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APHIS

Gypsy Moth Cooperative Eradication Program in Multnomah County, Oregon

Environmental Assessment February 2016

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I. Introduction

The gypsy moth (GM), *Lymantria dispar* L., is one of the most destructive pests of trees and shrubs in the United States. There are two types of GM—the European (also known as North American GM) and the Asian (AGM). The European GM was originally imported into Massachusetts from Europe in 1869 for silk production experiments. However, some moths were accidentally released and became established. The European GM infestation spread and now covers the entire northeastern part of the United States, from Maine south to North Carolina, and west to Michigan and parts of Wisconsin. Isolated outbreaks of European GM have also occurred west of the Mississippi River. The Asian gypsy moth (AGM) (including *Lymantria dispar asiatica*, *Lymantria dispar japonica*, *Lymantria albescens*, *Lymantria umbrosa*, and *Lymantria postalba*) is an exotic pest not known to occur in the United States. AGM may pose more of a risk compared to the European GM. Unlike the flightless female European GM, AGM females are active fliers. Their ability to fly long distances makes it probable that AGM could spread quickly throughout the United States. The European gypsy moth has more than 250 known host plants but prefers oak, while the AGM has a much broader host range, including larch, oak, poplar, alder, willow, and some evergreens. Establishment of GM in the United States would pose a major threat to the environment, the urban, suburban, and rural landscapes, and the forestry industry.

The GM life cycle begins in the early spring with the hatching of first instar larvae from eggs laid the previous summer. Newly hatched larvae hang by silken threads and are caught by the wind and, thereby, are dispersed to other trees in forests. Small larvae begin feeding on leaves. GM larvae go through 5 or 6 feeding stages. Between stages, the GM larvae molt by shedding their skin. Larvae typically feed at night and rest in bark crevices during the day. In areas with high caterpillar densities, feeding may occur all day which can result in defoliation and, in severe cases, cause tree mortality.

Pupation generally occurs about 8 weeks after egg hatch. Once they emerge as adults, the female GM emits a pheromone that the males can detect through their antennae. The males locate the females and mate. After mating, the female lays eggs in a single mass on any solid object, including tree trunks, shrubs, nursery stock, vehicles, camping equipment, and outdoor household articles.

Heavy infestations of GM can alter ecosystems and disrupt people’s lives. The larval life stage can cause defoliation and can, in extreme cases, cause tree mortality. Defoliated trees are vulnerable to other insects and diseases. Repeated or widespread defoliation events from larval feeding can alter wildlife habitat, change water quality, reduce property and esthetic value, and reduce the recreational and timber value of forested areas. When present in large numbers, GM caterpillars can be a nuisance, as well as a hazard to health and safety (USDA, 1995).

II. Purpose and Need

USDA APHIS in cooperation with Oregon Department of Agriculture (ODA), propose to eradicate the GM infestation located in Multnomah County, Oregon (within the Portland metro area). The alternatives being considered have been analyzed in detail in the 1995 final environmental impact statement (EIS) for GM management in the United States and a recent supplemental EIS (USDA, 1995; 2012). The findings of that EIS regarding the alternatives being considered will be summarized and incorporated by reference into this environmental assessment (EA). The need for this proposed action is based on the potential adverse ecological and economic impacts of GM infestations on the infested and surrounding areas.

ODA has been surveying for GM populations in Oregon since 1977. Isolated infestations have been detected periodically, resulting in successful eradication efforts with the most recent program being conducted in southeast Eugene in 2009. In 2015, ODA staff trapped two AGM, one in Forest Park and another near the Port of Portland's Terminal 4 in the St. Johns area of Northwest and North Portland. Across the Columbia River in Washington another AGM was also trapped. Additionally ODA trapped two more European GM nearby, one near the Port of Portland Terminal 6 in St. Johns and another just west of Forest Park. The area contains preferred host plants that are susceptible to defoliation by both AGM and European GM, and could support successful reproduction and spread of the pest. USDA convened a technical working group to develop recommendations regarding the AGM infestation. The technical working group determined that it was likely that adult female AGM are present in the Portland/Vancouver area. Based on uncertainties regarding population levels, the working group recommended eradication to mitigate potential ecological, economic, and human impacts (USDA, 2015).

GM egg masses and pupae have been known to attach to items that people bring with them when they enter and leave Oregon. Therefore, if GM were to become established and allowed to spread throughout these areas, it could potentially spread to other areas within Oregon, as well as other parts of the country, including the surrounding States. In the absence of timely eradication action, the associated damage, defoliation, and mortality of host plants from such an occurrence could be devastating.

This EA is tiered to USDA's 1995 final EIS and 2012 supplemental EIS for GM management in the United States. Eradication is being proposed because of the isolated nature of these infestations and the threat that a reproducing population of GM would pose to the vegetation resources of this area.

This site-specific EA is designed to examine the environmental consequences in the proposed treatment areas when using a range of treatment options analyzed in the 1995 final EIS and 2012 supplemental EIS for GM management in the United States that may accomplish the program's goals. The goal of this project is to eliminate GM from the identified area in Multnomah County, Oregon.

This EA is prepared consistent with National Environmental Policy Act of 1969 (NEPA) (42 United States Code (U.S.C.) § 4231 et. seq.), the Council of Environmental Quality NEPA regulations (40 Code of Federal Regulations (CFR) part 1500 et. seq.), APHIS' NEPA implementing regulations (7 CFR part 372), and FS' NEPA implementing regulations (36 CFR part 220) for the purpose of evaluating how the proposed action and alternatives described in the following sections, if implemented, may affect the quality of the human environment. This EA is being made available to the general public and comments are requested from any interested party.

A. Public Outreach

ODA has conducted extensive outreach activities through press releases, briefings and contact with potentially impacted stakeholders through various media sources. This type of activity will continue prior to the proposed treatments as well as providing outreach to stakeholders after treatments have been completed. Outreach will include public open house meetings and notifications to affected residents and other stakeholders. Two public open house meetings have been scheduled at the James John Elementary School, 7439 N. Charleston Ave, Portland, OR 97203; one on 2/17/2016 at 6:30 pm to 8:30 pm and another on 2/20/2016 at 9:00 am to 12:00 pm.

To date ODA has met and continues to work with various state agencies and Oregon State University extension personnel about the proposed program. At the county and city level ODA has conducted outreach to the Multnomah County Commissioners, Portland City council, Office of Neighborhood Involvement and Port of Portland, among others. Meetings are also proposed with various neighborhood associations such as St Johns, Cathedral Park, Linnton and Hayden Island groups.

ODA has already conducted, or is planning outreach activities with various non-governmental agencies including the Xerces Society, Oregon Beekeepers Association, Audubon, Northwest Center for Alternatives to Pesticides, Oregon Wild, Nature Conservancy and Forest Park Conservancy, among others.

B. Authorizing Laws

1. USDA Authorities

Authorization to conduct treatments for GM infestations is given in the Plant Protection Act of 2000 (7 U.S.C. section 7701), and the Cooperation with State Agencies in Administration and Enforcement of Certain Federal Laws (7 U.S.C. section 450). The Cooperative Forestry Assistance Act of 1978 (P.L. 95–313) provides the authority for Federal and State cooperation in managing forest insects and diseases. The 1990 Farm Bill (P.L. 101-624) reauthorizes the basic charter of the Cooperative Forestry Assistance Act. The National Environmental Policy Act (NEPA) of 1969 requires detailed environmental analysis of any proposed Federal action that may affect the human environment. The Federal Insecticide, Fungicide and Rodenticide Act of 1947, as amended, known as FIFRA, requires insecticides used within the United States be registered by the U.S. Environmental Protection Agency (EPA). Section 7 of the Endangered Species Act prohibits Federal actions from jeopardizing the continued existence of federally listed threatened, endangered, or candidate species or adversely affecting critical habitat of such species. Section 106 of the National Historical Preservation Act and 36 CFR part 800: Protection of Historic Properties requires the State Historic Preservation Officer be consulted regarding the proposed activities.

2. State Authorities

ORS 570.305. This statute gives broad enabling authority to eradicate dangerous insect pests and plant diseases. It states that “the director [State Department of Agriculture], and the chief of the division of plant industry, are authorized and directed to use such methods as may be necessary to prevent the introduction into the state of dangerous insect pests and plant diseases, and to apply methods necessary to prevent the spread, and to establish control and accomplish the eradication of such pests and diseases, which may seriously endanger agricultural and horticultural interests of the state, which may be established or may be introduced, whenever in their opinion such control or eradication is possible and practicable.”

C. Decisions to be Made

The preferred alternative in this document proposes a multiagency approach between APHIS and ODA. The responsible officials must decide the following:

- Should there be a cooperative treatment program, and if so, what type of treatment options should be used?
- Is the proposed action likely to have any significant impacts requiring further analysis in an environmental impact statement (EIS) if treatments are to be implemented?

D. Responsible Officials

The responsible official for the APHIS is:

Anthony Man-Son-Hing
National GM Program Manager
USDA/APHIS/PPQ
920 Main Campus Drive
Raleigh, NC 27606

The responsible official for APHIS will make a decision before mid-April to ensure timely funding for the proposed eradication program.

The official responsible for implementation for ODA is:

Clinton Burfitt.
Manager, Insect Pest and Prevention Management Program
Oregon Department of Agriculture
635 Capitol St. NE
Salem, OR 97301

E. Other Gypsy Moth Work

No additional GM treatment work is currently planned elsewhere in Oregon for 2016. In the event that there is a need for additional treatments a separate EA and decision notice will be issued for this work. There are proposed GM activities planned in Washington State that may be coordinated with GM work in Oregon. The Washington work is being analyzed in a separate EA and will have a separate decision notice.

III. Alternatives

This EA is tiered to the USDA's 1995 Final EIS and 2012 supplemental EIS for GM Management in the United States. The preferred alternative in the 1995 EIS is alternative 6: Suppression, Eradication, and Slow the Spread. This alternative was proposed because of the isolated nature of GM infestations in Oregon. This site-specific EA is designed to examine the environmental consequences of a range of treatment options listed under the EIS preferred alternative (alternative 6) that may accomplish the program's goal.

Under alternative 6 of the EIS, six treatment options were analyzed in the 1995 EIS with an additional treatment option analyzed in the 2012 supplemental EIS:

1) Btk—a biological insecticide containing the bacterium *Bacillus thuringiensis* var *kurstaki* (Btk). The insecticide is specifically effective against caterpillars of many species of moths and butterflies, including GM.

2) Diflubenzuron (Dimilin®)—an insect growth regulator that interferes with the growth of some immature insects.

3) GM Virus (Gypcheck®)—a nucleopolyhedrosis virus which occurs naturally and is specific to GM. Gypcheck is an insecticide product made from the GM nucleopolyhedrosis virus.

4) Mass Trapping—a treatment that consists of large numbers of pheromone traps used to attract the male GM thus preventing them from mating with females and, thereby, causing a population reduction.

5) Mating Disruption—a treatment that consists of a carrier (i.e., tiny plastic flakes, beads, etc.) that release disparlure, a synthetic GM sex pheromone. The pheromone confuses male moths and prevents them from locating and mating with females.

6) Sterile Insect Technology—a treatment that consists of an aerial release of a large number of sterile male GM. This reduces the chance that female moths will mate with fertile males, which results in progressively fewer and fewer fertile egg masses being produced, and eventual elimination of the population.

7) Tebufenozide—an insecticide that controls molting in various insects and other invertebrates.

Of the treatment options listed above, Btk and diflubenzuron have proven to be the most effective eradication tools for use with small populations of GM, such as the area being proposed in this site-specific EA.

The remaining treatment options were not selected due to availability, or environmental or efficacy concerns. Diflubenzuron is an insect growth regulator that has a broader nontarget host range than Btk, and can kill many other insects in addition to moths and butterfly caterpillars. Its use may adversely affect other insect populations and, therefore, was not selected. Similar types of impacts would be expected with the use of tebufenozide. GM virus (Gypcheck®) is very host-specific, but is not widely available in the market; therefore, it was not selected. Mating disruption was not selected due to the presence of alternate life stages. Sterile insect release experiments show variable results for eradication programs and, consequently, sterile insect technology was not selected.

This EA analyzes two alternatives (1) the no action alternative and (2) the proposed action that will utilize three applications of Btk, combined with post-treatment delimit trapping for three years to ensure that the treatment is effective.

A. No Action

Under the no action alternative, GM would reproduce and populations would spread to surrounding areas. This is not a preferred alternative because environmental damage and regulatory action will occur sooner than if other alternatives are selected. If no action was taken APHIS would not aid in the treatment of the area. Some control measures could be taken by other Federal and non-federal entities however these measures would neither be controlled nor funded by APHIS.

B. Proposed Action

Under the proposed action alternative, APHIS would provide funding for the proposed treatment area. Btk (Foray® 48B) will be applied via aerial application over the proposed treatment area. The proposed formulation is certified for organic production. Three applications of Btk will be applied with an interval of approximately seven to 14 days between each application. These applications are estimated to begin sometime in mid-April 2016. The exact date of application will be timed so that the applications occur during the early larval stages when GM caterpillars hatch from their eggs and are most susceptible to treatments.

Pheromone-baited GM traps will be used to monitor success of the treatments. Trapping density will be as high as 49 traps per square mile in the treatment area to determine if the treatments are successful.

IV. Affected Environment

The treatment site proposed for GM eradication is approximately 8,674 acres. A map of the area is available in Appendix A with a brief description of the area below.

Portland (Multnomah County)

Human Health

The proposed area for GM treatments is located in the northwest and north Portland metro area (appendix A). There are about 4,000 properties within the proposed 8,674 acre eradication area; many are single-family residences. The treatment area lies primarily between the Willamette and Columbia Rivers and is mostly developed as a residential and business/industrial area with the exception of some wetlands contained within the Smith and Bybee Wetlands Area, and on Hayden Island.

Western Hayden Island and the associated Oregon Slough contain industrial development including a dredge deposit management area and various natural areas (City of Portland, 2013). The area west of the Willamette River is composed mostly of mixed and deciduous forest with some residential and business development. The proposed treatment area contains one school, Sitton Elementary. Another school –James John Elementary is just outside the boundary to the east in St Johns. No hospitals are present within the treatment boundary. No historic properties are present within the proposed treatment area. However, a fire station and a police station are located along the east boundary of the eradication area.

Approximately three to four school bus lines run through the eradication area. Activities at Sitton begin at 6:45 am. Buses arrive between 7:40 and 8:00 am. The other bus line will travel through the St. Johns area until 8:42 am. One bus line travels from north to south on St. Helens Rd. starting at 7:03 am and leaves the area by 8:15 am. Another bus line travels along Skyline Blvd. from north to south beginning at 7:16 am and progressing out of the spray zone at 7:25am. Then from the opposite direction a bus comes through same stretch of Skyline Blvd. at 8:11 am. The last bus line travels through Germantown Rd and Old Germantown Rd between 7:04 am and 8:06 am. Additionally, the city buses travel through the area mainly along Marine Drive, Columbia Boulevard, Lombard Street, St. Louis Ave and St. Helens Road.

Ecological/Environmental Resources

Although a significant portion of the proposed area has been developed for residential, business, and industrial use, there are several terrestrial and aquatic habitats that support a diversity of fish and wildlife species. The two largest aquatic resources that occur within the proposed spray boundary are the Willamette and Columbia Rivers. The Columbia River runs along the north boundary of the eradication area, while the Willamette River runs through the middle and then along northwest side of the eradication area. Bybee Lake and part of the Smith Lake are also within the eradication area. The Columbia River and Willamette River divide the eradication areas into three distinct blocks: Hayden Island, Saint Johns, and Forest Park. Both of these rivers are home to a variety of aquatic species, including federally listed salmonids. These areas are not proposed for treatment but do fall within the treatment boundary where land applications will occur.

The eradication area includes nine city parks: Forest Park, Linnton Park, Kingsley Park, Cathedral Park, Saint Johns Park, Pier Park, Chimney Park, Smith and Bybee Lakes Park, and Kelley Point Park. The 2,000 acre Smith and Bybee Wetlands Natural Area is also contained within the proposed treatment area. The natural area is composed of open water, marshes and wetland forests that attract and support a variety of fish and wildlife. Water quality within the natural area is considered impaired under Section 303(d) of the Clean Water Act. Reasons for impairment within Bybee Lake are related to algal growth and pH while the Columbia Slough on the southwest boundary of the natural area is listed as impaired due to high iron and manganese concentrations (EPA, 2016). Multnomah Canal runs into the Willamette River just northwest of the proposed treatment border and is listed as impaired due to temperature (EPA, 2016).

West of the Willamette River are three city parks, Linnton, Clark and Wilson, and Forest Park (City of Portland, 2016). The largest of the three parks, Forest Park, is approximately 5,172 acres and is home to over 112 bird and 62 mammal species as well as other plant and wildlife species, including host plants for GM. The West Hayden Island and Oregon Slough also support a variety of fish and wildlife species in various aquatic, semi-aquatic and terrestrial habitats (City of Portland, 2013).

V. Environmental Impacts of the Proposed Action and Alternatives

There are potential environmental consequences from both alternatives being considered. The risks associated with ecological and human impacts are examined under both alternatives.

A. No Action

Selection of the no action alternative would likely result in the establishment of GM populations in Multnomah County which could lead to damage to trees relative to the level of infestation. The no action alternative would allow GM to flourish in the existing area, and continue to spread into surrounding areas. With the establishment of GM, the environmental concerns discussed below would likely occur. The ecological and human health effects associated with GM were examined in the 1995 final EIS and the 2012 supplemental EIS for GM management in the United States (USDA, 2012; USDA, 1995). This EA incorporates the EIS evaluation by reference and the material discussed in both of the EIS documents. The ecological and human health effects are summarized below from the EIS as well as any new information.

1. Gypsy Moth

a. Ecological Impact

Most of the environmental impacts associated with GM are caused by the larval stage. This stage of GM is the feeding stage which can lead to changes in forest stand composition (USDA, 1995). In areas where GM populations are high, trees can be defoliated, leading to stress (USDA, 1995). Trees that are stressed are more susceptible to diseases and other plant pests (USDA, 1995). In circumstances where high populations are sustained over several years, GM feeding damage can cause tree mortality (USDA, 1995). GM-related defoliation of trees can also result in negative impacts to native Lepidoptera (Redman and Scriber, 2000; Manderino et al., 2014).

The areas of infestation, as well as surrounding areas, contain many host trees that would be threatened by GM defoliation. GM larval feeding can lead to changes in forest stand composition and nesting sites, and cover for birds and other animals could be reduced (USDA, 1995). If GM were to spread to other areas, changes in water quality and effects to aquatic organisms could occur (USDA, 1995). The loss of vegetation in the affected areas could lead to increased erosion of soil and loss of moisture retention (USDA, 1995).

b. Human Impact

In addition to these effects, some people have been shown to be allergic to the tiny hairs on GM caterpillars. These people could suffer minor allergic reactions (primarily rashes) if GM were allowed to become established. Also, irritation to eyes and throat are common reactions with increased GM infestations (USDA, 1995). In heavily infested areas, large numbers of caterpillars limit enjoyment of the outdoors for some people due to GM larval droppings and defoliation (USDA, 1995).

B. Proposed Action

The preferred action alternative is the aerial application of Btk and placement of pheromone-baited traps. Potential impacts to human health and the environment are discussed below.

1. Btk

Bacillus thuringiensis var *kurstaki*, or Btk, is a naturally occurring bacterium that has selective insecticidal activity against certain butterflies and moths. The bacillus bacterium is a large group of bacteria that occurs naturally in soil, water, air, plants, and wildlife. The subspecies, kurstaki, is part of the *Bacillus thuringiensis* biopesticide group that has been registered for more than 45 years for a variety of agricultural and nonagricultural uses. Btk is widely used in agriculture, both conventional and organic, and as a transgene in genetically engineered crops to control pests on a variety of crops. Btk also has multiple nonagricultural uses and has been the preferred material for GM eradication programs in the United States for several years. The specificity of Btk to certain insects is based on its mode of action which requires ingestion by lepidopteran larvae where, once in the midgut, the alkaline pH breaks down the crystalline proteins that produce the toxins which bind to the midgut cells in the larvae (Cooper, 1994). The alkaline conditions and binding sites present in the midgut of lepidopteran larvae are not present in mammals and most other nontarget organisms.

Btk is available in several formulations, depending on its use. The formulation proposed for use in this program is Foray® 48B which is a commonly used formulation for control of lepidopteran pests. Additionally, the Organic Materials Review Institute listed Foray® 48B as a Certified Organic product. Three aerial applications of Foray® 48B, 7- to 14-days apart, will be made at a rate of 64 to 107 fl oz. of product per acre. The lower rate is typically used however rates of application vary based on the life stage of GM found and the level of infestation. The program uses the lowest rate possible that will still ensure adequate control of GM.

a. Ecological Impact

Nontarget species (i.e., birds, mammals, amphibians, and reptiles) should not be affected by the proposed Btk treatments for this program. A lack of effects would also be expected for domestic animals as well. Available toxicity data for all terrestrial vertebrates indicate low toxicity (EPA, 1998; WHO, 1999; USDA, 2004; USDA, 2012). Although no direct effects to birds and wild mammals are expected, there is the possibility of indirect effects through the loss of invertebrate prey items which may serve as a temporal input into their diet. Based on the available data, indirect effects have not been noted in studies with wild mammals (Innes and Bendell, 1989; Belloco et al., 1992); however, one study reports indirect reproductive effects to birds that rely on caterpillars as a primary food source (USDA, 2004). Slight effects on reproduction in spruce grouse (such as nestling growth rates) were seen when applications occurred over large forested areas (Norton et al., 2001); nevertheless, in several other studies assessing impacts to a wide diversity of songbirds, no indirect effects on reproduction or other endpoints were noted (USDA, 2004). Bird populations that may occur in the proposed treatment areas are not expected to be impacted by the loss of prey items. Bird species expected in these areas have shown no indirect effects based on Btk applications over larger areas. In addition, the potential treatment areas are relatively small compared to the foraging areas that birds may use. Finally, only some lepidopteran larvae will be impacted in the potential treatment areas, while other terrestrial insects will be available as prey items for birds.

Effects to most nontarget terrestrial invertebrates are not expected with the exception of lepidopteran larvae, with early instars more sensitive than later instars. Within the lepidopteran group, sensitivities can be highly variable (Peacock et al., 1998). In general, due to Btk's unique mode of action, toxicity to pollinators and beneficial insects are considered low based on laboratory and field studies testing honey bees, as well as other beneficial insects (USDA, 2004). Effects to honey bees, in particular, are not expected based on the available published studies designed to evaluate short- and long-term effects from exposure to Btk or Bt-related proteins (EPA, 1998; Sterk et al., 2002; Bailey et al., 2005; Duan, et al, 2008). These studies evaluated impacts to larval and adult honey bees from oral or contact exposures with no lethal or sublethal impacts noted at concentrations above those expected from the proposed use pattern for

Btk in this program. Some nontarget Lepidoptera larvae (caterpillars) present in the proposed spray areas would likely be killed by the application of Btk. However, depressions in caterpillar populations are expected to be temporary due to recolonization from adjacent untreated areas. No threatened or endangered lepidopteran species are expected to be present in the treatment site based on information from the U.S. Fish and Wildlife Service.

Btk is not expected to be of significant risk to aquatic resources in this program due to the low toxicity of Btk to aquatic organisms and the lack of significant exposure. The Willamette and Columbia Rivers, Bybee Lake and Columbia Slough are located within the proposed treatment area however impacts to these aquatic resources, and others in the area, are not anticipated due to label restrictions and lack of risk to aquatic resources. Multiple freshwater and saltwater fish species were tested in the laboratory to determine what level of Btk exposure would result in any effect (USDA, 2004). The levels required to produce an effect were much higher than any potential off-site residues that would occur as a result of this program (USDA, 2004). There have been laboratory studies supported by field data which suggest that exposure could result in minimal effects to aquatic invertebrates at environmental concentrations above expected values in this program (Richardson and Perrin, 1994; Kreutzweiser et al., 1992; USDA, 2004). However, studies showed that *Daphnia magna*, mayflies, stoneflies, copepods, and mysid shrimp were not affected when exposed to concentrations well above those expected in the environment after application of Btk (USDA, 2004). Therefore, it is unlikely that fish and other aquatic organisms will be negatively impacted by the use of Btk in the proposed GM eradication program.

After application, exposure to light, higher temperatures, and moisture decrease the amount of Btk remaining in the environment. In a summary of studies regarding the environmental fate of Btk, the majority of studies indicated that insects were only affected for approximately one week; however, other studies have shown that while persistence of Btk in the environment may decrease rapidly, the insecticidal activity can persist up to three months under certain environmental conditions (USDA, 1995). Btk's persistence in water depends on organic matter, content, and salinity (USDA, 1995). Btk has been found in aquatic field studies for up to 13 days, and in some studies up to four weeks, after application (USDA, 1995). Variations in environmental fate are attributable to various factors, including environmental conditions, formulation chemistry, study protocols, and sampling substrates.

b. Human Impact

Based on the extensive use of Btk and its long historical use in these types of programs, a large amount of mammalian toxicity data exists, as well as information from surveillance programs in previously conducted treatments. Available acute laboratory toxicity data with Btk and its various formulations demonstrate low acute mammalian oral, dermal, and inhalation toxicity and pathogenicity (McClintock et al., 1995; EPA, 1998, WHO, 1999; Siegel, 2001; USDA, 2004). The material safety data sheet (MSDS) of Foray® 48B, states that the formulated material can be a transient mild eye and skin irritant and is considered practically non-toxic in oral, dermal and inhalation exposures (Valent, 2011). The information in the MSDS applies to workers handling larger quantities of the concentrated material compared to the reduced potential exposure from material applied during application. Previously conducted human health risk assessments, which compare potential exposure data from similar applications to those proposed in this program, have demonstrated wide margins of safety with potential exposure values to the general public ranging from 28,000 to 4 million times below levels where effects were observed in laboratory studies (EPA, 1998; USDA, 2004).

Concerns have been raised regarding the pathogenicity of Btk and, in particular, the production of enterotoxins (which are summarized in a publication from an anti-spray advocacy group) (Ginsberg, 2006). Btk belongs to a group of bacteria within the *Bacillus* genus, including *Bacillus cereus*, which has been linked to foodborne illness incidents via the production of enterotoxins which can cause gastrointestinal symptoms, such as diarrhea. The Centers for Disease Control report that *B. cereus* is responsible for approximately 0.6 percent of the total number of foodborne illness cases reported between 1988 and 1992, as well as between 1998 and 2002 (EPA, 1998; CDC, 2006).

Btk has been shown to produce low levels of enterotoxin in cultures; however, no reported foodborne illness cases linked to Btk exist in more than 45 years of extensive use. The lack of pathogenicity may be related to the relatively low levels of enterotoxin produced in Btk compared to *B. cereus* (Damgaard, 1995), or the enterotoxins are not typically present in commercial formulations that are produced in North America. Siegel (2001) reported that enterotoxins may be degraded during the fermentation process, or that the isolates used may not produce enterotoxins under the conditions of the fermentation process. In addition, impacts of *B. cereus* enterotoxin are only realized in cases where the enterotoxin can multiply under appropriate conditions; this does not appear to occur for Btk in the environment. This is supported by a lack of gastrointestinal symptoms linked to Btk applications by workers or the public, and laboratory studies that report no enterotoxin production in rats orally dosed with Btk or associated symptoms (EPA, 1998; USDA, 2004; Wilcks et al., 2006). The lack of reported gastrointestinal symptoms associated with Btk use in workers and the general public, as well as a lack of effects observed in laboratory studies, indicate factors other than the presence of enterotoxin are required to cause symptoms similar to those in *B. cereus* (Federici and Siegel, 2008). Immune response and infectivity data for Btk, as well as results from surveillance studies, suggest that immune-related adverse effects in the general public are unlikely (USDA, 2004; Federici and

Siegel, 2008).

Several epidemiology studies have been published based on surveillance data from applications similar to those proposed in this program in the United States, Canada, and New Zealand. These studies are summarized in several publications and indicate that no significant adverse effects were reported in the general population, including sensitive subgroups, such as children or asthmatics (Aer'Aqua Medicine, 2001; Siegel, 2001; Noble, et al., 1992; Pearce et al., 2002; Parks Canada, 2003; USDA, 2004; Otvos et al., 2005).

One of the larger monitoring studies conducted in association with forestry Btk applications was in New Zealand (Aer'Aqua Medicine, 2001). Applications to an area containing approximately 88,000 residents were monitored using self-reporting of adverse effects, as well as information from participating physicians. Results from the study demonstrated no Btk-related cases of anaphylaxis, incidences of birth defects, or changes in birth weight, meningococcal disease, or infections. Adverse effects that were self-reported during the study were related to dermal, respiratory, and eye irritation.

Petrie et al. (2003) conducted a study to investigate the impacts of an aerial application of Foray® 48B on self-reported symptom complaints and visits to health care providers after applications in West Auckland, in 1999, to control the painted apple moth. A group of 292 residents within the spray area were questioned prior to treatment, with only 192 residents (or 62 percent) responding after treatment. The authors of the paper assessed the frequency of 25 potential health problems before and after treatment. Of these 25 symptoms, including sleep problems, dizziness, difficulty concentrating, irritated throat, itchy nose, diarrhea, stomach discomfort, and gas discomfort, 8 were found to have increased after application. These results are similar to those reported from the same area by an advocacy group opposed to the spray (Blackmore, 2003; Goven et al., 2007). Petrie et al. (2003) states that sleep problems, dizziness, and difficulty concentrating may be related to anxiety regarding perceptions about the risk of the program. A significant increase in participants with hay fever symptoms was noted; however, this may be incidental, as the authors point out, because the onset of the pollen season could have influenced reporting. The authors attribute the gastrointestinal symptoms to possible enterotoxin production from the microbial insecticide; however, this possibility is not supported by any available literature, and no other additional information is offered. The authors do not discuss the possibility that the gastrointestinal symptoms may be related to the reported anxiety from the perceived risks of the application. In addition, the statistical comparisons that were utilized in the study are not considered appropriate for the multiple comparisons that were made (Federici and Siegel, 2008; USDA, 2004). A review of the study and the application of conservative statistical analysis more appropriate for multiple comparisons revealed that none of the endpoints were found to be statistically significant (USDA, 2004). The authors point out that the results should be interpreted with caution as only slightly more than half of the original residents responded post-application through self-reporting which could bias the results. It is important to note that there was no increase in the frequency of visits to general practitioners or other health care providers after treatment which is consistent with results from other surveillance studies of Btk applications.

Proposed applications of Btk in this program pose minimal risk to the general population, based on the large amount of available toxicity data, surveillance data, and long-term use without significant reports of adverse effects. Glare and O'Callaghan (2000) provide a comprehensive review of *Bacillus thuringiensis*, including Btk. They conclude with this statement, "After covering this vast amount of literature, our view is a qualified verdict of safe to use" (Glare and O'Callaghan, 2000). The World Health Organization's Environmental Health Report (1999) states "Bt products can be used safely for the control of insect pests of agricultural and horticultural crops as well as forests."

Mild irritation of the eyes, skin, and respiratory tract may be associated with exposures to Btk; however, this is more likely to occur to applicators who are handling the concentrated material. Risks to applicators will be minimized as long as Foray® 48B is handled according to label requirements. Public meetings as well as additional public outreach and education will continue with local citizens, as well as the Oregon Health Authority and local hospitals and clinics closer to the time of treatment.

c. Summary

Human health risks are expected to be minimal from Btk applications in this program, based on its long-term safety which has been demonstrated through laboratory and monitoring studies. The potential for exposure is greatest to workers who handle the concentrated product; however, exposure will be minimized by following label requirements. It is likely that a small buffer area surrounding the eradication area will receive some *B.t.k.*, but in quantities much less than inside the eradication area. Movement of *B.t.k.* beyond the eradication area is likely to be affected by conditions such as temperature, humidity, wind direction, wind speed, and terrain. A continuation of local outreach and education will minimize anxiety and health concerns associated with these treatments.

There will be minimal risk to most nontarget terrestrial and aquatic organisms due to limited exposure and low toxicity. Impacts to some native lepidopteran larvae within the spray areas may occur; however, the effects are expected to be transient due to the size of the treatment areas and specificity of Btk to the larval stage of the insect. Label requirements and other restrictions, where appropriate, will further reduce risk to sensitive organisms, such as some aquatic invertebrates and pollinator species as described above.

2. Trapping

Trapping will involve disparlure/pheromone-baited traps to attract male GM, including European GM and AGM. Disparlure is the common name for cis-7,8-epoxy-2- methyloctadecane, a synthetically produced sex pheromone of the natural pheromone that is used by the female GM to attract the male GM. The environmental impacts and human impacts are summarized below.

a. Ecological Impact

In acute toxicity tests, disparlure was not toxic to mammals, birds, or fish (USDA, 2006). Disparlure does exhibit toxicity to aquatic invertebrates; however, the effects are related to study design and the limited solubility of the pheromone (USDA, 2006). Studies using cladocerans revealed toxicity was related to the organisms becoming physically trapped at the water surface where undissolved pheromone was present (USDA, 2006). Risks to aquatic organisms are not expected in this program because all pheromone will be placed in sticky traps, thus eliminating any potential offsite run-off or drift. Pheromone traps do catch small numbers of nontarget organisms that accidently fly or crawl into the traps. However, because the pheromone in the trap is specific to GM, nontarget insects will not be attracted to traps, the number of nontarget organisms affected will be very small, and the pheromone will have minimal impacts to the environment.

b. Human Impact

Disparlure belongs to a group of compounds known as straight-chain lepidopteran pheromones. Acute toxicity studies with this group of compounds have shown very low mammalian toxicity through multiple exposure routes. The lack of toxicity with these types of compounds has resulted in reduced data requirements for their registration by the U.S. Environmental Protection Agency (EPA) (EPA, 2004). Subchronic and chronic studies are limited for these types of chemicals; however, given the low acute toxicity and the fact that pheromones occur naturally in the environment, human health risks are expected to be minimal. The reduced data requirements introduce uncertainty into potential long-term risks; however, the lack of significant exposure to the public (given its use in sticky traps and the limited amount used in the proposed program) substantially reduces the potential for exposure and risk. The pheromone can be persistent on individuals who come into physical contact with disparlure; if this were to occur, the individuals may attract adult male moths for prolonged periods of time (up to 2 to 3 years) (USDA, 2006). No toxic effects are expected but it may be a considerable nuisance in GM-infested areas, such as the eastern United States (USDA, 2006). The level of exposure required to cause the attractant effect cannot be characterized, although the likelihood of the effect is much greater for workers than for the general public.

Nevertheless, physical contact with disparlure from trapping is unlikely, and would only occur if someone were to tamper with the traps.

c. Summary

Human health risks are expected to be minimal from using disparlure baited traps in this program based on disparlure's long-term safety and the fact that it would be unlikely that humans would come into contact with disparlure in the traps. The potential for exposure is greatest to workers who handle the concentrated product; however, exposure will be minimized by following label requirements. A continuation of local outreach and education will minimize anxiety and health concerns associated with these treatments.

There will be minimal risk to most nontarget terrestrial and aquatic organisms due to limited exposure and low toxicity. The traps themselves are baited with pheromone specific to gypsy moth. There may be incidental captures of nontarget insects that enter the trap by mistake; however the number affected would be very small.

VI. Other Issues

A. Cumulative Impacts

The proposed GM eradication program has limited impacts to lepidopteran and other nontarget species in the affected areas. These limited impacts are not expected to have a cumulative impact with past, present, or future projects in these areas. Based on the analysis in the environmental impacts section, there are greater potential impacts to the environment with the use of Btk versus trapping. Btk primarily impacts lepidopterans and also species that may rely on lepidopterans as a primary source of food.

Btk has other uses including organic and inorganic crop, and home and garden uses. The amount of Btk currently used in the treatment area is unknown; however, there would be an expected increase in environmental loading of Btk with the proposed treatments. The increase in environmental loading from the proposed Btk applications will be transient since applications will occur over a relatively short period of time. The cumulative impacts from additional Btk use, relative to other stressors is expected to be incrementally negligible to human health and the environment due to the low risk of Btk. Cumulative impact potential is greatest for native Lepidoptera in the treatment block that may be sensitive to Btk applications; however, these impacts are expected to be minor since they would be localized and transient compared to the cumulative impacts that could result in the establishment of GM.

Cumulative impacts from the no action alternative would be expected to be greater than those from the preferred alternative since no treatments would allow GM to become established and spread to other areas within Oregon, Washington, and the rest of the United States. As previously mentioned both the AGM and European GM have a wide host range and damage to these host plants would be expected in the event that the GM is allowed to become established. Cumulative impacts to forest systems already under stress would be expected if GM were allowed to become established in the western United States. The effects of natural and manmade stressors to forests (e.g., timber harvests, acid rain, climate change, and other pests and diseases) can be additive or synergistic, that is, the effects of all of the stressors together become greater than the individual stressors alone (Cox, 1999; Logan et al., 2003). The addition of GM defoliation to forested areas that are already under would be expected to result in cumulative economic and environmental impacts (USDA, 2012). New areas where GM becomes established would be subjected to insecticide applications. Risk to human health and the environment may be increased with these applications since many insecticides are registered for use to control GM and may have a greater risk compared to Btk (USDA, 2012).

In the event that the GM population is not eradicated from these areas, future treatments may be required. Treatment with Btk in the same areas over several years may lead to an increase in effects to lepidopteran species, thus limiting their chances to reestablish in the proposed treatment area. However, if future treatments are needed, a subsequent EA will be conducted and risks will be evaluated further.

B. Threatened and Endangered Species

Section 7 of the Endangered Species Act (ESA) and ESA's 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. USDA APHIS has considered the impacts of the proposed program regarding listed species in Multnomah County.

The marbled murrelet (*Brachyramphus marmoratus*), streaked horned lark (*Eremophila alpestris strigata*), yellow-billed cuckoo (*Coccyzus americanus*, and bull trout (*Salvelinus confluentus*) are the U.S. Fish and Wildlife Service (FWS) federally listed species that may occur in Multnomah County. APHIS is currently working with the FWS regarding the potential for impacts to any listed species from the proposed program. APHIS has prepared a biological assessment that the proposed gypsy moth program is not likely to adversely affect federally listed species managed by the National Marine Fisheries Service (NMFS), including Chinook, chum, sockeye, and coho salmon, Pacific eulachon, and North American green sturgeon. APHIS has submitted a biological assessment to the NMFS requesting concurrence on its determination that the program is not likely to affect listed species.

C. Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 U.S.C. 668–668c) prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald eagles, including their parts, nests, or eggs. The act provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle…[or any golden eagle], alive or dead, or any part, nest, or egg thereof." The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb."

APHIS contacted the Oregon Ecological Services FWS office and the FWS Pacific Regional Bald Eagle Coordinator to determine if any bald eagle nests may occur in the proposed treatment area. Nest location information within the proposed treatment blocks was provided to APHIS by the FWS and the Port of Portland. APHIS is working with ODA and the FWS Pacific Regional Bald Eagle Coordinator regarding updated information about nest activity and requirements for treating in proximity to active nests. Nest monitoring for activity will use protocols proposed by the FWS Pacific Regional Bald Eagle Coordinator (FWS, 2016). Nests that are determined to be active prior to the proposed treatments will have a 1000-foot no spray buffer applied to minimize nest disturbance. Spray buffers are based on recommendations from FWS in the National Bald Eagle Management Guideline document (FWS, 2007). APHIS is working with ODA and the FWS Regional Bald Eagle Coordinator for a potential disturbance permit in cases where applications within the 1000-foot no spray buffer may be required due to the presence of AGM host material that would require Btk applications. Btk has low toxicity to birds and would not be expected to have indirect effects to their prey items based on available toxicity data, therefore any permits would be based on the potential for disturbance.

D. Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918 (16 U.S.C. 703–712) established a Federal prohibition, unless permitted by regulations, to pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird or any part, nest, or egg of any such bird. FWS released a final rule on November 1, 2013, identifying 1,026 birds on the List of Migratory Birds (FWS, 2013). Species not protected by the Migratory Bird Treaty Act include nonnative species introduced to the United States or its territories by humans and native species that are not mentioned by the Canadian, Mexican, or Russian Conventions that were implemented to protect migratory birds (FWS, 2013).

The proposed use of Btk is not anticipated to result in negative impacts to migratory birds due to its low toxicity to vertebrates. Impacts to nesting and foraging are also not anticipated due to the selective nature of Btk to certain lepidopteran insects. Impacts to certain lepidopteran insects that are prey items for birds may occur; however, the comparatively small areas of treatment relative to suitable bird habitat in the spray area, and the general feeding habits of most migratory birds suggest that their populations would not be negatively impacted.

E. Historical Preservation

Consistent with the National Historic Preservation Act of 1966, APHIS has examined the proposed action in light of its impacts to national historical properties. No historic properties have been noted within the proposed treatment area. If there are changes in the program treatment area ODA will coordinate with the State Historic Preservation Office to ensure that if any historic properties occur in the proposed treatment area there will be no impacts to these properties.

F. 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 disproportionately high and adverse human health or environmental effects on any minority or low-income populations. The proposed treatment areas have been determined based on GM finds in the area. The proposed treatment itself will have minimal effects to those that live in this area, and will not have disproportionate effects to any minority or low-income population. ODA has been providing outreach to all communities within the proposed treatment area, including low-income populations such as the homeless. Future meetings and notification to the public within the affected communities, and with agencies such as the Portland Housing Bureau, will ensure that there are not disproportionate impacts to minorities and low-income populations.

Consistent with EO 13045, "Protection of Children from Environmental Health Risks and Safety Risks," APHIS considered the potential for disproportionately high or adverse environmental health and safety risks to children. The children in the proposed treatment areas are not expected to be adversely affected disproportionately more than adults from the proposed program actions. Available toxicity data and human health risk assessments about the potential risk of Btk have shown that children would not be at risk from the proposed treatments. Additionally, outreach and notification to the public regarding the treatments will allow concerned parents to reduce the potential for exposure during the proposed treatment dates.

Executive Order 13175, “Consultation and Coordination with Indian Tribal Governments” was issued to ensure that there would be “meaningful consultation and collaboration with tribal officials in the development of Federal policies that have tribal implications…”. Ceded tribal lands within the proposed treatment area were identified and a request for consultation was submitted to the affected tribes on February 4, 2016.

VII. Listing of Agencies and Persons Consulted

National Marine Fisheries Service
510 Desmond Drive SE, Suite 103
Lacey, WA 9853

Oregon Department of Agriculture
Plant Division
635 Capitol St. NE
Salem, OR 97301

Port of Portland
7200 NE Airport Way
Portland, OR 97218

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Plant Protection and Quarantine
Plant Health Programs
4700 River Road, Unit 134
Riverdale, MD 20737

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Plant Protection and Quarantine
6135 NE 80th Avenue
Portland, OR 97218

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. Fish and Wildlife Service
Division of Migratory Birds
911 Ne 11th Avenue
Portland, OR 97232

U.S. Fish and Wildlife Service
2600 SE 98th Ave. Suite 100
Portland, OR 97266

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Appendix A. Map of Treatment Area