered to be low. The formulation of cyfluthrin to be used in the program is of comparable or lower toxicity than the active ingredient. Cyfluthrin is considered to be practically nontoxic to birds, with acute oral median lethal toxicity values greater than 2,000 mg/kg (EPA, 2011). Chronic toxicity to birds is also low, based on reproductive studies conducted with the mallard and northern bobwhite, with no effect concentrations greater than 250 ppm (EPA 2011a).

The broad-spectrum activity of cyfluthrin results in high toxicity to most insects, including pollinators. The 48-hour contact median lethal dose for honey bees is 0.037 µg/bee (EPA 2011a). Pollinators, such as honey bees, should not be impacted; however, because applications are made using a granular formulation, no applications to flowering parts of plants are anticipated, and the insecticide is not systemic in plants. Impacts to soil-borne terrestrial invertebrates are not expected for applications to balled and burlapped plants, although impacts to field grown plants and grass sod would be anticipated where applications occur. Commercial nurseries are intensively managed and their environment is not likely to be favorable to native, terrestrial invertebrates.

Cyfluthrin is highly toxic to fish and very highly toxic to most aquatic invertebrates (EPA 2011a). The greatest risk to aquatic resources is through drift from cyfluthrin applications. Cyfluthrin runoff is not expected to be significant to aquatic resources because this type of insecticide binds tightly to soil and has very low solubility, thereby reducing the potential for transport and exposure to most aquatic organisms. There is the potential for risk to sediment-dwelling invertebrates; however, adherence to label recommendations and the lack of drift will reduce the potential for aquatic residues that could result in impacts to aquatic invertebrate populations.

c. Environmental Quality

Cyfluthrin impacts to soil, water, and air quality are expected to be minimal, based on the environmental fate and label requirements for application. Cyfluthrin half-lives in soil are variable depending on pH and organic matter. Laboratory and field dissipation half-lives range from approximately 30 to 94 days. Once cyfluthrin reaches the soil, it binds very tightly to soil particles, and is not considered to be water soluble. Its high affinity for soil and low solubility suggest that any cyfluthrin that reaches an aquatic resource will be soil bound or will partition very rapidly to the sediment. The lack of mobility suggests that ground water contamination will not be a concern. Surface water quality could be impacted from drift during applications; however, several mitigation measures are stated on the label to protect surface water quality. Cyfluthrin will only occur in the atmosphere during application, but will dissipate rapidly and is not expected to volatilize back into the atmosphere based on its chemical properties.

13. Lambda cyhalothrin

a. Human Health

Lambda cyhalothrin is a pyrethroid insecticide with a mode of action similar to those previously described in this EA. The proposed use in the IFA program would be to containers, balled and burlapped plants, field-grown plants, and sod using the formulation Scimitar® GC, which is a liquid concentrate. The technical active ingredient has moderate acute oral toxicity with LD_{50} values of 56 to 79 mg/kg (Durkin 2010). Dermal and inhalation toxicity is also moderate with values of 623 mg/kg and 0.065 mg/L, respectively. Similar data for the formulation proposed in the IFA program shows much lower toxicity with oral, dermal, and inhalation values greater than the highest concentration tested and would be considered practically nontoxic. The formulation proposed for use is not considered to be an eye irritant, but is a slight skin irritant. Exposure of the concentrated material to the skin can cause parasthesia which is a slight tingling or numbness sensation. Lambda cyhalothrin is not a developmental or reproductive toxicant at relevant exposure levels, and is not considered mutagenic or carcinogenic. Adherence to label directions and program requirements will minimize the potential exposure and risk to applicators and workers who would be at risk in the proposed applications to various commodities in commercial nurseries under quarantine.

b. Ecological Resources

Lambda cyhalothrin is considered practically nontoxic to birds, based on available data for the bobwhite quail and mallard duck (EPA 2011a). Chronic toxicity is also low with NOEC values greater than the highest test concentration in long-term reproductive studies. Lambda cyhalothrin is considered highly toxic to honey bees and other pollinators and, due to its broad spectrum activity, would be expected to impact terrestrial invertebrates in areas of treatment.

Lambda cyhalothrin is very highly toxic to aquatic vertebrates and invertebrates in acute and chronic exposures. Acute and chronic toxicity to freshwater and marine fish are from the low ppt to low ppb range (EPA 2011a). Aquatic invertebrates are more variable in their sensitivity to lambda cyhalothrin, based on available data. Acute median lethality values range from 1 ppt for mosquito larvae and freshwater amphipods to 2.4 ppb for midge larvae. Current labeling for the proposed formulation require a 25-foot application buffer from water bodies for all uses and additional drift mitigation measures, such as droplet size requirements, vegetative filter strips, temperature inversion, and wind speed restrictions for sod uses which will reduce the exposure and risk to aquatic fauna.

c. Environmental Quality

Impacts to soil, water, and air quality are not anticipated for the proposed use of lambda cyhalothrin beyond the areas of application within commercial nurseries. The half-life of lambda cyhalothrin in soil is less than 50 days under aerobic conditions, and the insecticide will bind strongly to soil based on available data regarding partitioning between soil and water. In water, lambda cyhalothrin has very low water solubility and, due to its preferential binding to soil and sediment, will not occur in solution. Under aerobic conditions in water the half-life is approximately 21 days. Due to the low solubility and high affinity for soil, lambda cyhalothrin is not expected to contaminate groundwater. Surface water contamination is also minimized due to the environmental fate of lambda cyhalothrin and label restrictions that require buffer zones, as well as other measures, depending on the use pattern, that will reduce offsite drift and runoff. The reported vapor pressure for lambda cyhalothrin indicates that it will not volatilize into the atmosphere and impact air quality, and will only occur in the atmosphere near the ground in areas where applications occur in the nurseries.

B. Preferred Alternative

1. Abamectin

a. Human Health

Abamectin is a mixture of two avermectin compounds that are derived from the bacterium *Streptomyces avermitilis*. These products have insecticidal properties that are used to control a variety of pests in agricultural and nonagricultural applications. As a technical material, abamectin is considered highly toxic to mammals from ingestion with median lethality values ranging from 4.4 to 14.9 mg/kg (EPA, 2004). Comparable studies with the formulated material show lower toxicity from oral exposures (Syngenta, 2012). The proposed formulation would be considered practically nontoxic to mammals in acute oral exposures with an LD_{50} that exceeds 5,000 mg/kg. Dermal toxicity is much lower with median lethality values typically higher than the highest concentration tested. The bait formulation is considered non-respirable therefore the potential for exposure and risk to workers is minimal. The proposed formulation is minimally irritating to the eye and is not a skin sensitizer, or considered irritating to the skin. Abamectin is not considered mutagenic or carcinogenic based on long-term laboratory studies with the mouse and dog. In studies using the rat, abamectin has been shown to be teratogenic at doses that also result in maternal toxicity. Reproductive effects, such as retinal folds, reduced pup bodyweight and mortality have been noted in 2-generation studies with a reported no observable adverse effect level of 0.12 mg/kg/day (EPA, 2004).

Abamectin will be applied as bait using ground equipment in commercial nurseries (container and field grown) where significant exposure to the public is not expected. Exposure and risk will be greatest for workers and applicators during the time of application. These risks are expected to be negligible based on the toxicity of abamectin and the use of protective personal equipment that will minimize exposure. Impacts to drinking water resources are not expected. Abamectin has very low solubility in water and adheres strongly to soil and sediment and, therefore, it would not be expected to leach to ground water or be present in surface water. Adherence to label requirements will further reduce the threats to surface water that may be used as a source of drinking water.

b. Ecological Resources

Abamectin acute oral toxicity is high to wild mammals based on laboratory data using the technical material. However, the formulation proposed for use in the IFA program has an approximate ten-fold reduction in acute oral toxicity. Available data for the technical and formulated material indicate that dermal toxicity to mammals is low. Developmental and reproductive effects have been noted in longer term studies at concentrations greater than 1 mg/kg/day. Toxicity to birds is low with median lethal dietary toxicity values of 383 and 3,102 ppm for the bobwhite quail and mallard, respectively (EPA, 2014). Indirect impacts to mammals and birds that depend on invertebrate prey items are not expected since the proposed areas of treatment are commercial nurseries and the bait formulation would reduce the potential for exposure to non-target invertebrates. Abamectin is considered highly toxic to honey bees and other nontarget terrestrial invertebrates however the risk to pollinators will be minimized by the use of a bait formulation (EPA, 2014). Sensitive terrestrial invertebrates may be impacted however reductions will be localized and only for those species that are present in the soil where the bait is applied.

Abamectin is highly toxic to fish and aquatic invertebrates. The range of concentrations that cause direct mortality to fish from abamectin exposure is in the low-ppb range, while the range of sensitivities to aquatic invertebrates is greater because of a larger number of tested species. Toxicity values for aquatic invertebrates vary from the high part per trillion (ppt) range, with freshwater crustaceans being the most sensitive, to less tolerant species such as the eastern oyster with effect concentrations in the mid-ppb range (EPA, 2014). Abamectin risk to aquatic vertebrates and invertebrates is reduced by label restrictions regarding applications near water and the type of formulation proposed for use. Abamectin will be applied as a bait reducing the potential for off-site drift and runoff. Low application rates and the environmental fate of abamectin, such as low water solubility and a strong affinity to soil and sediment, would result in low residues in water, and reduce the potential for adverse impacts to fish and aquatic invertebrates.

c. Environmental Quality

Impacts to air quality from the proposed abamectin treatments are expected to be negligible. Abamectin does not exhibit environmental fate or chemical properties that suggest that it would volatilize into the atmosphere. In addition the use of a bait formulation will eliminate drift during application. Impacts to soil quality would be limited to those areas of treatment within commercial nurseries. Abamectin has a variable half-life in soil, depending on the degradation process, and can range from a few hours in the presence of light to approximately 60 days under dark, aerobic conditions. Abamectin is not expected to impact ground or surface water because of label restrictions for the proposed formulation and the environmental fate for this class of insecticides. Label restrictions prohibit applications to areas where surface water is present or to intertidal areas above the below the high water mark. Due to the very low solubility and strong tendency to bind to soil, abamectin is not considered mobile and would not move to ground water resources. Its presence in surface water would be short lived because it would bind to sediment, and it is also sensitive to photodegradation in water with a reported half-life of less than a day. Degradation in sediment is slightly slower with half-lives ranging from 2 to 4 weeks.

2. Metaflumizone

a. Human Health

Metaflumizone is a semicarbazone insecticide that blocks sodium channels in the nervous system of insects resulting in paralysis and death (Salgado and Hayashi, 2007). The proposed formulation for the IFA program is considered practically non-toxic in acute rat oral and dermal toxicity studies (BASF, 2012). The formulation is not a skin sensitizer and is minimally irritating to the skin and eyes. The technical active ingredient also has low acute oral, dermal and inhalation toxicity and has low potential to irritate the skin or eyes, and is not a skin sensitizer (CA DPR, 2008). Metaflumizone is not considered to be a carcinogen and chronic effects to human health at relevant doses are not anticipated based on the proposed use pattern in this program (EPA, 2011g). Metaflumizone is not considered to be neurotoxic, teratogenic or mutagenic based on available studies (Hempel et al., 2007).

Metaflumizone will be applied as bait using ground equipment in commercial nurseries (container, field grown, grass sod) where significant exposure to the public is not expected. Exposure and risk will be greatest for workers and applicators during the time of application. The risk to workers and applicators will be minimal based on the toxicity profile for metaflumizone and the use of required personal protective equipment. Impacts to drinking water are not expected based on label restrictions regarding application near aquatic resources and the low potential for leaching into groundwater (CA DPR, 2008).

b. Ecological Resources

Metaflumizone acute toxicity to wild mammals and birds is expected to be low based on the available mammalian and avian toxicity data. Avian acute oral toxicity studies show that median lethality exceeds the highest test concentration. Avian acute dietary studies indicate slight toxicity to mallards and the northern bobwhite (EPA, 2014). The low toxicity and use of a bait formulation result in low direct risk to wild mammals and birds. Indirect impacts from the loss of invertebrate prey are also not anticipated. Applications of the bait reduce the potential for non-target impacts and treatments will only occur in localized areas within commercial nurseries. Available data for the earthworm shows low toxicity from exposure to metaflumizone and the acute toxicity to honeybees appears to be low with median contact toxicity values exceeding the highest test concentration (CA DPR, 2008).

Metaflumizone acute toxicity is high to most aquatic vertebrates and invertebrates with median lethal concentrations ranging from the low to mid part per billion range to 1.36 mg/L for the freshwater cladoceran, *Daphnia magna*. Effects to sediment dwelling aquatic invertebrates is similar with lethality occurring around one part per million in ten day exposures (CA DPR, 2008). Some of the toxicity values exceed solubility limits for the two isomers that make up metaflumizone and therefore exposure and risk to less sensitive aquatic species would not be expected. The use of a bait formulation will eliminate the potential for off-site drift to aquatic habitats while label language and the environmental fate of metaflumizone will reduce the potential for runoff. Label restrictions regarding protection of aquatic resources, and in the case of application buffer zones for broadcast treatments near aquatic habitats, will minimize the risk to aquatic vertebrates and invertebrates. Metaflumizone that may be present in soil and sediment will preferentially bind to both substrates further reducing bioavailability and risk to most aquatic species.

c. Environmental Quality

Impacts to air, soil and water quality are expected to be negligible for the proposed use of metaflumizone based on the proposed use pattern and environmental fate of metaflumizone. Metaflumizone would not impact air quality since it has a low potential to volatilize into the atmosphere based on its reported low vapor pressure value, and application as a bait formulation that would eliminate drift (CA DPR, 2008). Impacts to soil are expected to be negligible from the proposed use of metaflumizone with any impacts confined to the area of treatment. Metaflumizone may impact some soil invertebrates however these impacts would be restricted to the area of application. Areas of treatment such as containers or field grown sod in commercial nurseries are highly disturbed areas and the use of metaflumizone is not expected to result in significant additional impacts to soil quality. Available soil binding data suggests metaflumizone binds to soil with a reported half-life of approximately 198 days (CA DPR, 2008). The high binding affinity of metaflumizone to soil and low water solubility suggests that impacts to surface and drinking water will be negligible. The low solubility of metaflumizone in water and affinity to bind to organic matter suggests that leaching into groundwater or transport to surface water from runoff would not be a significant pathway of exposure. In addition the bait formulation would not be expected to move off-site during rainfall events to surface water. Label language for the proposed bait formulation also provides further protection to surface water by reducing the potential for exposure.

V. Cumulative Impacts

The information below on cumulative impacts was previously provided in the March 2012 EA that added approved pesticides. The same information is provided below, incorporating updated information on the proposed action.

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 insecticides proposed to be added to the list of available insecticides for the IFA quarantine program are also used in a wide variety of residential and/or commercial applications throughout the area covered in the affected environment of this EA, based on information collected from pesticide labels (available in the EPA Pesticide Product Label System (EPA 2011d)). Land use summaries for each State discussed in the affected environment of this EA and the broad spectrum activity for a majority of the IFA insecticides suggests that urban and agricultural use of these products also occurs. These products are used to treat multiple pests, including IFA, at a greater frequency of use than that used in the IFA quarantine program. The products proposed for use in this supplement are not currently used in other APHIS programs where IFA treatments may occur,with the exception of abamectin which is one of many products that may be used in citrus orchards to control the Asian Citrus Psyllid. (Information for APHIS plant pest programs is available on the APHIS website:
http://www.aphis.usda.gov/plant_health/plant_pest_info/index.shtml.)

In the case of the IFA quarantine, all program insecticide treatments will only occur in commercial nurseries, sod farms, and field-growing nursery facilities where ground disturbance and other activities (e.g., pesticide use and fertilizer application) are routine activities unrelated to IFA. Cumulative impacts to human health and terrestrial resources (e.g., soil and nontarget fauna from the proposed pesticides) are expected to be minor within the current quarantine as applications for IFA already take place. The newer active ingredients appear to have equal or less risk to human health, and will be confined primarily to applicators that treat plants prior to shipment. Geographic areas where the IFA quarantine does not currently exist, but covered in this EA, would expect to see increased insecticide use due to the IFA quarantine once the county becomes part of the IFA quarantine. Increased pesticide loading would be anticipated within the nurseries; however, adherence to label language will reduce the potential for significant cumulative impacts beyond those already occurring with other activities in the nursery. There is the potential for cumulative impacts to aquatic resources that are adjacent to nursery operations. Offsite transport of pesticide runoff into receiving streams from applications to containerized plants, as well as broadcast applications in nurseries, have been noted in several studies (Stearman and Wells 1997, Briggs *et al.* 1998, Gan and Lee 2005, Gan 2006). Runoff is expected to be minimal for the two proposed insecticides due to label restrictions regarding applications near aquatic areas, the use of a bait which is less susceptible to runoff, and the preference for both insecticides to bind to soil and sediment. In other cases where impairment is due to reasons other than the proposed pesticides, there is the concern for mixture toxicity which could result in cumulative impacts to water quality and aquatic resources. Water bodies that are impaired for reasons other than pyrethroid and organophosphate insecticide toxicity may also be impacted with increased pesticide use because impacts could be a result of mixture effects. Water quality data from areas within the current IFA quarantine, as well as outside the quarantine, show pesticide mixtures to be a common occurrence in surface water with varying impacts to aquatic organisms (Gilliom *et al.* 2007). Mixtures, including pesticides currently used and proposed for use in the IFA program, can have additive or greater than additive toxicity to aquatic and terrestrial organisms (Deneer 2000, Lydy and Austin 2004, Key *et al.* 2007, Trimble *et al.* 2009, Svendsen *et al.* 2010). In the case of pyrethroids, such as permethrin and cyfluthrin, they may also have slightly antagonistic toxicity to aquatic biota, therefore there is uncertainty in the ability to quantify the potential cumulative impacts of these mixtures (Brander *et al.* 2009). The two new formulations have buffer zone restrictions, as well as other protective label language regarding aquatic resources that will minimize the potential for any cumulative impacts to aquatic resources.

Incremental cumulative impacts to human health and the environment are expected to be minor within the nurseries to be treated and, in particular, to those already under the IFA quarantine. The additional pesticides that can be used do not appear to result in additional risk to human health beyond those currently used in the program. Cumulative impacts from offsite transport through runoff and drift are more difficult to quantify due to the geographic area considered in the EA, and the uncertainty regarding spatial and temporal use patterns of pesticides and other contaminants in aquatic resources. In cases where the nurseries are not adjacent to aquatic resources, no cumulative impacts would be expected. In cases where aquatic resources are in proximity to treatment areas, the method of application, the formulations proposed, label restrictions, and the fate of most insecticides proposed for use will reduce the potential for cumulative impacts to any aquatic resources.

VI. Other Environmental Considerations

The information below on other environmental considerations was previously provided in the March 2012 EA that added approved pesticides. The same information is provided below, incorporating updated information on the proposed action.

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. IFA quarantine treatments will only take place in nurseries that occur within the current quarantine area, and have regulated articles that require treatment prior to shipment to areas that are not part of the quarantine. These nurseries are established commercial facilities where applications will only be made in the nurseries and not in locations where the public (including minority and low-income populations) would be present. The potential for the offsite movement of pesticide is reduced by the proposed use patterns of each formulation, and adherence to all label language designed to protect the public, as well as workers and applicators, within the nurseries. Because chemical treatments are being applied only in nurseries, APHIS has determined that the human health and environmental effects from the proposed applications are minimal and are 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 proposed action. All proposed treatments will occur within production nursery facilities where the public, including children, would not be present. Drift to areas adjacent to production nurseries where children could be present is not expected because the methods of application and formulations used have a low potential to move offsite through the atmosphere. The lack of exposure to this portion of the population would suggest that risks to children from the proposed application of insecticides would not be expected to result in adverse impacts. Items shipped out of the quarantine area after treatment and then moved to areas where children may occur is another potential route of exposure.

Exposure of IFA treatments to children is greatest in soil which is where IFA resides and is the focus of treatments in the quarantine program. Exposure to children would be low in these situations because the soil associated with the roots of the plant that may have residues would be localized relative to the amount of untreated soil in the area if plants are transplanted. Use of both insecticides in the IFA program would not be to plants grown for food, thus reducing the potential for dietary exposure that could result in adverse effects to children and the general population. In addition, treated plants with any IFA insecticide may be held after treatment at the nursery prior to shipping where degradation and weathering would occur, further reducing exposure. Based on the available data regarding the toxicity of each insecticide and their proposed use pattern, APHIS determined that no disproportionate effects to children are anticipated as a consequence of implementing the preferred alternative

B. Threatened and Endangered Species

Section 7 of the Endangered Species Act and its implementing regulations require Federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of critical habitat. APHIS is preparing a biological assessment (BA) that evaluates the potential for impacts to listed species under the jurisdiction of the Fish and Wildlife Service (FWS). The potential for affecting endangered and threatened species exists primarily within the nurseries where pesticide treatments would occur. The FWS BA addresses the potential for impacts to approximately 606 listed species that have been identified to occur within the current quarantine area and the expanded areas described in this EA. Effects determinations and mitigation measures have been proposed for those species where co-occurrence between treatments and habitat may occur. Any conservation measures decided upon will be incorporated into the compliance agreements required by the nurseries. Concurrence with FWS on the BA will ensure that adequate protective measures are in place for the protection of listed species that may co-occur with program activities.

VII. Listing of Agencies and Persons Consulted

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Plant Protection and Quarantine
CPHST Gulfport Lab
3505 25th Ave.
Gulfport, MS 39501

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

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

VIII. Appendices

Appendix I. Observed Damage to Wildlife by IFA

Animal (Type)	Noted Effects	Reference
Gopher tortoise	Direct predation on hatchlings	(Allen *et al.* 2004)
Alligator mississippiensis	Infested nests received less maintenance by females resulting in hatchlings with lower birth rate	(Allen *et al.* 2004)
Burmese python	Eggs susceptible to IFA in laboratory studies	(Diffie *et al.* 2010)
Loggerhead sea turtle (federally listed endangered species)	Eggs susceptible to IFA in laboratory studies	(Diffie *et al.* 2010)
Diamondback terrapin (IUCN Red List[1] as lower risk or near threatened)	Eggs susceptible to IFA in laboratory studies	(Diffie *et al.* 2010)
Yellowbelly slider	Eggs susceptible to IFA in laboratory studies	(Diffie *et al.* 2010)
Eastern painted turtle	Eggs susceptible to IFA in laboratory studies	(Diffie *et al.* 2010)
Yellow rat snake	Eggs susceptible to IFA in laboratory studies	(Diffie *et al.* 2010)
Vireo griseus (black capped vireo is federally endangered; white-eyed vireo)	Protection of nests from IFA predation increased nest survival by 10%	(Campomizzi *et al.* 2009)
Orthalicus reses reses (Say) (Stock Island tree snail)	Federally listed as threatened; Florida State listed as endangered; extinct from the wild; IFA thought to be a major factor in its extinction	(Wojcik *et al.* 2001)
Cottontail rabbit (*Sylvilagus floridanus* (Allen))	Mortality (33 to 75%) of newborn rabbits when exposed to fire ants	Hill, E.P., 1970. Observations of imported fire ant predation on nestling cottontails. Proc. Southeast. Assoc. Game Fish Comm. 23: 171–181 (cited in (Wojcik *et al.* 2001))
Box turtle (*Terrapene carolina triunguis* (Agssiz))	Mortality of adult turtles due to IFA stings	Montgomery, W.B., 1996. Predation by the fire ant, *Solenopsis invicta*, on the three-toed box turtle, *Terrapene carolina triunguis*. Bull. Chicago Herpetol. Soc. 31: 105–106. (cited in (Wojcik *et al.* 2001))
Toad (*Bufo houstonensis* (Sanders))	IFA stings caused mortality of young toads; federally listed as endangered	Freed, P.S. and K. Neitman, 1988. Notes on predation on the endangered Houston toad, *Bufo houstonensis*. Tex. J. Sci. 40: 454–456. (cited in (Wojcik *et al.* 2001))

[1] IUCN = International Union for Conservation of Nature and Natural Resources. The IUCN Red List provides information on the conservation status of plant and animal species (http://www.iucnredlist.org/).

Appendix II. Land Resource Regions Overlapping with the Geographic Areas Covered in this Environmental Assessment

Land Resource Region (LRR) Overlapping with Federal Quarantine[1]	States or Parts Thereof Under Federal Quarantine and Fall within the LRR	States or Parts Thereof within the LRR Not Under Federal Quarantine	Soil Orders and Suborders Found in the LRR
C—California subtropical fruit, truck, and specialty crop region	California (one county under quarantine and parts of 2 other counties)		There are four dominant soil orders: Alfisols, Entisols, Mollisols, and Vertisols. There are six dominant soil suborders: Xeralfs, Xererts, and Xerolls; Fluvents, Orthents, and Ochrepts are found in the flood plains and alluvial fans and are soils important for agricultural purposes.
D—Western range and irrigated region	California – one county; New Mexico - one county		There are three dominant soil orders: Aridisols, Entisols, and Mollisols. There are five dominant soil suborders: Argids, Calcids, Orthents, Ustolls, and Xerolls.
G—Western Great Plains Range and Irrigated Region	Texas (small portion of the northwest corner), Oklahoma (very small portion)	Colorado, Kansas, Montana, Nebraska, New Mexico, North Dakota, South Dakota, Wyoming	There are two dominant soil orders: Entisols, Mollisols. There are four dominant soil suborders: Ustorhents, Torriorhents, Haplustolls, and Argiustolls.
H—Central Great Plains winter wheat and range region	Oklahoma, Texas	Colorado, Kansas, Nebraska, New Mexico	The dominant soil order is Mollisols, but significant acreages of Alfisols, Entisols, and Inceptisols are also present. The dominant soil suborder is Argiustolls. Other suborders include Haplustolls, Ustipsamments, Calciustolls, Paleustolls, and Paleustalfs.
I—Southwest plateaus and plains range and cotton region	Texas		There are five dominant soil orders: Alfisols, Aridisols, Inceptisols, Mollisols, and Vertisols. There are five dominant soil suborders: Calcids, Ustalfs, Ustolls, Usterts, and Ustepts.
J—Southwestern prairies cotton and forage region	Oklahoma, Texas	Kansas	There are four dominant soil orders: Mollisols, Entisols, Alfisols, and Vertisols. There are four major soil suborders: Paleustalfs, Haplustolls, Haplusterts, and Argiustolls.
N—East and central farming and forest region	Alabama, Arkansas, Georgia, North Carolina, Oklahoma, South Carolina, Tennessee, Virginia	Illinois, Indiana, Kentucky, Missouri, Ohio, Pennsylvania, West Virginia; very small areas in Kansas, Maryland, New York	There are four dominant soil orders: Alfisols, Entisols, Inceptisols, or Ultisols. There are four major soil suborders: Dystrudepts, Hapludalfs, Hapludults, and Paleudults.
O—Mississippi delta cotton and feed grains region	Arkansas, Louisiana, Mississippi, Tennessee	Missouri, very small areas in Kentucky and Illinois	There are four dominant soil orders: Alfisols, Vertisols, Inceptisols, or Entisols.

			There are five major suborders: Aqualfs, Aquerts, Epiaqualfs, Epiaquerts, and Udifluvents.
P—South Atlantic and gulf slope cash crops, forest, and livestock region	Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia	Illinois, Kentucky, Missouri	There are five major soil orders: Alfisols, Entisols, Inceptisols, Ultisols, or Vertisols. There are 14 major soil suborders: Dystruderts, Dystrudepts, Fragiudalfs, Eutrudepts, Fluvaquents, Fraglossudalfs, Hapludalfs, Hapluderts, Hapludults, Kandiudults, Kanhapludults, Paleudalfs, Paleudults, and Quartzipsamments.
T—Atlantic and Gulf Coast lowland forest and crop region	Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Texas, Virginia	Delaware, Maryland, New Jersey	There are five dominant soil orders: Alfisols, Entisols, Histosols, Spodosols, and Ultisols. There are five dominant soil suborders: Aqualfs, Aquents, Aquults, Psamments, and Udults.
U—Florida subtropical fruit, truck crop, and range region	Florida		The dominant soil order is Entisols, and significant areas of Alfisols and Histosols. There are three dominant suborders: Aqualfs, Aquents, and Psamments.

[1]Land resource regions (LRRs) are geographically associated major land resource areas (MLRAs) which approximate broad agricultural market regions (USDA–NRCS). LRRs are categorized by capital letters. Major land resource areas (MLRAs) are geographically associated land resource units (LRUs). MLRAs are described in the Agriculture Handbook 206, and include brief descriptions of total area of the MLRA in a particular State; list of major cities, highways, and culturally significant Federal- and State-owned lands within each MLRA; and information on physiography, geology, climate, water, soils, biological resources, and land use in the MLRA.

(Source: (USDA NRCS 2006)

Appendix III. Major Uses of Land (2007) for States within the IFA Quarantine and the Expanded Geographic Area Covered in this Environmental Assessment

State	Cropland	Grassland Pasture and Range	Forest-use Land	Special-use Areas	Urban Areas	Miscellaneous Other Land	Total Land Area[1]
			------------------------------------ 1,000 acres ------------------------------------				
Alabama	3,104	2,642	22,587	1,535	1,140	1,468	32,476
Arkansas	8,240	3,293	18,596	1,568	589	1,039	33,324
California[2]	9,550	27,524	26,983	25,377	5,166	5,213	99,814
Florida	2,760	5,558	15,649	5,008	4,052	1,486	34,513
Georgia	4,619	1,292	24,267	2,073	2,465	2,344	37,060
Louisiana	4,435	1,860	14,142	1,975	1,088	4,380	27,880
Mississippi	5,556	2,055	19,579	958	607	1,265	30,020
New Mexico[2]	2,367	52,122	14,977	6,477	493	1,232	77,668
North Carolina	4,843	1,231	18,037	2,858	2,357	1,849	31,175
Oklahoma	12,840	18,707	7,620	1,731	736	2,312	43,947
South Carolina	2,001	795	12,646	1,081	1,230	1,517	19,270
Tennessee	6,019	2,093	13,913	2,072	1,594	688	26,379
Texas	34,115	101,735	17,159	6,220	4,646	3,676	167,550
Virginia	3,251	2,463	15,350	1,662	1,555	1,059	25,340

[1]Miscellaneous areas, such as marshes, open swamps, bare rock areas, deserts, rural residential areas, and other uses not inventoried.
[2]Values for California and New Mexico are for the entire State; however, only eight counties in California and one county in New Mexico are part of the geographic scope of this assessment.

Source: (USDA ERS 2007, Nickerson *et al.* 2011).

Appendix IV. 2011 Counties within the IFA Quarantine and the Expanded Geographic Area Covered in this Environmental Assessment that are Designated as Nonattainment Areas for One or More Common Air Pollutants Tracked by the Environmental Protection Agency (EPA)

State or Part Thereof Under IFA Quarantine and the States and Counties Considered in the EA[1]	Number of Counties with Nonattainment Status[1]	County with Nonattainment Status	Pollutant[2]
Alabama (all 67 counties are under IFA quarantine)	5	Jackson, Jefferson, Shelby, Walker	PM-2.5 1997
		Jefferson, Shelby, Walker	PM-2.5 2006
		Pike	Lead 2008
Arkansas (part or all of 33 counties are under IFA quarantine; This EA considers all 75 counties)	0	No counties listed	
California (part or all of 3 counties are under IFA quarantine; This EA considers 8 counties out of 57)	7	Los Angeles	Lead 2008
		Los Angeles, Orange, Riverside, San Bernardino	PM-2.5 1997
		Imperial, Los Angeles, Orange, Riverside, San Bernardino	PM-2.5 2006
		Imperial, Los Angeles, Orange, Riverside, San Bernardino	PM-10
		Imperial, Los Angeles, Orange, Riverside, San Bernardino, San Diego, Ventura	8-Hr Ozone
Florida (all 66 counties are under IFA quarantine)	1	Hillsborough	Lead 2008
Georgia (all 156 counties are under IFA quarantine)	27	Barrow, Bartow, Bibb, Carroll, Catoosa, Cherokee, Clayton, Cobb, Coweta, De Kalb, Douglas, Fayette, Floyd, Forsyth, Fulton, Gwinnett, Hall, Heard, Henry, Monroe, Newton, Paulding, Putnam, Rockdale, Spalding, Walker, Walton	PM-2.5 1997
		Barrow, Bartow, Carroll, Cherokee, Clayton, Cobb, Coweta, De Kalb, Douglas, Fayette, Forsyth, Fulton, Gwinnett, Hall, Henry, Newton, Paulding, Rockdale, Spalding, Walton	8-Hr Ozone
Louisiana (all 60 counties are under IFA quarantine)	5	Ascension, East Baton Rouge, Iberville, Livingston, West Baton Rouge	8-Hr Ozone
Mississippi (all 82 counties are under IFA quarantine)	0	No counties listed	
New Mexico (1 county out of 33 is under IFA quarantine)	1	Dona Ana	PM-10
North Carolina (60 counties – all or	10	Catawba, Davidson, Guilford	PM-2.5 1997

part thereof – are under IFA quarantine; this EA considers all 100 counties)		Cabarrus, Gaston, Iredell, Lincoln, Mecklenburg, Rowan, Union	8-Hr Ozone
Oklahoma (8 counties fall within the IFA quarantine; this EA considers all 77 counties)	0	No counties listed	
South Carolina (all 46 counties are under IFA quarantine)	1	York	8-Hr Ozone
Tennessee (55 counties are within the IFA quarantine; this EA considers all 93 counties)	7	Anderson, Blount, Hamilton, Knox, Loudon, Roane	PM-2.5 1997
		Anderson, Blount, Knox, Loudon, Roane	PM-2.5 2006
		Sullivan	Lead 2008
Texas (188 counties fall within the IFA quarantine; this EA considers all 254 counties)	18	Collin	Lead 2008, 2009
		El Paso	PM-10
		Brazoria, Chambers, Collin, Dallas, Denton, Ellis, Fort Bend, Galveston, Harris, Johnson, Kaufman, Liberty, Montgomery, Parker, Rockwall, Tarrant, Waller	8-Hr Ozone
Virginia (2 counties fall within the IFA quarantine; this EA considers all 95 counties)	4	Arlington, Fairfax, Loudoun, Prince William	PM-2.5 1997; 8-Hr Ozone

[1] The IFA quarantine area includes States of: Alabama, Florida, Georgia, Louisiana, Mississippi, South Carolina, and parts of Arkansas, California (part of Los Angeles and Riverside County and the entire county of Orange), New Mexico (one county), North Carolina, Oklahoma, Tennessee, Texas, and Virginia. The geographic range of this EA includes the current quarantine area, as well as areas into which IFA is likely to expand, based on research done by Korzukhin et al. (2001). The expanded region includes the entire State of Arkansas, North Carolina, Oklahoma, Tennessee, Texas, and Virginia. It also includes several additional counties in California (San Bernardino, Ventura, Santa Barbara, San Diego, and Imperial) and the entire county of Los Angeles, and Riverside in California.

[2] PM-10 = Particulate matter 10 micrometers in diameter or less; PM-2.5 = Particulate matter 2.5 micrometers in diameter or less; the year following a pollutant is the version of the standard used at the time of the measurement; 8-Hr Ozone is measured by taking "the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm".

Source: (EPA 2011c)

Appendix V. Number of Watersheds and Watersheds Containing Waters Impaired with Chemicals Used in the IFA Program

State or Part Thereof within the Current Federal Quarantine	Number of Watersheds within the Current Quarantine Area[1] and within the Expanded Geographical Region Covered in this EA[3]	Chemicals Used or Proposed For Use in The IFA Program Found in Impaired Waters
Alabama (entire State)	52	Chlorpyrifos
Arkansas (part of State)	22 (est.)[1] 59 total[3]	None listed
California (part of State)	4 (est.)[1] 40 total	*Calleguas Watershed (Ventura Co.):* Chlorpyrifos, Diazinon, Bifenthrin; *Newport Bay Watershed (Orange Co.):* Chlorpyrifos,; *Salton Sea Watershed (Imperial, Riverside, San Bernardino, San Diego Co.):* Chlorpyrifos *Santa Clara Watershed (Los Angeles, Santa Barbara, and Ventura Co.):* Chlorpyrifos,; *Santa Maria Watershed (Santa Barbara Co.):* Chlorpyrifos
Florida (entire State)	54[3]	None listed
Georgia (entire State)	52[3]	None listed
Louisiana (entire State)	60[3]	Fipronil
Mississippi (entire State)	59[3]	None listed
New Mexico (Dona Ana County)	4	None listed
North Carolina (part of State)	28 (est.)[1] 58 total[3]	None listed
Oklahoma (part of State)	20 (est.)[1] 67 total[3]	*Lower Canadian-Walnut Watershed, Deep Fork Watershed, Lower Cimarron-Skeleton Watershed*: Chlorpyrifos
Puerto Rico (entire territory)	11[3]	Pesticides listed but type not specified
South Carolina (entire State)	38[3]	None listed
Tennessee (part of State)	23 (est.)[1] 60 total[3]	None listed
Texas (part of State)	112 (est.)[1] 210 total[3]	None listed
Virginia (part of State)	4 (est.)[1] 53 total[3]	None listed

[1]The (est.) indicates the number is an estimate; we are unable to precisely overlay the States or counties under partial IFA quarantine with watershed and national wildlife refuge areas using the maps and resources consulted. The estimates provide enough information for the purposes of this document.
[2]The number of federally listed threatened or endangered species is unique for each National Wildlife Refuge but is not unique across refuges; a species may be found in multiple refuges.
[3]The total number of watersheds per State was obtained from EPA's Surf your watershed (http://cfpub.epa.gov/surf/locate/index.cfm).

Sources: (EPA 2011e, FWS 2011a, b)

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