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Coconut Rhinoceros Beetle Response Program on Oahu

Environmental Assessment
March 2014

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I. Introduction

The United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS) is proposing to implement a response program for the coconut rhinoceros beetle (CRB), *Oryctes rhinoceros*, from Oahu in the State of Hawaii. APHIS has the responsibility for taking actions to exclude, eradicate, and/or control plant pests under the Plant Protection Act of 2000 (7 United States Code (U.S.C.) 7701 et seq.). This action is necessary to prevent further spread of CRB on Oahu and prevent CRB from establishing in the area.

As a Federal Government agency subject to compliance with the National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4321 et seq.), this environmental assessment (EA) has been prepared consistent with NEPA regulations promulgated by the Council on Environmental Quality (40 Code of Federal Regulations (CFR) parts 1500-1508), USDA (7 CFR part 1b), and APHIS' NEPA implementing procedures (7 CFR part 372) for the purpose of evaluating how the proposed action, if implemented, may affect the quality of the human environment.

A. Coconut Rhinoceros Beetle

CRB is one of the most damaging insects to coconut palms (*Cocos nucifera*). Although primarily found attacking coconut and oil palm, CRB has also occasionally been recorded on bananas, sugarcane, papayas, sisal, and pineapples (CPC, 2010). In Mauritius, the royal palm (*Roystonea regia*), the latanier palm (*Livistona chinensis*), the talipot palm (*Corypha umbraculifera*), and the raphia palm (*Raphia ruffia*) are attacked. CRB will also infest the genus *Pandanus*, which is endemic to Hawaii(Bedford, 1980).

1. Biology

CRB is a large (30-35 millimeter (mm) long and 14-21 mm breadth), black or reddish black beetle. It is stout and possesses a horn on its head which is longer in males.

Adult females lay 3 or 4 clutches of eggs that contain approximately 30 eggs per clutch, in logs or other concentrations of organic material such as rotting stumps and rubbish piles, over a period of 9 to 12 weeks (Hinckley, 1973). Eggs hatch in 8 to 12 days into whitish grubs (Bedford, 1980). Larvae may develop in the tops of dead standing coconut palms that have been killed by adult beetle attacks or lightning strike or other causes (Bedford, 1980). Coconut stumps and logs on the ground are also important breeding sites (Bedford, 1980). There are four larval stages lasting 12 to 165 days, and a pupal period lasting three to four months. Adults fly at night and bore down into the folded, emerging fronds.

2. Damage

Adults are the injurious stage of the insect. CRB adults damage palm trees by boring into the center of the crown, where they injure the young, growing tissues and feed on the exuded sap. As they bore into the crown, they cut through the developing leaves. When the leaves grow out and unfold, the damage appears as V-shaped cuts in the fronds or holes through the midrib. If the growing tip is injured severe loss of tissue may cause decreased nut set. Also, the tree may die if the growing tip is destroyed or from a secondary infection The adult can damage spadices and leaflets, resulting in loss of coconut production (Hinckley, 1973). The CRB is one of the most damaging insects to coconut palms.

3. Distribution of CRB

The CRB is native to the coconut-growing regions of South and South-East Asia from Pakistan to the Philippines and was accidentally introduced into the South Pacific, including American Samoa, Fiji, Mayotte, Palau, Papua New Guinea, Reunion (La Réunion), Samoa, Tokelau, Tonga, and Wallis and Futuna (GISD, 2011). An infestation of CRB was detected on Guam on September 12, 2007. APHIS has been conducting an eradication program on Guam since that time.

4. History of CRB in Hawaii

In November 2013, one CRB adult was found in the international arrivals baggage claim area of Honolulu International Airport. APHIS checked the palms in the surrounding area and because no CRB damage was found, this interception is believed to be an isolated regulatory incident. On December 23, 2013, one suspect CRB was caught in a trap that was part of a cooperative agricultural pest survey program between APHIS and the University of Hawaii. The suspect specimen was confirmed on January 3, 2014. Subsequent surveys to date have captured 93 adult beetles, the majority of which have been collected from one breeding site. In addition, three dead adult beetles have been submitted to the program: one from Sand Island, one from Honolulu International Airport, and one from a location on the Joint Base Pearl Harbor-Hickam (JBPHH). Several hundred larvae, pupae, adults and associated breeding material were physically removed by hand and destroyed from one breeding site in a compost area near a golf course on JBPHH on Oahu.

B. Purpose and Need

The purpose of the proposed action is to implement a CRB response program in Oahu because of the economic damage potential of this insect and the high probability of its spread to uninfested areas (Smith and Moore, 2008). The program is a collaborative effort between APHIS, the University of Hawaii, the Hawaii Department of Agriculture (HDOA) and the JBPHH.

II. Alternatives

This EA analyzes the potential environmental consequences associated with the proposed action to implement a response program for the CRB in Oahu. Two alternatives are being considered: (1) no action by APHIS to implement a coordinated response program, and (2) the preferred alternative, to implement a coordinated response program to address the CRB infestation on Oahu.

A. No Action

Under the no action alternative, APHIS would not provide support to the HDOA, the University of Hawaii, or the JBPHH to cooperatively implement an response program. Control measures discussed in the preferred alternative could still be implemented but most likely in a reduced capacity due to the lack of APHIS personnel and other resources to support the response effort.

B. Preferred Alternative

The proposed CRB response program (preferred alternative) is a cooperative effort among APHIS, the HDOA, the University of Hawaii and JBPHH. Under the preferred alternative, APHIS, HDOA, the University of Hawaii and JBPHH would implement activities including delimitation, mass trapping, survey, sanitation and insecticide treatments using cypermethrin with piperonyl butoxide (PBO) and pyriproxyfen as tools to mitigate CRB damage in Oahu and prevent its establishment and spread. Insecticide efficacy against CRB is currently being evaluated and applications will only occur once the appropriate registrations have been obtained for the intended use. A technical working group has also been formed with subject matter experts to develop an
Integrated approach in responding to the CRB outbreak in Hawaii.

Regulatory control

Regulatory control may consist of the HDOA establishing a quarantine to eliminate intrastate and interstate movement and reduce human-assisted spread of CRB. High risk host material from within the quarantine area would be prohibited from moving outside the area, except under a permit issued by APHIS-PPQ. Under current cooperative CRB guidelines, greenwaste material within the infested areas, currently considered JBPHH, would be processed to eliminate older CRB life stages and disposed of at designated sites.

Delimitation and mass trapping

Delimitation and mass trapping strategies use the same methodology in trap design and location but trapping density differs. Delimitation determines whether the CRB is present in an area, while mass trapping is a method to reduce the CRB population. Panel traps are manufactured for agricultural pest surveys using a cross vane of corrugated plastic and bucket traps are made from five-gallon buckets fitted with a plastic vane. A commercially available lure containing a synthetic aggregation pheromone, ethyl 4-methyloctanoate, is suspended from the vane and attracts both sexes of the adult CRB. A small solar powered ultraviolet light attached to the vanes increase attractiveness of both traps. Attracted beetles strike the vane and fall into the bucket. Once inside the trap, the beetle lacks enough space to take flight and escape.

The traps are suspended from branches and existing aerial supports or placed on poles at a height of about eight feet. The traps are non-lethal and are checked and emptied at least once every one to two weeks. The program plans to place up to 64 traps per square mile within a two mile radius of a site where CRB are identified to delimit the infestation area. Additional traps will be placed throughout the island of Oahu at a density of up to four traps per square mile.

Mass trapping is aimed at reducing numbers or eliminating the adult beetles. Trap density for mass trapping is one trap per acre. Trap density will be increased if data indicate that a measurable increase in effectiveness will be realized. The program would use panel, bucket, or barrel traps for mass trapping. Barrel traps consist of 32 gallon garbage cans or 55 gallon drums that have compost in the bottom. The openings at the top allow adult beetles to enter but not exit. The barrels utilize decaying compost as well as the synthetic lure and lights that are used in the panel traps as attractants.

Visual Reconnaissance survey

Visual reconnaissance surveys would supplement delimitation trapping by visually identifying locations having feeding damage or the presence of grubs in dead palms, mulch piles, and decaying logs. Visual reconnaissance surveys will be done throughout Oahu with extra attention to areas within two miles of any trap catches or known breeding sites as well as other areas that may have a high risk of infestation.

Sanitation

Adult CRB spend only about three days at any time feeding on sap from young palm fronds. Most fresh greenwaste is not a host or means of conveyance for CRB. Per CRB Project protocols, fresh greenwaste would be allowed to be moved out of the area except for palm material that has any sign of CRB feeding damage. Sanitation of all other greenwaste within two miles of CRB detections would consist of chipping or grinding the debris and disposal through incineration or burning. Steaming, composting, and fumigation of greenwaste are options under consideration for the future.

Site cleaning would consist of removing all vegetation debris within ten meters of the flagging that marks the location. Dead palms and other dead trees will be felled. Heavily infested live trees of low or no value are also felled because CRB uses the tops of these for larval breeding sites. Stumps are dug out or cut flat to protrude no more than six inches above the ground. Cleaning will result in a steel raked finish with only light litter (less than one inch deep) remaining.

Greenwaste and other organic material collected from feeding and breeding sites would be chipped or ground to eliminate older life stages of CRB. The program may remove the processed debris from the site and transport it to an incinerator for final disposal when logistically feasible. All material would be loaded in such a way that material will not be blown or lost while in route to the processing site. Chipped material may be composted, burned, or steamed on site so that sufficient heat is generated to kill any eggs or larvae that may have survived the chipping process. For material left on site, it would be placed back into the excavation site after it has been completely processed and the area has been treated with an insecticide (see below). Then the area would be covered with secure bird netting and plastic to deter reinfestation.

Insecticide Treatments

Tree crowns: Using a lift or ladder, program personnel would ascend to the tree crown and remove all adults and immature beetles from any boreholes, frond bases, or other visible areas. Insecticide would be sprayed inside any boreholes and frond basal areas. The insecticide cypermethrin (demon®Max) can be applied at a maximum label rate of 0.1% with the insecticide synergist piperonyl butoxide (PBO) (Exponent®) This application rate may increase based on efficacy work on CRB in Hawaii but would only occur once the product is registered at the higher use rate. The same criteria would also apply for the other active ingredient, pyriproxyfen, which currently has a maximum application rate of 56 milliliters (ml) per 50 gallons (gal) of water. Coconuts would be removed from trees prior to treatment of tree crowns and bore holes.

Stumps: Stumps of felled trees, to prevent beetle emergence from within or under the stump, would be treated with one of the following:

- cypermethrin (demon®Max) applied at a maximum label rate for emulsifiable concentrate or wettable powder plus insecticide synergist (Exponent®)
- pyriproxyfen, (NyGuard®) applied at maximum label rate

Larval breeding sites: Larval breeding sites consist of piles of rotting or composting plant material from coconuts or mixed with other organic matter. These piles serve as attractive locations for beetles to lay their eggs. Eggs hatch and larvae live and feed in the debris pile. Larval breeding sites would be treated with one of the following insecticides:

- cypermethrin (demon®Max) applied at a maximum labeled rate for emulsifiable concentrate or wettable powder plus insecticide synergist (Exponent®)
- pyriproxyfen, (NyGuard®) applied at a maximum labeled rate

All insecticide treatments will be applied with a backpack or power sprayer. Allowable application, protective equipment, exclusion, dosage, and entry restrictions will follow the label instruction of the insecticide specified. Only licensed applicators or persons working under the supervision of a licensed applicator shall apply insecticides. Areas would be retreated at specified intervals based upon the label directions, persistence of the insecticide, and environmental conditions. No application of insecticides would be made within 100 feet of streams, drainages, or the intertidal high water mark.

III. Affected Environment

This section of the EA presents the baseline conditions of socio-economic and environmental resources that could be impacted by CRB response activities. APHIS uses this information as the basis against which potential impacts of the program are evaluated.

1. Demograhic Information

The program action area where CRB has been detected is located on the south-central side of Oahu(Appendix A). The majority of the CRB detections have occurred on, or adjacent to the JBPHH and the Honolulu International Airport. The JBPHH is approximately 27, 694 acres in size with a population of 84,000 military and civilian personnel (CNIC JBPHH, 2014). Approximately eight historical sites are associated with, or are adjacent to the JBPHH. These sites are primarily batteries and other military facilities associated with Pearl Harbor. Other military sites include a portion of Ford Island which is home to several historic military sites associated primarily with the attack on Pearl Harbor during World War II. The Honolulu International Airport is the largest airport serving the state of Hawaii and is east of the JBPHH. A portion of the action area also lies west of the JBPHH and contains Iroquois Point with a residential population of approximately 3,500 people.

Other areas within the proposed program include parts of downtown Honolulu and areas northwest of the city predominated by residential areas. Open areas northwest of Honolulu include the Navy-Marine Golf Course, the Mamala Bay Golf Course, the Honolulu Country Club Golf Course, Keehi Lagoon Beach Park, Moanalua Garden, and portions of the Salt Lake District Park and Salt Lake. Sand Island is an approximately 500-acre island west of Honolulu that has Sand Island Beach Park and the 14-acre Sand Island State Recreation Area (HSP, 2014). Other state parks include the Iolani State Monument which is located in downtown Honolulu. In addition to the state parks there are approximately 45 national historical sites located in downtown Honolulu. One of these sites is the Foster Botanical Garden located in Honolulu and contains a palm collection that contains potential CRB host plants.

2. Ecological Resources

A majority of the current action area for the proposed CRB response program lies on lands developed for industry, urban, and military use. Palm trees are associated with these developed areas as well as parks and other open areas. Ecological resources, such as marine habitat (e.g. Mamala Bay and Keehi Lagoon), lie to the west of the action area . The Sand Island Recreation Area also contains native marine and terrestrial ecological resources and is used by hikers, campers and fisherman. The Foster Botanical Garden is also present in the current action area and contains a variety of rare plants including trees that are CRB hosts. The Foster Botanical Garden also contains CRB host trees including the cabbage palm, *Roystonea oleracea*. One of these trees has been declared an “exceptional tree” under the Exceptional Tree Act (Act 105) that was established by the State to protect trees that are recognized for their critical ecological function. The list of exceptional trees contains other cabbage palm trees on Oahu, as well as other palm species (HDPR, 2014).

3. Environmental Quality

There are several freshwater resources within the proposed action area as well as substantial marine resources adjacent to the action area. Due to the significant development within the proposed action area, some of the waterbodies have degraded water quality. Some of these waterbodies are currently listed as impaired under 303(d) of the Clean Water Act. Salt Lake is listed as impaired due to trash and turbidity. The beach area adjacent to Keehi Lagoon is listed as impaired due to excessive algal growth, nutrients, and pathogens. Other impaired waterbodies in the current action area are impaired for similar reasons. Areas adjacent to the JBPHH, including the rest of Pearl Harbor, are listed as impaired due to polychlorinated biphenyls, turbidity, nutrients, and suspended solids. The Honolulu Harbor area is also listed as impaired due to excessive nutrients, pathogens, metals, suspended solids, and turbidity. Air quality in the area over the past two years appears to be good based on the lack of exceedance of any priority pollutants that are assessed under the Clean Air Act (HSDH, 2014).

IV. Environmental Impacts

A. No Action

Impacts that could result from APHIS’ implementation of the no action alternative relate primarily to economic and environmental effects related to the spread of CRB. Damage from CRB to local host plants would be substantial if a viable pest population were to spread and become established on Oahu. The establishment of CRB on Oahu would also put other islands and mainland United States at risk from introduction of CRB. Any host plant damage from the anticipated spread would soon be much greater than any impacts from the initial host plant removal contemplated under an integrated response program. Based on historical data from previous introductions of CRB in other areas the loss of palms could reach 50 percent. In the tourist area of Tumon on Guam, for example, a conservative estimate of loss of palms is 2,000 trees, and with an approximate replacement value of

$2,500, could result in replacement costs of two and a half million dollars. (Moore, 2009). Since tourism is important on Oahu, as well as the rest of Hawaii, the damage and loss of palms to resort, park, and residential shade and ornamental plants from CRB could result in reductions in private property values, loss of tourism, and increased costs associated with replacing dead palms. Economic impacts would also be anticipated if CRB becomes established in commercial palm production affecting costs as well as diminishing yields through the loss of trees. A permanent infestation could also lead to additional interstate and international quarantine restrictions affecting other countries and the United States. These restrictions would result in increased costs to producers through implementation of mitigation measures.

From an environmental perspective, the loss of native palms would impact the diversity of forests on Oahu and result in increased erosion on beaches where palms and other vegetation provide protection against erosion (Mimura and Nunn, 1998; Moore, 2009). In addition, a lack of increased APHIS efforts to control CRB damage would likely result in control efforts by other public and private entities, including landscapers and landowners. Most actions of these groups would be uncoordinated and spread of CRB is likely if an established population were not cooperatively managed. Individual efforts to limit plant damage would be expected to potentially involve use of insecticides with increasing frequency resulting in increased pesticide loading in the environment and risk to human health and the environment.

B. Preferred Alternative

Impacts to the human environment related to any regulatory controls, such as a quarantine, as well as delimitation/mass trapping and survey are not anticipated. Delimitation and mass trapping use a similar methodology employing the aggregation pheromone, ethyl 4-methyloctanoate. Mass trapping may result in the collection of some non-target invertebrates; however, this pheromone appears to be specific to this beetle genus (Leal, 1998). The specificity of the pheromone, the localized trapping effort, and low density of traps per acre are not expected to result in population level impacts to non-target invertebrate populations. Impacts to human health and other non-target organisms are also not expected because these pheromones will only be applied by hand as a lure suspended below the vanes that are attached to the trap. This method of pheromone application results in low exposure potential for the general public. In addition, all traps will be labeled advising the public not to disturb the traps which will further reduce the potential for exposure. Acute effects data for mammals, birds, fish, and terrestrial and aquatic invertebrates suggests that ethyl 4-methyloctanoate is practically non-toxic with median lethality values exceeding the highest test concentrations (BPDB, 2014). The low toxicity and low potential for exposure to humans and non-target organisms suggests the use of ethyl 4-methyloctanoate will result in negligible risk.

Delimitation and mass trapping will also use an ultraviolet light to attract CRB. These types of lights will attract some non-target invertebrates and incidental collection may occur. Other invertebrates may be attracted to the light itself, or such as with predators and parasites, may be attracted to the concentration of other invertebrates. Trapping is non-lethal so some non-target invertebrates may be released as traps are checked. The low density of traps that are currently proposed, and the localized area of trapping, suggests that population level impacts to non-target invertebrates would not be anticipated.

Sanitation

Sanitation activities related to the CRB response program are expected to have minimal impacts to the environment. Plant material containing CRB will either be composted, chipped, ground, or burned on-site, or transported off-site to a facility approved for incineration. On-site chipping could result in excessive noise during the operation of machinery but these events would be brief and are not expected to impact the public. Any on-site burning would be minor and only occur in circumstances where appropriate permits have been obtained. APHIS and its cooperators will work with the Hawaii Deparment of Health which regulates open burning and can issue Agricultural Burning Permits, when required. There is the possibility of some physical soil disturbance during the removal of infested trees, debris, and stumps; however, areas will be raked to minimize the amount of disturbance and decrease the potential for erosion.

Insecticide Treatments

Pyriproxyfen

Pyriproxyfen is part of a group of insecticides known as insect growth regulators that act as a juvenile hormone (JH) analog. Juvenile hormones are produced in insects naturally and are important in development, reproduction, and diapause. In this case, the JH analog is used as an insecticide to prevent larval insects from maturing to adults. Pyriproxyfen has several agricultural and non-agricultural uses in controlling a variety of insect pests. Its proposed use in the CRB program would be as applications to stumps or larval breeding sites using the formulation NyGuard® applied with a backpack sprayer.

1. Human Health Toxicity and Risk

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 the formulation is practically non-toxic in acute exposures. Handling the formulated product can result in eye and skin irritation. In longer term studies pyriproxyfen has been shown to have low toxicity with no observable effect levels well above any exposures scenarios that could occur in the proposed program (EPA, 2009). Pyriproxyfen, and associated metabolites, are not considered to be carcinogenic or mutagenic based on available mammalian studies to support registration of the active ingredient (Bayoumi et al., 2003; EPA, 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. None of the treatments will be made to host plant material that would be consumed by humans; therefore, significant dietary exposure and risk is not anticipated. Exposure to pyriproxyfen from drinking water is also not anticipated due to the method of application, the environmental fate of the chemical, and the use of application buffers to protect surface water. The greatest possibility of exposure for the general public would be with the treatment of larval breeding sites and possible consumption of treated soil or host plant material after application. The risk from this type of exposure to the public is very low based on the available toxicity data and conservative assumptions regarding exposure.

2. Ecological Toxicity and Risk

Proposed pyriproxyfen applications are not expected to have adverse impacts to fish and wildlife. The method of application, the low toxicity of the insecticide to most organisms, and program mitigations to reduce exposure result in minimal risk. Pyriproxyfen has low toxicity to wild mammals and birds, suggesting very little direct risk. Based on the mode of action of pyriproxyfen and the small areas of treatment, it 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 non-target terrestrial invertebrates but these impacts will be minimized by the small area of treatment and the selective nature of the insecticide. Available acute contact toxicity data for pollinators shows that pyriproxyfen is practically non-toxic to adult honeybees (EPA, 2011c). Also, no toxicity has been observed in adult bumblebees nor to male production and brood production. However, pyriproxyfen may impact larval bumblebee mortality at concentrations higher than applications made in this program (Mommaerts et al., 2006). Pyriproxyfen toxicity to aquatic organisms is variable with acute toxicity above water solubility

(0.367 milligrams per liter) for most fish species, suggesting low acute risk to aquatic vertebrates (EPA, 2011c). Sublethal impacts in acute and chronic exposures can occur at concentrations in the low parts per billion range for fish and in the parts per trillion range for aquatic invertebrates (EPA, 2011c; Sihuincha et al., 2005; Matsumoto et al., 2008). Median lethal acute effects to aquatic invertebrates vary from the middle to upper parts per billion range, depending on the test species (EPA, 2011c). Direct or indirect risk to aquatic organisms through loss of food items is expected to be low. The application method will reduce the likelihood of off-site drift and runoff, as well as the implementation of a 100-foot application buffer from aquatic areas.

3. Environmental Quality

Impacts to soil quality from pyriproxyfen applications are not expected, based on where treatments will occur and its fate in soil. Applications are directed primarily at stumps or small areas where larval host material occurs. 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 two weeks (CA DPR, 2000). Pyriproxyfen is not anticipated to have impacts to air quality, based on 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. Some material may be present in the atmosphere at the site of treatment during application but will quickly dissipate to the ground since applications are made using backpack sprayers using large, coarse droplets, reducing drift. Impacts to surface or ground water are also not anticipated due to the low solubility of pyriproxyfen in water as well as its preference to bind to soil and sediment, thus reducing the threat to surface and ground water. In addition, program operations require a 100-foot buffer from water bodies, further reducing the potential of program insecticides to impact water quality. This will also reduce the potential for volatilization from water into the atmosphere which is considered moderate for pyriproxyfen based on available fate data (CA DPR, 2000)

Cypermethrin + Piperonyl Butoxide (PBO)

Cypermethrin is a pyrethroid insecticide with a the mode of action causing paralysis in affected organisms that occurs through effects to the axon of the nerve (EPA, 2005). Cypermethrin has several agricultural and non-agricultural uses to control a variety of insect pests. Its proposed use in the CRB program is to treat bore holes, frond bases, stumps, and larval breeding sites using an emulsifiable concentrate or wettable powder formulation. Cypermethrin will also be mixed with the insecticide synergist, piperonyl butoxide, to increase the efficacy of treatments.

1. Human Health Toxicity and Risk

The technical active ingredient, cypermethrin, and the proposed formulation is moderately toxic in oral exposures but is considered practically non-toxic 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 based on 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 (EPA, 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 milligrams per kilogram of body weight (mg/kg). Wang et al. (2010) 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. PBO is considered practically non-toxic to mammals via acute oral, dermal or inhalation exposures. It is minimally irritating to the eye and skin but is considered a skin sensitizer. PBO is not considered neurotoxic or mutagenic and has only been shown to cause developmental effects or demonstrate carcinogenicity at very high doses (EPA, 2006). Synergistic effects of PBO and pyrethroids does not appear to occur in mammals at relevant doses (EPA, 2006; Cantalamessa, 1993).

Similar to pyriproxyfen, exposure and risk will be the greatest for applicators. Adherence to personal protective equipment recommendations will reduce risk to workers. Exposure to the general public in areas where they may frequent will be very low for cypermethrin treatments of boreholes and frond bases because aaplications are made directly into the boreholes and the frond bases are well above the reach of the general public. The greatest chance for exposure to cypermethrin treatments would be through the ingestion of soil or plant material in cases where breeding sites are treated. No applications are made to parts of the plant that would be consumed as food; therefore, dietary exposure would be very low. Exposure to cypermethrin from drinking water is also not anticipated due to use of application buffers from surface water and the extremely low probability of groundwater contamination based on the environmental fate for this insecticide-. Risk to cypermethrin through the primary pathway of exposure, ingestion of soil, is very low based on the known toxicity and conservative assumptions regarding the amount of soil that would need to be consumed to reach an adverse effect.

2. Ecological Toxicity and Risk

Cypermethrin has low acute and chronic avian toxicity with reported acute median lethal doses and chronic no observable effect concentrations greater than the highest test concentration (EPA, 2005). Toxicity is high to most terrestrial invertebrates, including honey bees; however, the applications to boreholes and stumps as well as the small areas of treatment for larval sites will reduce exposure because flowers would not be expected to be treated. In addition, label language designed to protect foraging honeybees will provide additional protection from risk to cypermethrin exposure. PBO has low avian and wild mammal toxicity and has been shown to be practically non-toxic to honeybees (EPA, 2014). Treatments using cypermethrin and PBO could impact some soil borne terrestrial invertebrates; however, this will be minimized by the small treatment areas for the larval breeding sites and the affinity for the insecticide to bind to soil, reducing bioavailability (Hartnik and Styrishave, 2008). The localized impacts that could occur to some terrestrial invertebrates from treatment of larval breeding sites is not expected to pose an indirect risk to terrestrial vertebrates that depend on invertebrates for prey because they would forage over areas greater than the area of treatment. Direct risk to wild mammals and birds from the use of PBO with cypermethrin are also not expected to result in a increased risk compared to cypermethrin alone. As previously mentioned the synergistic effects of PBO and pyrethroids is not expected in mammals at relevant doses. There is some uncertainty in this assumption as it relates to birds since the potential for synergism in exposed birds is unknown, However the wide margin of safety to birds exposed to cypermethrin alone suggest that synergistic effects would have to be much greater than what has been reported for terrestrial invertebrates to result in an adverse effect to birds, which is unlikely.

Cypermethrin is considered highly toxic to aquatic invertebrates and vertebrates with reported median lethality values in the low parts per trillion to low parts per billion range, depending on the test species, although fish were slightly less sensitive when compared to aquatic invertebrates (Solomon et al., 2001; EPA, 2005). PBO is considered moderately to highly toxic to freshwater and marine aquatic invertebrates with acute median lethality or effect concentrations ranging from 0.51 to 12.0 mg/L (EPA, 2014). Acute fish toxicity is also considered moderate with median lethality values ranging from 1.8 to 6.4 mg/L. PBO has been shown to act as a synergist with pyrethroids in its effects to aquatic invertebrates. Data regarding synergistic effects of PBO and pyrethroids in fish are less conclusive

(EPA, 2006). Acute and chronic risk to aquatic habitats is not anticipated because of the proposed method of application, environmental fate of cypermethrin and PBO, and proposed 100-foot application buffers from aquatic habitats.

3. Environmental Quality

Cypermethrin is not expected to cause adverse impacts to soil, water, or air quality due to the method of application, the environmental fate of the insecticide, and additional mitigation measures beyond those stated on the label. Cypermethrin breaks down in soil under aerobic and anaerobic conditions with half-lives of less than 65 days (EPA, 2005). Cypermethrin has very low water solubility and a high binding affinity to soil and sediment that would result in a very low probability of ground or surface water contamination. Cypermethrin that would move off-site as drift and enter surface water would dissipate quickly from the water column based on 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 (Agnihorti et al., 1986; Roessink et al., 2005; He et al., 2008). Surface water is further protected by adherence to label restrictions and the implementation of a 100-foot application buffer from surface water. Physical and chemical characteristics for cypermethrin preclude significant volatilization into the atmosphere. Cypermethrin may be present in the air as drift following an application to stumps or larval breeding sites; however, the directed hand application using large, coarse droplets will minimize the probability of any off-site drift during these types of applications. PBO is also not expected to result in measurable impacts to soil, water or air quality. PBO is degraded by soil micoorganisms and is sensitive to light with a photolysis half-life of less than 8.4 hours in water (EPA, 2006). PBO is moderately mobile in water and could be susceptible to runoff however application restrictions near surface water will reduce the potential for impacts to water quality. The method of application for PBO plus it's short half-life in air (< 3.4 hours) suggests impacts to air quality will not occur. There may be some material in the air immediately after application as drift however this will be very localized and short duration.

C. Cumulative Effects

The selection of the preferred alternative described in this EA for the CRB response program is not anticipated to have a significant cumulative impact on human health or the environment. There will be an increase in insecticide loading in certain areas; however, it is anticipated that with a cooperative integrated approach, insecticide use would be less compared to permanent establishment of CRB on Oahu that could occur under the no action alternative. Insecticide use would not be expected to have cumulative impacts to soil, air, or water quality beyond baseline conditions because of the proposed method of application, the environmental fate of pyriproxyfen and cypermethrin, and in the case of surface water, the use of a 100-foot application buffer for both insecticides. These conclusions are based on assumptions of labeled maximum use rates for each insecticide and would also hold true if efficacy work results in higher applications rates due to the wide margins of safety with current rates. Both insecticides may be used on Oahu for other purposes; however, their use in areas where CRB detections would be likely to occur are expected to be minimal. Similarly PBO would also not be expected to result in significant cumulative impacts. PBO may act as a synergist with pyrethroid insecticides but may have an antagonistic effect when it occurs with other insecticides such as some organophophates. The co-occurrence of PBO with other pesticides from other uses is not expected to be significant, in particular in aquatic systems, due to the implementation of application buffers and favorable environmental fate.

D. Threatened and Endangered Species

Section 7 of the Endangered Species Act and its implementing regulations require Federal agencies to ensure their actions are not likely to jeopardize the continued existence of threatened or endangered species or result in the destruction or adverse modification of critical habitat. APHIS has determined that with the implementation of protection measures for some species, the proposed Program may affect, but is not likely to adversely affect the Hawaiian hoary bat (*Lasiurus cinereus semotus*), Hawaiian coot (*Fulica alai*), Hawaiian common moorhen (*Gallinula chloropus sandvicensis),* Hawaiian stilt (*Himantopus mexicanus knudseni*), or Hawaiian duck (*Anas wyvilliana*). No critical habitat occurs in the program area. APHIS has received concurrence from the FWS on these determinations.

E. Other Considerations

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

EO 13045, "Protection of Children from Environmental Health Risks and Safety Risks," acknowledges that children, as compared to adults, may suffer disproportionately from environmental health and safety risks because of developmental stage, greater metabolic activity levels, and behavior patterns. This EO requires each Federal agency to identify, assess, and address environmental health risks and safety risks that may disproportionately affect children. The current program action area contains over 60 schools representing primary, secondary and higher education institutions. Any program activities that could occur on school property would be coordinated with the appropriate school officials to ensure that children would not be adversely impacted by program activities. Any program insecticide applications will be made directly to trees, stumps, as well as small areas that are larval breeding sites in undeveloped lots, landscape areas surrounding hotels and businesses, and within public parks. In cases where applications could be made in public areas where children are present, the program applicators ensure that the general public is not in or around areas being treated to minimize exposure during application. The only possible exposure could occur from a child playing in the treated soil or on treated stumps. The available human health data and very conservative assumptions regarding ingestion of treated soil or host material suggests that risks to children in these types of scenarios would be extremely low in cases of exposure for each proposed program treatment. Therefore, it was determined that no disproportionate effects on children are anticipated as a consequence of implementing the preferred alternative.

Consistent with the National Historic Preservation Act of 1966, APHIS has examined the proposed action in light of its impacts to national historic properties. On March 11, 2014 a letter was prepared and sent to the State Historic Preservation Officer (SHPO). APHIS will continue to work with the SHPO to address potential questions or concerns regarding CRB response activities that could occur on properties protected by the National Historic and Preservation Act.

APHIS has also contacted Native Hawaiian Organizations on the island of Oahu to make them aware of the proposed CRB response program and to address questions or concerns regarding the program. Letters were sent to approximately 50 Native Hawaiian Organizations explaining the need for the program and to provide contact information regarding response efforts. The current action area includes Native Hawaiian homeland adjacent to the Keehi Lagoon Beach Park.

IV. Listing of Agencies and Persons Consulted

U.S. Department of Agriculture
Animal Plant Health Inspection Service
PPQ-PDEM Pest Evaluation
4700 River Road, Unit 134
Riverdale, MD 20737

U.S. Department of Agriculture
Animal Plant Health Inspection Service
PPQ-PHP-Regulations, Permits and Manuals
4700 River Road, Unit 150
Riverdale, MD 20737

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

U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard
Room 3-122, Box 50088
Honolulu, HI 96850

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Appendix A. CRB Response Program Action Area on Oahu.