Cooperative Screwworm Eradication Program

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I. Introduction

A. Background

The New World screwworm, *Cochliomyia hominivorax*, is a fly of the family Calliphoridae that is found in tropical and semitropical regions of North, Central, and South America (USDA-APHIS 2014b). In this document, “screwworm” refers to this species. The screwworm is a serious pest of warm-blooded animals such as livestock, domestic and wild animals and, rarely, human beings, at an estimated average cost of $20 million per year to the United States livestock industry (USDA-APHIS 2017a). Because screwworm has the potential to cause significant economic losses to animal breeders (Vargas-Terán et al., cited in Fresia et al. 2014), dairy farms, and leather production (IAEA/FAO 2000; Vargas-Terán et al. 2005-), it is necessary to plan an effective emergency response to ensure that veterinary or medical treatment is done in a timely manner and that any risk of spread of released fertile adult flies from the infested host is prevented.

Female flies lay their eggs at the edges of wounds or on mucous membranes of animals, which then hatch into larvae (Wyss 2000, USDA-APHIS 2014b, Hall et al. 2016). Flies will not lay eggs on dead animals (USDA-APHIS 2014b). As the larvae feed on the flesh of an animal, the infested wound becomes enlarged and putrid, attracting more screwworm flies that lay more eggs in or near the wound. This condition is called myiasis. Animals with myiasis may display signs of discomfort, lethargy, weight loss and depression (USDA-APHIS 2014a, Hall et al. 2016). If untreated, a severe case of myiasis may cause the death of the animal within 1 to 2 weeks (USDA-APHIS 2014b).

The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS) has eradicated the screwworm fly from the United States and has participated in successful cooperative screwworm eradication programs in Mexico and Central America. The United States was declared screwworm-free in 1966, followed by Mexico in 1991, Belize and Guatemala in 1994, El Salvador in 1995, and Honduras in 1996 (Wyss 2000). Currently, screwworm is found in every South American country except Chile, and in five countries in the Caribbean (Robinson et al. 2009, Mastrangelo and Welch 2012, USDA-APHIS 2014b, a). The screwworm was eradicated from Panama in 2005 (The Center for Food Security and Public Health 2007), and the Darien province in that country is now the northernmost limit of New World screwworm (Hall et al. 2016). Sterile screwworm adults are regularly released in the Darien Gap to prevent reinvasion from South America, and remains at risk because of Caribbean populations (Robinson et al. 2009).

Although screwworm is usually a pest of large domesticated animals, it was recently identified in federally endangered Florida Key deer *(Odocoileus virginianus clavium*, a subspecies of white-tailed deer). In July 2016, three cases of severe myiasis were found in three domestic animals, and in a Key deer, although confirmation did not come until September 2016 (USDA-VS 2016). The following month, screwworm infestations were reported on several Keys (Delgado et al. 2016). Many of the Key deer wounds that were infested by screwworms likely were from injuries from males battling one another for mates (rutting), causing head and shoulder wounds from antlers (FWS 2016b). This outbreak was the first Florida infestation in 57 years (FDACS 2016c), and the first U.S. infestation in 34 years (FDACS 2016c).

Between October 2016 and January 2017, more than 130 Key deer were killed by screwworm or had to be euthanized as a result of screwworm (Association 2017b). The Florida Commissioner of Agriculture declared an agricultural emergency, and as a result, the Florida Department of Agriculture and Consumer Services (FDACS) established an animal health checkpoint in Key Largo, Florida, to check all animals traveling north on Route 1 for signs of screwworm infestation to prevent further spread of the fly (FDACS 2016a). In addition, APHIS began releasing sterile flies in October 2016 (FDACS 2016a).

In January 2017, a stray dog infested with screwworm was discovered on the mainland, near Homestead, Florida, approximately 100 miles northwest of the original infestation. It is unclear how the dog arrived in Homestead, but it was the only positive case of screwworm identified in the area. Sterile flies were released in the Homestead area as a precaution (Association 2017a).

In total, more than 188 million sterile flies were released in affected areas of the Florida Keys, and more than 17,000 inspections occurred at animal health checkpoints (USDA-APHIS 2017c). On March 23, 2017, APHIS announced that this effort had successfully eradicated screwworm in Florida (USDA-APHIS 2017b). APHIS considers an area to be screwworm-free following surveillance (trapping flies and visually inspecting animals for signs and symptoms of screwworm infestation). No new cases of screwworm have been reported in Florida since January 10, 2017. When sterile flies are released, elimination of screwworm is usually achieved within three life cycles after the last detection. The flies have on average a 21-day life cycle, and they continue to circulate in the area for three weeks beyond each release. In the Keys, APHIS completed five life cycles beyond the last positive screwworm detection. Out of an abundance of caution, APHIS also released flies in the Homestead area for three completed life cycles.

APHIS and FDACS will continue passive surveillance to ensure any new findings are quickly identified. This surveillance includes veterinarians reporting any suspicious cases, wildlife surveillance, concerned citizens that see suspicious wounds on animals or even on a person, and continued communication with the parks and the National Key Deer Refuge (USDA-APHIS 2017b).

B. Screwworm Biology

The screwworm's life cycle length varies with temperature: in warmer temperatures, it can be as brief as 18 days, or in cooler areas, as prolonged as 2 to 3 months (Baumhover 2002). Female flies lay two or more clutches of up to 400 creamy white eggs at a time (and up to 2,800 eggs in a typical 10-30 day lifespan (USDA-APHIS 2017a) in a shingle-like pattern at the edges of wounds or body orifices (Laake et al. 1936; Knipling, cited in Novy 1991). Egg batches are laid in intervals of a few days (Hightower et al. 1972). Larvae hatch within a day (Matlock and Skoda 2009), and immediately start to feed on fluids and underlying tissues. As they feed, the wound enlarges and deepens due to damage from the larva's hook-like mouthparts. The odor, serum, and blood from the wound attracts additional females to oviposit in the wound. Severe infestations may lead to host death (USDA-APHIS 2014b).

Second- and third-instar larvae may be distinguished by their resemblance to a wood screw: they have a tapered, cylindrical body with rings of backwardly protruding dark brown spines around the body (Figure 2) (Laake et al. 1936), lending the name screwworm (FAO 2008). A second diagnostic character is that while other fly larvae are surface feeders, screwworm larvae burrow deep below the surface of tissues to feed (FAO 2008, Agriculture 2016b).

Figure 2. *Cochliomyia hominivorax* screwworm larva (left) (photo by J. Kucharski, USDA ARS) and adult (right) (photo by Guillermo Fadul, Screwworm Barrier Maintenance Program in Panama).

Five to seven days after egg hatch (Matlock and Skoda 2009), mature larvae exit the wound and burrow a few centimeters into the ground to pupate (USDA-APHIS 2014a). Depending on temperature, pupae mature in as short as 7 days or as long as 60 days (USDA-APHIS 2014a).

Adult screwworm flies have a distinctive coloration and pattern: a reddish-orange head, a metallic blue or bluish green thorax and three longitudinal dark stripes on the dorsum, or back, of the fly (Figure 2) (Laake et al. 1936). Males live from two to three weeks, feeding on flower nectar, while females, which feed on flower nectar and animal flesh, live about 10-30 days (The Center for Food Security and Public Health 2007). Males can mate within 1 day of emergence, females within 3 days (FAO 1992).

Screwworm females may lay eggs in wounds as small as tick or insect bites such as stable or horn flies (Alexander 2006, Mastrangelo and Welch 2012), as well as wounds subsequent to animal husbandry practices including dehorning, castration, docking, branding, registration tagging, and shear cuts (for goats) (Alexander 2006, Robinson et al. 2009, Hall et al. 2016). Other sites may include the inner corners of eyes, nasal sinuses, periodontal tissues, rectal and genital orifices, navels of newborns, and shedding of antler velvet in deer (Chaudhury et al. 2010, Mastrangelo and Welch 2012, USDA-APHIS 2014b, FDACS 2016a, Hall et al. 2016).

In addition to visual cues, screwworm females may be attracted to the distinctive odor emanating from wounds (FAO 1992, Alexander 2006, Cork and Hall 2007). Volatiles from the bacterial action of coliform species residing in the wounds may be responsible for this attraction (Baumhover 2002, Cork and Hall 2007, Chaudhury et al. 2010). Other species of flies may also infest the wound, and secondary bacterial infections may occur (FAO 1992).

Flies are capable of long-distance flight up to 300 kilometers (Hightower et al. 1965), but typically fly only 10 to 20 kilometers in warm, humid environments (OIE, 2013). According to Mayer and Atzeni (1993), long-distance dispersal may occur as a result of wind and other climatic conditions, habitat factors, and the availability of food and hostss.

C. Purpose and Need

The discovery of any infested person or animal returning to the United States from infested countries requires emergency medical or veterinary treatment to remove any active larvae present in open wound tissues. The possible emergence of full grown screwworm fly larvae from an infested animal or human poses a risk of fly dispersal to the surrounding community, and this potential to spread constitutes a public health threat, an environmental threat, and an agricultural threat. Discovery of infested animals is often revealed by veterinary inspection upon arrival, but screwworm myiasis in a human may go undetected for several days after the person has returned to the United States. Delays in treatment increase the possibility that larvae could emerge and reproducing adult flies could escape to the surrounding areas. The opportunistic nature of the screwworm flies in these site-specific situations makes it critical that emergency action begin immediately to eliminate any pest risk.

In response to the elevated threat of infestation of screwworms to livestock and humans in the United States, APHIS proposes to participate cooperatively with state agriculture departments in localized actions designed to exclude and eradicate screwworms in the United States. The emergency nature of these actions to exclude screwworms from being reintroduced to the United States requires that all necessary planning documentation be prepared in advance to allow the required emergency actions to proceed in a timely manner. Each eradication action will be adapted in response to the individual circumstances associated with the detection of persons or animals with myiasis. An infested passenger or animal could enter the United States at any international airport, border crossing, or marine port. Therefore, actions could occur at any location in the country. However, the urgency of response to actual pest risk increases at those locations where the screwworm fly has historically been known to breed year-round, particularly in the southern United States (Arizona, California, Florida, New Mexico, and Texas) where average winter temperatures are not cold enough to affect screwworm fly survival.

APHIS has responsibility for taking actions to exclude, eradicate and/or control agricultural pests such as screwworms. The statutory authority for conducting this program in cooperation with the state agencies is contained in the Talmadge-Aiken Act (7 U.S.C. 450); and in 21 U.S.C. 111, 114, 123, and 134. APHIS' authority for regulatory action in this program is based upon 7 CFR Part 2.80, which authorizes the implementation of programs to exclude, control, and eradicate insect pests that serve as agents of animal disease. The Animal Health Protection Act of 2002, as amended (7 U.S.C. §§·8301-8317), provides broad authority for APHIS to prevent the introduction into or dissemination within the United States of any pest or disease of livestock (§§ 8303-8305).

The information presented in this environmental assessment is consistent with requirements in the National Environmental Policy Act of 1969 (NEPA), as amended (42 U.S.C. §§ 4321 et seq.), NEPA regulations promulgated by the Council on Environmental Quality (40 CFR§§ 1500-1508), and APHIS implementing procedures (7 CFR part 372).

II. Alternatives

The two alternatives considered for eradication of screwworms in the United States are: (1) no action, and (2) a cooperative screwworm eradication program (the preferred alternative). The scope of alternatives is limited necessarily by the need for action; however, flexibility exists within the framework of the kinds of actions that are possible within the preferred alternative. The possible actions applied to each alternative are described in this chapter and the potential environmental impacts associated with these alternatives are presented in chapter III.

A. No Action

The no action alternative would not involve APHIS in any program to eradicate or exclude screwworm flies. APHIS activities under the no action alternative would be limited to professional consultation and some coordination in support of activities to eradicate the flies. The responsibilities for the eradication of screwworm flies would be given to state and local governments with possible assistance from some public health organizations. Selection of the no action alternative would be expected to eventually result in additional reintroductions and spread of screwworms in the United States. This alternative would have considerable potential for adverse effects to public health, to the well-being of livestock, and to the health and survival of susceptible species of wildlife. The potential adverse impacts from the selection of this alternative would be much greater than from a cooperative screwworm eradication program.

B. Preferred Alternative

Under this alternative, the proposed cooperative screwworm eradication program would be characterized by a comprehensive program to detect screwworm flies in all life stages, treat infested individuals, and, where necessary, release sterile screwworm flies. The program would involve the cooperation of APHIS with State and local agencies and departments to eliminate any potential pest risk when emergency program action is necessary. APHIS actions related to this alternative prevent entry and spread of the screwworm fly in the United States. The costs of prevention are much less than would be the control costs in the absence of this effort.

Detection of screwworms requires surveillance of host animals and humans for infection, monitoring of fly populations using insect traps, and reporting of cases of myiasis by ranchers, veterinarians, and medical personnel. Most detections are expected to be reported through veterinary inspections or medical reporting. Trapping with decomposing liver and possibly vertical sticky traps may be used if it is suspected that adult flies have emerged at a given location. Swormlure-4, the lure used in the screwworm traps, releases a strong odor to attract screwworm flies.

If emergency program action is needed, APHIS will conduct veterinary inspection of domestic animals and livestock of foreign origin to detect screwworm myiasis. APHIS will also perform a thorough pathway study to identify possible sites of fly emergence, including monitoring population levels with trapping to determine the extent of the infestation. APHIS’ program would require insecticide treatment of all livestock wounds where there is a high risk of screwworm introduction.

In the event that humans become infested, the resultant discomfort will probably lead to prompt medical treatment. The length of time that elapses before these individuals seek medical treatment will determine the potential for introduction and spread of screwworms into the United States. Earlier medical treatment (preferably immediately upon entry to the United States) would result in less chance of fly emergence from a wound.

Program response to the reported entry of an infested person or animal, or of infested wildlife or livestock, must be decided on a case-by-case basis. If the screwworm discovery is on a small scale, the medical or veterinary treatment of the individual or animal would focus on preventing further tissue damage and to prevent the emergence from open wound tissue of mature larvae that could disperse. The extent of program action after treatment depends upon movement of the infested host and development of the larval screwworms in their open wound tissues. APHIS will base its program response decisions on similar information in the event of small or large scale screwworm infestation in wildlife, as well.

When a case of screwworm myiasis is found several days after a person or animal has returned to the United States, APHIS will conduct an epidemiological pathway study to determine the possible locations in the United States where emergence of viable larvae from the wound could have occurred. This study is done by reviewing the locations where the person or animal has been since their entry into the United States. If the screwworm myiasis is detected at the time of arrival of the individual into the United States and treated immediately, then further actions may not be needed. If the infection is detected at an early stage when the screwworm larvae are only in the first instar, then the risk of release of viable screwworms from the infested host is slight and further actions may also not be needed to eliminate the risk of screwworm reintroduction after treatment. If, however, there has been some larval development in the infested tissue and the infested individual has spent some time at various locations in the United States, then further agency action will be considered.

If the detection of screwworm warrants the use of insecticides to prevent its spread, treatments would be made with insecticides registered with the U.S. Environmental Protection Agency (EPA) for control of screwworm flies. The treatments would be applied in a timely manner to ensure that there is no survival of adult screwworm flies and no movement of flies outside the treatment area. The organophosphate, carbamate, and pyrethroid classes of insecticides are effective against larval and adult flies (USDA-APHIS 2014b). Doramectin oral doses can be administered to livestock for protection (The Center for Food Security and Public Health 2007, Mastrangelo and Welch 2012).

A critical method of screwworm control is the sterile insect technique (SIT) (Wyss 2000). Control with sterile screwworms, a technique used with great success for the past 61 years, involves the mass rearing, sterilization (irradiation of 5-to 6-day old pupae), and ground or aerial release of sterilized screwworm flies. The flies are released in sufficient quantities to outnumber and outcompete wild screwworm flies in the mating process. When sterile males mate with fertile females, the females then lay sterile eggs, which are not viable. Because females only mate once, the population of flies is progressively reduced (Knipling 1955). After successive releases, the wild screwworm population decreases to zero.

Use of SIT will be considered when APHIS determines that a population of the flies is present or may be in the process of developing within the continental United States. Factors to be considered include stage of larval development, affected host's movement history, environmental and seasonal considerations, and in the case of humans, time elapsed since U.S. entry, locations visited since returning to the United States, and treatment provided (USDA-APHIS 2014a).

The simplest and most rapidly effective release is at ground level. Dispersal by air may be considered if the infested area is large, or if other factors make ground release impractical or ineffective (USDA-APHIS 2014a). The Florida infestation was treated with ground release of sterile flies. Sterile release of flies should continue for at least 3 life cycle periods, or about 9 weeks in warm conditions after the last positive case or fertile fly detection (USDA-APHIS 2014a).

The Program would add other methods to the list of approved screwworm eradication program methods that may become available in the future that have the same or fewer potential environmental impacts. The addition of methods to the program is referred to as adaptive management. A new chemical treatment would be available for use if it is registered by the EPA to control screwworm and poses no greater risks to human health and non-target organisms than the currently approved treatments.

III. Potential Environmental Impacts

In this chapter, APHIS summarizes the potential impacts of the no action and preferred alternatives to the physical, biological, and human environment of the southern portions of Florida, Texas, New Mexico, and Arizona. Screwworm thrives in tropical and subtropical environments, and can survive winters in these states (Novy 1991).

A. No Action

The no action alternative would not involve APHIS in any program to eradicate or exclude screwworm flies. The responsibilities for the eradication or suppression of screwworm flies would be given to state and local governments. Although state and local governments might successfully eradicate and exclude screwworms under certain circumstances, their access to useful resources on an emergency basis is more limited than APHIS. For example, the SIT used against screwworm flies is strictly a Federal or international effort that would not be directly available to state or local governments. Selection of the no action alternative would be expected to eventually result in the reintroduction of screwworms to the United States and eradicated areas in Mexico and Central America. The rate of dispersion from the site of introduction depends upon location and climatic conditions at the time, but dispersion could eventually include the historic limits in North America. The screwworm fly was historically established in the southern United States and dispersed northward as far as the Canadian border annually. Prior to 1962, the state of Texas, which accounted for the majority of screwworm infestations, estimated that up to 1 million livestock animals were infested in a given year. From then until the late 1970s, screwworm infestation fluctuated with weather and other factors, from the hundreds to thousands (Novy 1991). Inaction or inadequate action would have considerable potential for adverse effects to public health, to the well-being of livestock, and to the health and survival of susceptible species of wildlife. The potential adverse impacts from the selection of this alternative could be much greater than from a cooperative screwworm eradication program.

1. Physical Environment

The affected area includes the historic range of the screwworm in the central and southern United States (James 1947). Most important to the incidence and severity of potential screwworm infestations are climatic conditions. Screwworm populations are most abundant in hot and humid areas (Vargas-Terán et al., 2005). Due to eradication efforts, screwworm has not occupied the extent of its potential range in decades; however, the northward trend in warmer temperatures could lead to an expansion of the screwworm's range northward in the United States.

National, state, county, and city parks, as well as National Wildlife Refuges, are located within the geographic area described for this assessment. An example of the parks within the affected environment are located in Table 1. Parks are considered mixed-use and are used for recreational purposes and preservation of animal habitats and ecological resources. National Wildlife Refuges are managed by the U.S. Fish and Wildlife Service (FWS) and are areas set aside to conserve fish, wildlife, and plants.

Table 1. Several parks and wildlife refuges in the affected area

State	Park or Refuge
Arizona	Buenos Aires National Wildlife Refuge
	Cabeza Prieto National Wildlife Refuge
	Grand Canyon National Park
	Leslie Canyon National Wildlife Refuge
	Saguaro National Park
	San Bernadino National Wildlife Refuge
California	Coachella Valley National Wildlife Refuge
	Death Valley National Park
	Joshua Tree National Park
	San Diego National Wildlife Refuge
	Seal Beach National Wildlife Refuge

State	Park or Refuge
Florida	Biscayne National Park
	Everglades National Park
	National Key Deer Wildlife Refuge
	Key West National Wildlife Refuge
	Ten Thousand Islands National Wildlife Refuge
New Mexico	Carlsbad Caverns National Park
	San Andres National Wildlife Refuge
Texas	Big Bend National Park
	Guadalupe Mountains National Park
	Laguna Atascosa National Wildlife Refuge
	Lower Rio Grande National Wildlife Refuge

Soil plays a key role in determining the capacity of a site for biomass vigor and production in terms of physical support, air, water, temperature moderation, protection from toxins, and nutrient availability. Soils also determine a site's susceptibility to erosion by wind and water, and flood attenuation capacity. Soil properties such as temperature, pH, soluble salts, amount of organic matter, the carbon-nitrogen ratio, numbers of microorganisms and soil fauna all vary seasonally, as well as over extended periods of time (USDA-NRCS 1999). Soils are organized into four levels of classification, the highest being the soil order. Soils are differentiated based on characteristics such as particle size, texture, and color, and classified taxonomically into soil orders based on observable properties such as organic matter content and degree of soil profile development (USDA-NRCS 2010). The Natural Resources Conservation Service (NRCS) maintains soil maps on a county level for the entire United States and its territories. Under the no action alternative, soils in the program area would not be disturbed.

The Clean Air Act (CAA) requires the maintenance of National Ambient Air Quality Standards (NAAQS). The NAAQS, developed by the EPA to protect public health, establish limits for six criteria pollutants: ozone (O_3), nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), lead (Pb), and inhalable particulates (coarse particulate matter [PM] greater than 2.5 micrometers and less than 10 micrometers in diameter [PM_{10}] and fine particles less than 2.5 micrometers in diameter [$PM_{2.5}$]). The CAA requires states to achieve and maintain the NAAQS within their jurisdiction. Each state may adopt requirements stricter than those of the national standard and each is also required by EPA to prepare a State Implementation Plan containing strategies to achieve and maintain the national standard of air quality within the state. Areas that violate air quality standards are designated as non-attainment areas for the criteria pollutant(s), whereas areas that comply with air quality standards are designated as attainment areas. Non-attainment areas are typically associated with large metropolitan areas with many mobile (e.g., vehicle) and stationary (e.g., power plants and factories) sources. Other than emissions from mobile sources, crop farming emission sources are not specifically regulated nationwide under the CAA. The degree to which emissions from farming practices (such as prescribed burning) are allowed are location-specific within each State Implementation Plan (US-EPA 2011). The no action alternative will not impact air quality, and any vehicle use associated with this alternative is minor compared to background use of vehicles, particularly in metropolitan areas.

The principal law governing pollution of the nation's water resources is the Federal Water Pollution Control Act of 1972, better known as the Clean Water Act (CWA). The Act uses water quality standards, permitting requirements, and monitoring to protect water quality. The EPA sets the standards for water pollution abatement for all waters of the United States under the programs contained in the CWA, but, in most cases, gives qualified states the authority to issue and enforce permits. Drinking water is protected under the Safe Drinking Water Act of 1974 (Public Law 93-523, 42 U.S.C. 300 *et seq*.).

Surface water in rivers, streams, creeks, lakes, and reservoirs supports everyday life through the provision of water for drinking and other public uses, irrigation, and industry. Surface runoff from rain, snowmelt, or irrigation water can affect surface water quality by depositing sediment, minerals, or contaminants into surface water bodies. Surface runoff is influenced by meteorological factors such as rainfall intensity and duration, and physical factors such as vegetation, soil type, and topography. The no action alternative will not change patterns of surface water, ground water, or drinking water from current patterns.

2. Biological Resources

Vegetation

Diverse vegetation characterizes the affected environment. APHIS identified a representative selection of plant species for regions in Arizona, California, Florida, New Mexico, and Texas in Table 2. The no action alternative will not affect plant communities in the affected area.

Table 2. Representative vegetation in the affected area (Society 2017, USDA-APHIS 2017a, Association No Date)

State	Region	Vegetation
Arizona	Southern	Prickly pear, cholla, creosote bush, mesquite
California		Coast live oak, Fremont cottonwood, California buckeye, mission manzanita, western columbine, California wax myrtle, sand dune sedge, quaking aspen, Santa Lucia bush mallow, succulent species
Florida	Southern coastal flatwoods	Slash and longleaf pines; cabbage palms and live oaks; understories of saw palmetto, gallberry and grasses
	Everglades and Keys	Bald cypress, mangroves, willows, sawgrass, pickleweed, buttonbush and maidencane

State	Region	Vegetation
New Mexico	Southern	Desert grasses and shrubs such as mesa dropseed, creosote bush, sagebrush, yuccas, blue grama grass and sideoats grama grass, junipers, pinyons, and ponderosa pine
Texas	Gulf prairies and marshes	Oaks, elms, tall bunchgrasses, saltgrass, pricklypear, sedges and rushes

Wildlife

A wide variety of mammals, reptiles, amphibians, birds, and fish inhabit the affected area. Some representative wildlife are listed in Table 3. If the no action alternative is selected, some animals may become infested with screwworm, and population levels could decline significantly. The Florida Key deer infestation that ensued in 2016 resulted in the deaths of more than 130 deer, illustrating the potential of screwworm to quickly impact wildlife populations.

Table 3. Representative wildlife in the affected environment

State	Mammals	Birds	Reptiles and Amphibians	Fish	References
Arizona	Mule deer	Quail	Rattlesnake	Trout	(USDA-NCRS 2006)
	Desert bighorn sheep		Kingsnake	Largemouth bass	(Department 2016)
	Antelope			Crappies	
	Javelina			Catfishes	
	Coyote			Yellow perch	
				Arctic grayling	
California	Bats	Loons	Salamanders	Crappies	(Wildlife 2016a)
	Squirrels	Grebes	Frogs and toads	Bullheads	(University of California 2017)
	Mice, rats and voles	Albatrosses	Tree frogs	Trout	
	Foxes	Herons	Snapping turtles	California tilapia	
	Wolves	Boobies	Tortoises	Salmon	
	Raccoons	Cormorants	Geckos	Coastal three spine stickleback	
		Storks and ibises	Gila monsters	Humboldt sucker	
			Pit vipers	Sculpins	
Florida	White-tailed deer	Woodpeckers	Alligators	Largemouth bass	(USDA-NCRS 2006)
	Feral hog	Mourning dove	Turtles	Black crappie	
	Bobcat	Bobwhite quail		Red drum and blackdrum	
		Wood storks		Sea trout	

State	Mammals	Birds	Reptiles and Amphibians	Fish	References
	Raccoon	White ibis		Tarpon	
	Skunk	Egrets		Sheepshead	
	Otter	Herons		Snook	
	Squirrel	Snipe			
New Mexico	Mule deer	Scaled quail	Eastern snapping turtle	Gila trout	(USDA-NCRS 2006)
	White-tailed deer	Mourning dove	Rio Grande cooter	Rio Grande cutthroat trout	(Society 2017)
	Antelope		Western painted turtle		(Fish 2016)
	Javelina		Alligator lizards		
	Mountain lion		Leopard lizards		
	Cougar		Geckos		
	Foxes		Gila monsters		
	Bobcat		Sonoran whipsnake		
	Badger		Western diamond rattlesnake		
			Toads and frogs		
			Salamanders		
Texas	Armadillo	Cormorants	Cottonmouths	Black bass	(Association No Date-a)
	Bats	American coot	Copperheads	Temperate bass	(Wildlife 2016b)
	Bear	Egrets	Alligators	Catfishes	(Wildlife No Date)
	Bison	Herons		Bullheads	
	Coyote	Killdeer		Crappies	
	Beaver	Woodpeckers		Sunfishes	
	Deer	Ruby-crowned kinglet		Carps	
	Foxes	Meadowlarks		Minnows	
	Gophers	Brown-headed cowbird		Gars	
	Prairie dogs	Red-winged blackbird		Blackdrum and reddrum	
	Javelina			Snook	
	Sheep			Seatrout	

Agricultural Production
The following is a brief summary of key agricultural crops in the affected states. Arizona's chief commodities are cotton, lettuce, sorghum, spring wheat, broccoli, cauliflower, chile peppers, honeydew and cantaloupe (USDA-NASS 2016d). California's number one crop is almonds, followed by grapes, strawberries, English walnuts, and hay. Oranges and grapefruit production are also important in California (USDA-NASS 2016a).

Chief crops in Florida are oranges, strawberries, bell peppers, grapefruit, and peanuts, in that order. Other citrus fruits such as tangerines and tangelos also contribute to the state's economy (USDA-NASS 2016b). Much of the land in the affected area of southern California is under irrigation, and is managed for crops such as rice, sugar beets, cotton, and grain (USDA-NCRS 2006).

The most important crops in New Mexico are pecans, hay, cotton, and onions (Agriculture 2016c). Major commodities in Texas are cotton, grain corn, sorghum, and wheat (USDA-NASS 2016c). The no action alternative will not have any impact on agricultural production in Arizona, California, Florida, New Mexico, or Texas.

Livestock Production
For the purposes of this EA, livestock refers to cattle and calves; hogs and pigs; sheep and lambs; and goats, and also includes milk, wool, and mohair production. Cattle and calves refers to all cattle and calves, whether raised for beef or for dairy.

Of the states in the affected area, Texas has the largest livestock industry (Table 4). In 2015, California led the nation in milk production with 40.9 billion pounds (lb), followed by Texas with 8.27 billion lb, New Mexico with 7.8 billion lb, Arizona with 4.7 billion lb, and Florida with 2.5 billion lb (USDA-NASS 2012, Agriculture 2016a, Agriculture 2016c, FDACS 2016b, USDA-NASS 2016d).

Table 4. Livestock production in the affected area in 2015 (Agriculture 2016a, Agriculture 2016c, FDACS 2016b, USDA-NASS 2016d)

State	Cattle and Calves	Hogs and Pigs	Sheep and Lambs	Goats
Arizona	0.88 million	139,000	150,000	64,000
California	5.1 million	95,000	330,000	128,400
Florida	1.7 million	18,000	no data	47,400
New Mexico	1.38 million	1,500	90,000	11,000
Texas	11.7 million	880,000	735,000	928,000

Wool is another valuable livestock commodity. In 2015, California produced 2.85 million lb of wool, Texas produced 1.95 million lb, Arizona produced 680,000 lb, and New Mexico produced 648,000 lb. Mohair, from Angora goats, is produced in Arizona (120,000 lb), and Texas (580,000 lb) (USDA-NASS 2012, Agriculture 2016a, Agriculture 2016c, FDACS 2016b, USDA-NASS 2016d). All of the livestock production facilities in states within the proposed program area are vulnerable to screwworm infestations. Under the no action alternative, APHIS would not be able to treat outbreaks; this role would fall to state and local authorities and livestock producers. Subsequently, livestock producers have a greater likelihood of suffering losses under the no action alternative than under the preferred alternative.

3. Human Health and Safety

In rare instances, humans may become infested with screwworm. However, the discomfort associated with an infestation would usually lead the individual to seek prompt medical attention, and risk of spread of the infestation would likely be minimal.

If the no action alternative is selected, it is possible that livestock may become infested. Because livestock are raised primarily for meat or for commodities such as milk and wool, if infestations are large enough to cause serious animal losses, meat and milk prices may rise to accommodate shortages, which negatively impacts consumers. Meat as a dietary source of protein could be replaced by other food items, but this may be challenging for some populations. This situation is both stressful for producers suffering loss of livestock and associated income, and for consumers who may no longer be able to afford these products.

B. Preferred Alternative

The objective of the screwworm eradication program is to prevent entry of screwworms and eradicate any introduced screwworm flies released into the United States from an infested person or animal. The proposed program involves (1) detection of screwworm flies in all life stages, (2) treatment of infested individuals, (3) insecticide applications to eliminate screwworm flies and, if necessary, (4) the release of sterile screwworm flies.

Program monitoring of screwworm fly populations involves detection and reporting by ranchers, veterinarians, and medical personnel, trapping, and surveillance of host animals and humans. Trapping may be used if APHIS suspects that adult flies have emerged at a given location.

An infested human or animal should be treated as soon as possible by medical, veterinary, or wildlife personnel in order to prevent further tissue damage and emergence from the wounded tissue of mature larvae. Adherence to proper disposal of wastes from the medical and veterinary procedures ensures that there are no environmental risks and eliminates the potential risk of spread from screwworms that could emerge from untreated wounds. This treatment and proper disposal are critical to eliminate the public health risks, animal health risks, and risks to nontarget wildlife associated with screwworm fly infestations.

In addition to basic veterinary treatment, application of a formulated permethrin, coumaphos, or doramectin product may be used to treat external wounds on domestic animals and livestock to control and/or prevent screwworm infestations (USDA-APHIS 2014b). These formulations are registered with the EPA for this use. Program personnel are trained in the proper application procedures and safety precautions for these insecticides. Applications of these formulations are effective against screwworm flies and are not repellent to the flies. Although other insecticide formulations may effectively control screwworm flies, they may be more toxic to the infested host, be more irritating to the wound tissue, have repellent qualities to screwworm flies, or lack current EPA registration for this type of treatment. As part of the planned mitigation measures for the program, the program will also implement appropriate pesticide storage and disposal procedures for insecticides. The rapid response required for screwworm emergency efforts makes it important that insecticide applications be considered in a timely manner to all sites where there is high risk of emergence of screwworms from wounds of infested individuals.

Release of sterile flies is an important component of the program for eliminating screwworm populations. The sterile release program is discussed in detail in Chapter 2, Alternatives, under the preferred alternative.

1. Physical Environment

Preferred alternative actions associated with the screwworm program have some potential environmental impacts, but the adverse impacts from these actions are generally minimal and of short duration. These potential environmental impacts are discussed below.

Spillage of insecticides is a potential problem with respect to environmental contamination, although following best management practices will reduce the likelihood of this occurring. Ensuring that pesticide applicators are well-trained to handle spills will help mitigate potential environmental impacts that could occur as a result of a spill.

Permethrin is a synthetic pyrethroid that targets the insect nervous system. It may be used in mosquito treatment, used in food and feed crops, and on ornamental lawns, and on livestock and pets, structures, and buildings. If permethrin is spilled, it is fairly immobile in soil, where it is usually degraded by microorganisms. Sunlight may break down permethrin in the top layer of soil or surface water, but adheres well to sediments and persists for a relatively long time. Permethrin has low water solubility (EPA 1996, 2009), and will, therefore, not significantly impact groundwater (Toynton et al. 2009).

Coumaphos is a broad-spectrum organosphosphate chemical used to control arthropod pests on livestock by means of wettable powders, emulsifiable liquids, dusts, and flowable and ready-to-use products. As with permethrin, coumaphos is immobile in soil, but rapidly degraded by sunlight in water. It can, however, leach from soil into groundwater. Dip vats are used by APHIS to treat cattle near the United States-Mexico border, primarily to control ticks. Coumaphos residues in cattle dip vats may be degraded by bacteria that contaminate the vats (EPA 1996).

Doramectin is a fermentation product of a specific strain of *Streptomyces avermitilis* structurally similar to abamectin and ivermectin in the macrocyclic lactone chemical class. Doramectin affects gamma-aminobutyric acid (GABA)-sensitive neurons, which can lead to neurotoxicity, expressed by tremors, ataxia and gait abnormalities in mammals. The only volatile component of doramectin formulations is isopropyl alcohol, which is emitted in very small quantities during application. Its aqueous solubility is low, and it is rapidly broken down by sunlight in water. Doramectin residues strongly sorb to feces, and residues may be concentrated over time, although total quantities are thought to be very small (FDA 1997b, a). Through the excretion of doramectin in livestock and other animal waste, doramectin may contribute to rainfall runoff and, therefore, could be a source of pollution to soil, surface water and groundwater (Gil-Diaz et al. 2011).

The SIT program has minimal impact on the environment except to the target insect, the screwworm. Irradiated screwworm flies are sterile, but they are not radioactive.
The use of small aircraft to disperse sterile flies will release some pollutants such as carbon dioxide, nitrogen oxides, carbon monoxide, sulfur oxides, and water vapor; however, since agricultural aviation is currently used to treat crops, it is unlikely that planes used to release flies would add significantly to pollutant loads. The same is true for the use of road vehicles to move to treatment points, or to release sterile flies by ground.

2. Biological Resources

Since livestock are important to United States agriculture for commodities such as meat, milk and dairy products, and wool, prevention and treatment of screwworm is crucial. Given the history of screwworm in the United States before its eradication in 1966 (Wyss 2000), and its detrimental effect on livestock populations, preventing outbreaks from reaching livestock is important.

The preferred alternative should lead to overall benefits to livestock and wildlife. If animals become infested with screwworm, veterinary treatment with chemicals such as permethrin, doramectin or coumaphos may be used. The use of insecticides occurs primarily with livestock. However, with the discovery of screwworm on National Key Deer Refuge in Florida, FWS implemented a program to locate infested deer and administer medication, treat wounds by wildlife veterinarians, and to euthanize deer as appropriate. FWS prophylactically treated Key deer with oral doses of the drug doramectin. In addition, twenty-seven stations were constructed to allow deer to self-medicate by visiting the stations, and more than 3,000 doses of doramectin were administered (Service 2016).

Exposure to these chemicals can be minimized by management of treated animals. Following treatment for screwworm or for other parasites, livestock are usually kept penned for a specific refractory period, to avoid contact with humans and wildlife (Zoetis 2013b). Chemical residues may be transferred from a treated animal to an untreated animal by activities such as grooming (Floate et al. 2005), but these quantities are expected to be small. Wildlife and livestock may come into contact with each other in locations such as foraging areas and sources of water, but again, transfer of pesticide residues are likely to be very small.

When any pest control program is implemented, the effect on nontarget organisms also must be considered. Coumaphos and doramectin are administered directly to animals to kill parasites, and both are excreted in the feces of the treated animals. Gil-Diaz et al. (2011) noted that "as emerging contaminants, feces-borne drugs are suspected of causing adverse effects in both humans and wildlife." Residues of veterinary parasiticides such as doramectin can persist in the feces of treated animals for several months. For example, Gil-Diaz et al. (2011) found that doramectin could be detected in soil that had been amended with pig manure up to 7 months. This long persistence in soil could negatively affect soil biodiversity, and successive applications of manure contaminated with doramectin could result in accumulation that could adversely affect soil fauna, such as decomposers (Gil-Diaz et al. 2011, Wall and Beynon 2012). Doramectin can also slow down dung degradation and have deleterious effects on nematodes in the decomposer community. It can also have potential negative consequences for microorganism and vertebrate predators of insects (Floate et al. 2005, Wall and Beynon 2012).

A study of the effect of coumaphos residues in manure demonstrated that nontarget dung beetles were negatively affected (Lumaret and Errouissi 2002). Coumaphos is highly toxic to birds, and moderately to highly toxic to fish, and highly toxic to aquatic invertebrates on an acute basis (EPA 1996). Coumaphos used as a miticide in honey bee hives is also implicated as a factor in colony collapse disorder in bees (Johnson et al. 2010).

Studies of permethrin effects are somewhat varied. Shleier and Peterson (2010) used caged house crickets as surrogates for medium-sized nontarget insects following a mosquito spray application to assess nontarget toxicity. They showed low mortality in the crickets, and suggested that the ultra-low volume mode of permethrin application likely resulted in lower concentrations of permethrin reaching the crickets, and, therefore, less exposure. However, a study of the effect of permethrin and its metabolites excreted in feces following veterinary treatment demonstrated mortality to nontarget insects (Lumaret and Errouissi 2002). In addition, when permethrin contaminates surface water, it may produce toxic effects in a range of aquatic invertebrates such as chironomid midges; the larvae of caddisflies, dragonflies, damselflies, and mayflies; and beetles and true bugs. Exposure can take place directly via sprays, or indirectly by water runoff , spray drift and erosion (Antwi and Reddy 2015). Permethrin is considered to be highly toxic to bees and fish, but low in toxicity to birds (Toynton et al. 2009).

In tests of selected fruits and vegetables, less than 1 percent of the sources contained permethrin (Toynton et al. 2009). Doramectin is not expected to affect terrestrial plant growth, and tests of exposure of the drug to freshwater algae showed that it was not acutely toxic to the algae (FDA 1997b). In general, organosphosphates have few negative nontarget effects on plants, but one study noted that the chemical caused an increase in oxidative damage in the estuarine macroalga *Ulva pertusa* (Schweikert and Burritt 2012).

APHIS has determined sterile insect technique to be safe for use in all habitats, including endangered and threatened species habitats. In the course of their release, sterile flies may serve as food for fly predators. With regard to effects on endangered and threatened species, APHIS will consult with the FWS and/or the National Marine Fisheries Service (NMFS) for each individual eradication effort, and will comply with all protection measures stipulated in that consultation and mutually agreed on with FWS and NMFS.

3. Human Health and Safety

The potential consequences of implementing this program to the health of humans are minimal. It is possible, but not likely, that humans may become infested with screwworm. In that event, prompt medical treatment should be sought. The preferred alternative will be a benefit to human health because humans who own livestock or pets will be less distressed or worried about the potential for their animals to become infested, and if infested, that they will be treated promptly.

Humans with potential exposure to doramectin, coumaphos, and permethrin include program workers and the general public. Program workers are the most likely people to be exposed to chemicals. Under normal conditions with proper functioning personal protective equipment (PPE) and proper worker hygiene, occupational exposure to these chemicals is not expected. Accidental exposure may occur during applications. However, these types of accidental exposures are minimal with well-trained applicators following the label safety precaution (Zoetis 2013b, a). Risk from occasional accidental exposure is minimized by adequate training of workers. Occupational exposure for workers treating wildlife (such as the Key deer in the 2016 outbreak) would be similarly very low. Other federal agencies such as FWS would handle treatment of wildlife.

For the general public, potential direct contact exposure to permethrin, doramectin, or coumaphos is unlikely because the treatment area should be secured, with no public access to treated livestock during the application period. Therefore, dermal, inhalation or accidental ingestion exposure is not expected.

Doramectin has low toxicity in mammals because GABA is found only in the central nervous system of mammals and is protected by the blood-brain barrier (FAO/WHO 2006). Although doramectin is a hazard to humans at high doses, risks to program workers from doramectin via oral, inhalation, and dermal exposure is minimized by adherence to label directions regarding proper use of PPE. Overall, the preferred alternative use of doramectin to control screwworms is expected to pose minimal risks to human health.

Dietary exposure to meat from doramectin-treated cattle or swine is unlikely because APHIS will adhere to the time requirement on the insecticide label for withdrawal time, and discontinue use of doramectin 45 days for cattle, and 35 days for swine prior to slaughter. These withdrawal time periods allow doramectin residues to decrease to below the tolerance levels (a liver tolerance of 100 ppb in cattle, and 160 ppb in swine) (FDA 1997a, b). Consequently, risks to the general public from dietary consumption of doramectin in cattle or swine meat is expected to be negligible.

For applicators, the primary route of coumaphos exposure is through the skin. To minimize exposure, applicators are restricted in the number of animals they can treat in one day. PPE is generally required by the pesticide use label, including gloves, and sometimes respirators, depending on the formulation and application rate. EPA believes that exposure of coumaphos to persons entering treatment sites after application is minimal because most coumaphos is applied directly to livestock, and applicators usually do not contact the animals directly after the application procedure. Coumaphos is classified as not likely to be carcinogenic in humans. Humans may be exposed to coumaphos in drinking water since coumaphos wash-off from treated cattle can come into contact with and be adsorbed onto manure as well as transported as runoff, reaching surface and ground water sources of drinking water (EPA 2016). Dietary exposure to coumaphos from treated cattle or from milk is considered to be low (EPA 1996).

In humans, permethrin has low dermal toxicity and absorption and low inhalation toxicity, but it may cause skin irritation (Toynton et al. 2009). Mammalian prenatal development and reproductive studies show low chronic toxicity. EPA considers permethrin to be a possible human carcinogen (EPA OPP, 2003). Applicators for the screwworm eradication program are likely to have minimal exposure because of the use of PPE. The general public are likely to have even less exposure.

Workers in the USDA production labs rearing sterile flies are subject to a safety protocol, which lowers risk of exposure to radiation to a minimal level. Risk from released flies to the general public will not be any different than that from wild flies.

4. Wildlife Protections

a. Endangered Species Act

The Endangered Species Act of 1973 (ESA) as amended (16 U.S. C. 1531 *et seq.)* requires all Federal departments and agencies to consult with the FWS and/or NMFS to ensure that any action that they authorize, fund, or carry out is not likely to jeopardize the continued existence of an endangered or threatened species or result in the destruction or adverse modification of its critical habitat (16 U.S.C. 1536(a)(2)). Most agency actions related to cooperative screwworm eradication efforts are expected to occur in highly disturbed areas that would not be suitable habitats for endangered and threatened species. The use of SIT has been determined to be compatible for use in habitats of endangered and threatened species and could be applied effectively at some locations if necessary. APHIS will consult with FWS and/or NMFS regarding endangered and threatened species for each individual eradication effort and will comply with all protection measures stipulated and mutually agreed upon in that consultation.

Section 7 of the ESA and its implementing regulations require Federal agencies to ensure their actions are not likely to jeopardize the continued existence of listed threatened or endangered species, or result in the destruction or adverse modification of critical habitat.

(1) Potential Effects of Screwworms on Threatened and Endangered Species

Other than Key deer, no other listed species have been reported or detected with screwworm infestations.

(2) Potential Effects of Screwworm Eradication Programs on Threatened and Endangered Species and Critical Habitat

Traps using Swormlure-4 or rotten liver to attract the screwworm flies would not likely affect listed species or critical habitat other than potential disturbance of listed animals in an area. Although traps may capture other arthropods, APHIS anticipates that screwworm flies will be the primary organism collected. Listed arthropods would not be expected to be attracted to the traps, but APHIS will avoid placement of traps in the habitat of listed arthropods.

The use of sterile screwworms is the method most commonly used for eradication programs, and is compatible for use in habitats of endangered and threatened species. In the case of Florida, ground releases of sterile screwworms were widely used in the habitat of the Key deer and other listed species. Ground release of sterile flies resulted in little disturbance to listed species or critical habitat in the area. However, aerial releases of sterile flies could cause some temporary disturbance to some species because of the noise of the plane.

The application of a formulated permethrin or coumaphos product to treat external wounds on domestic animals and livestock would not expose listed species to these pesticides. Pesticide treatments to treat a screwworm-infested resident's dwelling and all properties within 200 meters of the infested resident's dwelling could cause direct and indirect effects to listed species and critical habitat. These effects could occur from acute toxicity to the listed species, to the prey of the species, or to pollinators of listed plants. APHIS will ensure that appropriate treatment buffers are in place from aquatic areas or habitat of listed species to so that pesticide applications will not adversely affect listed species, prey, or pollinators inhabiting those areas.

b. Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918 (MBTA), as amended (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 2016a). Species not protected by the MBTA 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 2016a).

Consumption of the sterile flies by birds should pose no risk since the flies are no different from wild flies except for the fact that they cannot reproduce. Because sterile release is sometimes accomplished by small aircraft, migratory birds may be disturbed by noise and air flow changes. Collisions with planes may also be a risk because of the higher probability of collision at the lower altitudes at which small aircraft fly (Sodi 2002, Lambertucci et al. 2015). When planning any flights for the program, migration patterns and daily use patterns should be considered, especially since bird collisions can increase dramatically during migration seasons (Sodi 2002). Because airfields may provide locations for key bird resources such as foraging areas and nesting sites (Sodi 2002), special care should be taken to avoid disruption of bird activity. Flight times may need to be adjusted to accommodate bird activity patterns in migratory birds (Lambertucci et al. 2015). The program may need to defer to ground treatment in known flyways or near bird refuge areas. APHIS will consider specific treatment areas and plans on a case-by-case basis, taking care to locate nesting sites and flight patterns of migratory birds before implementing treatment or sterile release.

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 (*Haliaeetus leucocephalus*), 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.

Bald eagles are concentrated around water sources such as lakes, rivers, and reservoirs. Of the states in the affected area, Florida has the densest nesting bald eagle population, with an estimated 1,500 pairs. By contrast, Texas estimates its nesting pairs at about 130. The affected states practice a range of conservation and monitoring activities such as closure of public areas near nesting sites and monitoring of habitat use and breeding activity (Fish 1996, Fish 2016, Commission 2017, Extension No Date). APHIS will determine if bald eagle nesting sites are present near the vicinity of any planned treatments prior to the treatment, and determine the best course of action on a case by case basis.

5. Environmental Justice

Consistent with Executive Order 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 minority and low income populations.

Resident populations should have low exposure to the insecticides used in the program. Effective communication about the program will be important and will require newspaper, television, and online notifications in English, Spanish, and any other languages of common use in the regional area of program implementation. For the recent infestation of Key deer in Monroe County, Florida, which includes the Keys, and in Miami-Dade County, Florida, where a secondary outbreak was found in Homestead, Table 5 summarizes some of the pertinent demographic data.

Table 5. Selected demographic data for Florida counties, collected in July 2015 (Bureau 2015)

	Monroe	Miami-Dade
Total population	77,482	2.7 million
Population/mi 2	74.3	1,351.50
Percent Hispanic/Latino	22.6	67
Percent foreign-born	18	52
Percent language other than English spoken at home	24.1	73
Percent age 65 or older	21.3	15.6
Percent in poverty	11.3	20

Miami-Dade County has a higher poverty rate, is more densely populated, and has a dramatically higher percentage of non-English speakers than Monroe County. This dichotomy is representative of the differences that exist within the range of the screwworm and indicates the need to tailor activities and outreach associated with the cooperative screwworm eradication program on a case-by-case basis. In Monroe County, trained volunteers promoted public awareness in a door-to-door campaign in neighborhoods. In Miami-Dade County, FDACS officials met with growers. Public awareness was heightened with displays and outreach materials at local shopping centers and community websites. Outreach during an outbreak might also occur at retirement communities, playgrounds, and churches.

The import of animals or other livestock from countries where screwworms are established is an activity that is not specific to any subgroup of the population. The cooperative screwworm eradication program could take place at any location where an infested person or animal enters the country. Therefore, no disproportionate effects on such populations are anticipated as a consequence of implementing the preferred action.

V. Potential Cumulative Impacts

Cumulative impacts are those impacts on the environment that result from the incremental impact of a proposed action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Cumulative impacts to human health from the proposed use of permethrin, doramectin, and coumaphos in the cooperative screwworm eradication program are not anticipated because if applied as the labels prescribe, exposure to humans will be negligible. Human exposure and risk is very low for the general public. The probability of exposure is greatest for workers who apply the chemicals. However, the risk to this group of the population will be negligible based on the low risk of the chemicals when using appropriate PPE.

Pesticide use in other Federal programs potentially contributes to cumulative impacts with chemicals used in screwworm eradication. Ongoing APHIS programs in the affected area using pesticides include fruit fly eradication programs and the cattle fever tick eradication program. The fruit fly eradication program chemicals include dichlorvos, methyl eugenol, trimedlure, and naled. Coumaphos is used in the cattle fever tick eradication program to treat cattle for ticks that may vector cattle fever, and extensively in apiaries for mite control (Sanchez-Bayo and Goka 2014). Doramectin may be administered to cattle for prevention of cattle tick fever, and to hogs and pigs and other animals as veterinary parasiticides. Permethrin is also used medically for human treatment of scabies. The implementation of the SIT program will not affect any other organisms except screwworm, so will not add to cumulative effects. The combined effects of these chemicals is likely to be very low since the individual exposure and toxicity for each chemical is low.

The cooperative screwworm eradication program is not expected to have cumulative ecological effects. Dung is an important food resource for many species of insects, particularly Diptera and Coleoptera, and, in turn, these insects provide food for insectivorous invertebrate and vertebrate predators. Insect activity in dung also aids in the important decomposition process, and the return of nitrogenous compounds to the soil. Chemical residues of veterinary parasiticides in livestock manure may be toxic to some insects, and have sublethal effects such as slowed or aberrant development (Wall and Beynon 2012). As mentioned in Chapter 3, Potential Environmental Effects, Biological Resources, repeated applications of doramectin can persist in manure-amended soil for several months, and accumulate (Gil-Diaz et al. 2011). However, this is not expected to lead to significantly increasing concentrations in soil (FDA 1997a, b). The amounts of doramectin excreted in dung depends on several factors, some of which are under the control of farm managers, such as timing of treatment and the proportion of animals being treated at any one time. Overall, though, these operations are considered to be relatively low-risk (Wall and Beynon 2012). Doramectin use for screwworm eradication is likely to be infrequent and short-lived when conducted, given that screwworm had not previously been detected in the United States for 30 years.

In summary, the cumulative impacts associated with the preferred alternative when assessed in relation to the current baseline and past, present, and future activities constitutes a small incremental change to the human environment. To preserve environmental quality for the human population and ecological resources, the cooperative screwworm eradication program would minimize potentially negative cumulative impacts by following best management practices.

APHIS does not find that any reasonably foreseeable effects caused by the program activities will occur later in time or be farther removed in time.

VI. Listing of Agencies and Persons Consulted

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Policy and Program Development
Environmental Analysis and Documentation
4700 River Road, Unit 149
Riverdale, 20737-1238

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Veterinary Services
2150 Centre Ave Bldg B
Fort Collins, CO 80526

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