United States Department of Agriculture

Marketing and Regulatory Programs

Animal and Plant Health Inspection Service

Giant African Snail Cooperative Eradication Program

Miami-Dade County, Florida

Environmental Assessment, October 2011

Giant African Snail Cooperative Eradication Program

Environmental Assessment
October 2011

Agency Contact:
Andrea Simao
USDA–APHIS–PPQ
Emergency and Domestic Programs
4700 River Road, Unit 26
Riverdale, MD 20737

Table of Contents

I. Introduction

The giant African snail (GAS), *Lissachatina* (*Achatina*) *fulica*, is a large, African terrestrial snail in the family Achatinidae. It has been introduced purposefully and accidentally to many parts of the world for medicinal purposes, food (escargot), as pets, and for research purposes. Where it it is introduced, it has the potential to be a significant pest of agricultural crops and can serve as an intermediate host for the rat lungworm (Venette and Larson, 2004). As a result, this species has been listed as one of the 100 worst invasive species in the world (Lowe et al., 2000). In September 2011, an infestation of this snail was discovered in the Coral Gables area of Miami-Dade County, Florida.

A. Giant African Snail, *Lissachatina fulica*

1. Biology

The GAS is a large, terrestrial snail that can reach up to 8 inches in length and 4 inches in diameter. The brownish shell with darker brown vertical stripes covers at least half of the length of the snail. It is native to eastern coastal Africa, but has spread to many tropical and subtropical locations around the world (Thiengo et al., 2007;.Cowie, 2000).

The GAS is a snail that possesses both male and female sex organs (hermaphroditic) but must be externally fertilized (rather than self-fertilized). One fertilized snail can establish a population as it can lay up to 1,200 eggs per year. Snail lifetimes of 4.5 to 9 years have been recorded (Smith and Fowler, 2003). The reproductive potential of GAS is extremely high (Smith and Fowler, 2003).

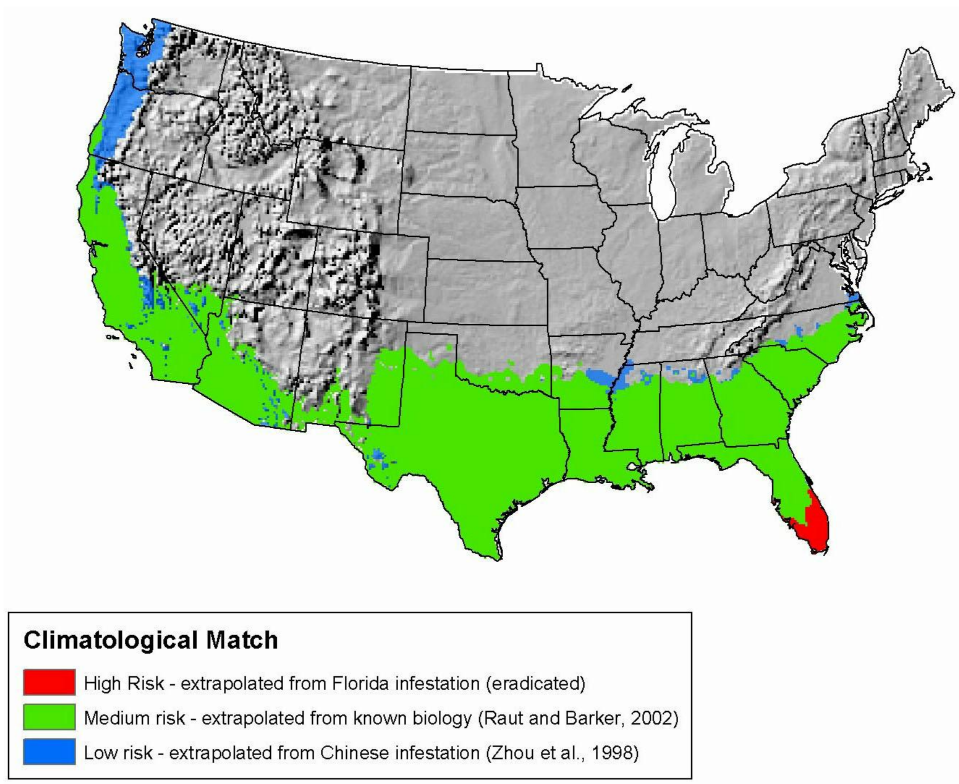
The GAS has large eggs, 4.5 to 5.5 millimeters (mm) in diameter that are laid in the soil. Hatchling snails begin searching for food immediately following emergence from the soil. The major requirement of hatchlings is calcium until their shell reaches 5 mm in size (Fowler and Smith, 2003). Very small and older individuals prefer feeding on detritus and decaying vegetation while GAS with shell heights of 5 to 30 mm selectively feed on living vegetation (Fowler and Smith, 2003).

Adult size is reached in about six months; after which growth slows but does not cease. Large adults can successfully aestivate (persist in a dormant condition) for 10 months while hatchling snails are restricted to about two months (Venette and Larson, 2004).

2. Habitat

The GAS thrives in forest edge, modified forest, and plantation habitats (Smith and Fowler, 2003). When the GAS becomes established, the most severe infestations tend to be in disturbed areas including residential and crop lands, forest edges, shorelines, and along roadways (Numazawa et al., 1988). Analysis of the worldwide geographic distribution of GAS suggests that this snail is most closely associated with tropical and subtropical moist broadleaf forests, and tropical and subtropical dry broadleaf forests (Venette and Larson, 2004). However, Smith and Fowler (2003) predicted a potential distribution of *L. fulica* in the continental United States of up to 38° latitude, including most of the southern states, up to Maryland in the east, through Texas to California in the west, and north to Washington and the climate of the Pacific northwest (see figure 1 below).

Figure 1. Potential distribution of GAS in the continental United States (Smith and Fowler, 2003).



3. Host Range

The GAS has a broad host range. It appears to prefer certain plants for food; specifically, younger snails prefer soft textured banana (*Musa*), bean (*Beta vulgaris*) and marigold (*Tagetes patula*) (Venette and Larson, 2004). Older snails prefer brinjal (*Solanum melongena*), cabbage and cauliflower (*Brassica oleracea* v. *capitata* and *botrytis*), Lady's finger (*Abelmoschus esculentus*), sponge gourd (*Luffa cylindrica*), pumpkin (*Cucurbita pepo*), papaya (*Carica papaya*), cucumber (*Cucumis sativus*) and peas (*Pisum sativum*) (Venette and Larson, 2004). See appendix A for a more complete list of host plants of the GAS.

4. Transmission of the Rat Lungworm

The GAS is a threat to human health because of its ability to spread diseases to animals and humans. It is known to transmit the rat lungworm, *Angiostrongylus cantonensis* (Chen), which in humans produces eosinophilic meningitis (Kliks and Palumbo, 1992). This lungworm can be transferred to humans by eating raw, undercooked, infected snail meat and fluids, or contaminated vegetables. This lungworm is present in the United States (Kim et al., 2002).

5. Nuisance Potential

The GAS can be a nuisance. They can multiply into large numbers, crawling on objects, leaving behind a slime trail (Fowler and Smith, 2003). They can create a strong odor when large quantities die, have been implicated in traffic accidents, and will collect on houses with whitewashed siding, causing disfiguring of the siding (Fowler and Smith, 2003).

6. History of the GAS in the United States

GAS are specifically prohibited for both interstate movement and importation into the United States and are confiscated when discovered. Although illegal, GAS are appearing in schoolrooms and in the pet trade across the country.

In 1966, a Miami, FL, boy smuggled three GAS from Hawaii into south Florida. His grandmother eventually released the snails into her garden. Seven years later, more than 18,000 snails had been found. The eradication program took nearly 10 years at a cost of $1 million. Eradication was declared in 1975.

In early September, 2011, the GAS was confirmed in the Coral Gables area of Miami-Dade County, Florida. Thousands of snails have been collected. At this time, it is unknown how or when the snails entered the United States or how the Coral Gables area became infested. Survey work is ongoing to determine the extent of the GAS infestation in Miami-Dade county along with outreach to private and government run solid waste, recycling and mulching facilities.

B. Purpose and Need

APHIS has the responsibility for taking actions to exclude, eradicate, and/or control plant pests under the Plant Protection Act of 2000 (7 United States Code (U.S.C.) 7701 et seq.). APHIS, in cooperation with the Florida Department of Agriculture and Consumer Services (FDACS), is proposing a program to eradicate the GAS from Florida using a molluscicide. The purpose of this action is to prevent further spread of GAS and help to eradicate it from the area. This is needed because of their plant pest potential and public health concern.

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

II. Alternatives

This EA analyzes the potential environmental consequences associated with no action and the proposed action to eradicate GAS from the infested area in Florida (see Appendix B for map of infested area). Delimitation of the infestation is ongoing and more infested locations may be found. Two alternatives are being considered: (1) no action by APHIS to eradicate the GAS from Florida, and (2) the preferred alternative, to eradicate GAS from the infested area in Miami-Dade County in Florida using the molluscicide iron phosphate.

A. No Action

Under the no action alternative, APHIS would continue to prohibit the importation and interstate movement of the GAS, and confiscate it from pet shops, schools, etc., where discovered. However, no eradication efforts in Florida would be undertaken by APHIS. Some control measures could be taken by other Federal or non-Federal entities, such as FDACS or homeowners; however, these measures would not be controlled or funded by APHIS. A lack of a cooperative eradication program would increase the likelihood that the GAS could not be eradicated from its current locations or spread to new locations.

B. Preferred Alternative

The GAS eradication program (preferred alternative) is a cooperative effort between APHIS and FDACS. Under the preferred alternative, APHIS and FDCAS would apply a molluscide that contains iron phosphate as the active ingredient. A formulation available for use is Sluggo®-AG which contains 1.0% iron phosphate and a slug and snail bait attractant in the form of wheat gluten. After eating the bait, snails stop feeding immediately because the iron phosphate interferes with calcium metabolism in their gut. Snails die three to six days later.

Sluggo®-AG is a pellet that is applied with a broadcast spreader, such as would be used to apply grass seed or fertilizer, in a 200-yard radius from GAS finds. The bait is applied evenly at approximately 20–44 pounds per acre, or 0.5 - 1 pound per 1,000 square feet. The bait is reapplied at least every two weeks as it is consumed by GAS. Treatments will be applied year-round. A 10-foot treatment buffer from aquatic areas will be applied.

Prior to treatment signed consent forms will be obtained from residents/homeowners. Homeowners will be provided with a notice that treatment will occur within the next 24 hours. Once treated, a treatment notice of date and time treatment occurred will be provided and homeowners/residents may then enter the treated area.

Hand picking of snails will also be conducted as part of the eradication program. Regular and extensive hand picking is effective in reducing snail numbers when done in combination with other control methods, particularly in newly infested areas (USDA, APHIS, 2003). Snails may be disposed of by freezing or immersion in boiling water or alcohol.

Treatments may continue for two to four years. After termination of eradication treatments, the area will be monitored for another one to two years to ensure that the GAS has been eradicated.

III. Affected Environment

1. Currently infested Area in Miami-Dade County

The initial GAS detection was made in the Coral Gables area of Miami-Dade County, Florida. The treatment area is mainly residential, although there are some commercial areas and parks. See appendix B for a map of the currently infested locations in Miami, including the nine treatment core areas.

2. Recreational Areas and Parks in Miami-Dade County

Douglas Park is within the treatment area in core 1. Other parks and recreational areas in or near the current treatment core areas include West Kendall District Park, and Nixon Smiley Pineland Preserve, both near cores 4 and 7. Core 5 is near Tropical Park. Miami Metrozoo and Larry & Penny Thompson Park are within cores 8 and/or 9. Other parks and recreational areas could be included in the treatment area if more GAS are found in other areas of the county.

Two national parks occur within Miami-Dade County: a portion of the Everglades National Park and the Biscayne National Park. The Everglades National Park is the only subtropical preserve in North America. It contains both temperate and tropical plant communities, including sawgrass prairies, mangrove and cypress swamps, pinelands, and hardwood hammocks, as well as marine and estuarine environments. The park is known for its rich bird life, particularly large wading birds, such as the roseate spoonbill, wood stork, great blue heron, and a variety of egrets. It has been designated a World Heritage Site, International Biosphere Reserve, and Wetland of International Importance. The

Biscayne National Park is a marine park located near Miami and protects part of the third-largest coral reef system in the world and the longest stretch of mangrove forest remaining on Florida's east coast. These provide habitat and nursery grounds for most of the region's important commercial and recreational fish, shellfish, and crustaceans. The park also harbors many endangered species, including the West Indian manatee, American crocodile, and Schaus swallowtail butterfly.

3. Human Population in Miami-Dade County

According to census data, the 2010 population of Miami-Dade County was 2,496,435 (U.S. Census Bureau, 2011). The population was 73.8% white (including Hispanic), 18.9% black, and 1.5 % Asian (U.S. Census Bureau, 2010). Of the white population, 65% reported themselves as Hispanic or Latino (U.S. Census Bureau, 2011). In 2009, 6.8% of the population was under five years old and 23% was under 18 years old (U.S. Census Bureau, 2011). Median household income in 2009 was $41,367 (U.S. Census Bureau, 2011). The homeownership rate for 2005 to 2009 was 58.3%.

4. Air, Water, and Soil Quality in Miami-Dade County

Air pollutants in Miami-Dade County are primarily ozone and particulate matter (ERM, 2009). In Miami-Dade County, sources of water pollution can be wastewater, other liquid wastes, stormwater runoff, or solid waste. Any spills on the ground could contaminate the aquifer, the source of drinking water for the county, which is located just below the surface. In 2005, iron in shallow groundwater was reported at 0.706 milligrams per liter in Miami-Dade County (PCD, 2005). In a soil report from 2002, the natural background concentration of iron in Miami-Dade County was 2,176 milligrams per kilogram (ERM, 2002).

Phosphorus levels in the Everglades have been a concern; it is considered one of the primary pollutants of the Everglades. The Everglades stretched from Lake Okeechobee to Florida Bay, and included forested uplands, large areas of sawgrass marsh, tree islands, and the Bay's estuary. However, flood control and irrigation projects, urban development, and agricultural practices have reduced the Everglades' size by 50 percent and affected its water quality and hydrology. The remaining components of the Everglades are located in three Water Conservation Areas and the Everglades National Park. The Everglades is an ecosystem that evolved with low phosphorus, controlling the growth of plants and shaping the specifc plants that occur there. However, with the addition of phosphates by humans, the phosphorus cycle in the Everglades has changed, causing a change in vegetation. The beginning of excessive phosphorus input into the Everglades can be traced back to the 1940s, when several thousand acres of land were cleared and converted to agricultural production. Runoff from the Everglades Agricultural Area (EAA) (an area of the northern Everglades, south of Lake Okeechobee, managed for agriculture) accounts for most of the phosphorus loading in the Everglades, although urban runoff has also been identified as contributing phosphorus. Prior to the creation of the EAA, phosphorus was supplied to the Everglades in rainfall. But because of excess phosphorus, there is now excessive growth of cattails, and other kinds of vegetation that were not found, or were only sparsely present in the Everglades. Microbial, vertebrate, and invertebrate community changes have also occurred in the Everglades due to excess phosphorus (Payne et al., 1999).

"In 1988, the federal government sued the State of Florida and two of its agencies, alleging that water released onto federal lands from agricultural sources contained elevated levels of phosphorus and other nutrients in violation of state water quality standards. Based on a 1992 Consent Decree settling this lawsuit, Florida enacted the Everglades Forever Act in 1994. This act required the state to establish a numeric limit for phosphorus by December 2003 and required actions to comply with this limit by December 2006. The federal judge overseeing the Consent Decree later adopted the December 2006 deadline. In spring 2003, Florida amended the 1994 Act to create flexibility in meeting deadlines for phosphorus mitigation to 2016 or later, and in July 2003, Florida issued a rule establishing a limit for phosphorus of 10 parts per billion and methods to measure compliance with that limit." (Sheikh and Johnson, 2004). EPA and the state of Florida are currently working towards developing numeric nutrient water quality criteria that will be applied to inland waters (EPA, 2011).

5. GAS Habitat at Risk for GAS Establishment in Miami-Dade County

Areas in Miami-Dade County that are considered high risk for GAS establishment include (from Smith et al., 2010):

• Canals: Moisture is a very important component of GAS habitat selection. In the South Florida area, canals are common and often run through urban areas that can provide dense vegetation along the banks. The GAS could find both food and water in these areas.

• Wooded/natural areas and parks: Any natural areas, cemeteries, old fields, or overgrown, abandoned residential properties could harbor a population of the GAS. Large wooded areas such as abandoned citrus groves, as well as state, county and municipal parks are good sites for GAS establishment. Green alleyways maintained by the city for water and power lines run continuously behind some properties, and could be possible locations for GAS establishment.

6. Native Mollusks in Florida

In Florida, there are approximately 100 native snail and slug species, and another 40 or so introduced exotic species (Garofalo et al., 2001). Most of the 140 species are less than ½-inch long. One of them, found in south Florida, is the Stock Island tree snail, a threatened species. Most Florida snails are small, seldom noticed, and do not feed on plants. A tree snail species, the Manatee snail, is considered beneficial by citrus growers because it clears algae and mold from the leaves (Garofalo et al., 2001).

IV. Environmental Impacts

A. No Action

A lack of a cooperative eradication program for the GAS would result in an expansion of its current range due to its high reproductive potential and broad host range (appendix A; Srivistava, 1992). Current estimates show that GAS expansion would be restricted to parts of southern Florida since it is considered a tropical snail preferring higher temperature and humidity conditions (Venette and Larson, 2004). An expansion of the GAS in Florida could result in ecological, public health and economic impacts.

From an ecological perspective the GAS would be expected to damage susceptible native vegetation, including rare species, when populations become sufficiently high. Venette and Larson (2004) identified approximately 30 threatened and endangered plant species in Florida that could serve as hosts for the GAS. The GAS would also compete for resources with native snails and threaten rare mollusks such as the federally endangered Stock Island snail, *Orthalicus reses*, that occurs in Miami-Dade county. Competition for resources as well as the threat of predation by the GAS would impact native snails and impede recovery efforts for rare species (Meyer et al., 2008). The presence of the GAS would also result in additional pesticide applications in both residential and other areas as populations increase and expand. It’s difficult to quantify the potential increase in loading that would occur however it would be anticipated that pesticide applications would increase over the long term if populations become established and expand. In addition to increased pesticide loading there is the potential for the use of other molluscicides that pose a higher comparative risk to human health and the environment than iron phosphate, the preferred alternative in this eradication program.

The establishment and expansion of the GAS could also pose a threat to human health. The GAS serves as the intermediate host for the nematode parasite, *Angiostrongylus cantonensis,* which can result in eosinophilic meningititis (Cross, 1987; Slom and Johnson, 2003). The parasite is also known as the rat lungworm and the rat is considered the primary host. Injestion of the larval stage of this parasite results in the larvae moving into the central nervous system from the intestinal tract and can result in a range symptoms such as nausea, headache and nerve related effects. Several human cases attributed to the GAS have been documented throughout the world and there is the potential for infections to occur in the human population in southern Florida if this invasive snail were to become established and expand its range. The GAS may also be a intermediate host for the parasite *A.costaricensis* which causes abdominal angiostrongylosis (Thiengo et al., 2007).

The broad host range of the GAS in crops and horticultural settings would result in loss of plants and increased pesticide use resulting in economic impacts as well. Currently the GAS is confined to mostly residential settings where plant loss would be confined to landscaping and garden plants, however expansion to other areas could pose a threat to agriculture. A preliminary pest risk assessment for the GAS conducted in 2003 estimated that if eradication did not occur that economic losses of approximately 53 million dollars could be expected (Venette and Larson, 2004). Adjusting for inflation these losses would be expected to be higher if eradication efforts were not successful in the current infestation.

B. Preferred Alternative

1. Human Health Risk

Iron phosphate is considered practically non-toxic to humans in acute dietary and dermal exposures. Median lethality values from dermal and dietary exposure are greater than the highest concentration tested for the active ingredient and the formulated material proposed for use in this program (EPA, 1997). Additional studies such as subchronic, genotoxicity and developmental studies are not available and have been waived as a condition for registration since iron phosphate has been recognized by the Food and Drug Administration (FDA) as a GRAS (generally recognized as safe) product. The formulation proposed for use is a mild eye irritant which could occur during application of the granules; however, no residents will be in the area during application due to the notification process by FDACS.

Dietary exposure and risk from the proposed use of iron phosphate in this program is expected to be very low. No uses will occur on food crops and all residents will be notifed 24 hours prior to treatment. The only possibility for oral exposure would be through the direct ingestion of the granules or treated soil. The risk from direct ingestion of granules would be low due to the very low toxicity of iron phosphate and the small amount of iron phosphate contained within each granule.

2. Ecological Risk

The toxicity of iron phosphate to non-target organisms is very low. Toxicity to wild mammals, birds, and fish is low based on available information and in most cases toxicity is above the highest concentration used in the study. Toxicity to other non-target soil organisms such as earthworms is also low based on available data for iron phosphate and the Sluggo formulation (Edwards, et al., 2009). Comparative toxicity of iron phosphate and the formulated product does suggest that Sluggo®-AG may be more toxic to earthworms. due to the presence of some inerts in the formulation. However, concentrations where effects were observed were above those expected in the proposed eradication program. Iron phosphate is expected to impact non-target mollusks that may occur in the area of application. These impacts will be restricted to those areas where treatments will occur.

Exposure and risk to non-target organisms is expected to be very low. Some birds and mammals that forage in residential areas may have some incidental exposure from ingestion of treated snails or soil; however, due to the low toxicity of iron phosphate direct risk to birds and mammals is not expected. In addition, birds and mammals would not only feed on treated snails but would also feed on other terrestrial invertebrates that would not have any residues within a treatment area and would also forage outside the 200-yard treatment radius, further reducing exposure and risk. Risk to aquatic organisms is also not anticipated due to the low aquatic toxicity, environmental fate, and program restrictions for iron phosphate applications. Iron phosphate has low solubility in water and would not be expected to occur in dissolved concentrations that could result in risk to aquatic organisms. The product would not be applied directly to water or to areas where surface water is present or to intertidal area below the mean high water mark. In addition, program restrictions require a 10-foot application buffer from waterbodies when water is present which would further reduce the potential for risk to aquatic organisms.

3. Environmental Quality

The use of iron phosphate is not expected to have impacts on air, soil, or water quality based on the use pattern and environmental fate of the molluscicide. Iron phosphate is applied as a bait which will eliminate impacts to air quality from drift and will not volatilize into the atmosphere due to its low vapor pressure.

Iron phosphate has very low solubility in water which would suggest it would not runoff into surface water or leach into groundwater which could be a concern due to the high water table in the program area. In addition, a 10-foot buffer will be applied to all waterbodies to further reduce the potential for runoff. Iron phosphate that could move into aquatic areas from a large storm event is not expected to have negative impacts on water quality since residues would be very low. Once in water, most iron phosphate would not be expected to stay in the water column due to a preference to partition into sediment. Depending on conditions in the receiving waters (ie. oxygen levels, sediment characteristics, etc.) iron phosphate could disassociate. In most situations, iron would bind to organic matter in sediment or, under low oxygen conditions, bind to sulfide, reducing bioavailability. Some phosphorus could become soluble; however these levels would be extremely low. This conclusion is based on very conservative estimates of phosphorus levels in shallow water bodies resulting from the proposed applications that suggest concentrations would be well below one part per billion (ppb). This assumes all phosphorus that would enter a waterbody would be soluble; however, depending on the type of waterbody, not all phosphorus from these applications would be bioavailable, thus further reducing water concentrations. Any residues would be at least an order of magnitude below proposed water quality numeric criteria values that have been derived for total phosphorus in lakes and streams in southern Florida (EPA, 2010).

Impacts to soil are also not anticipated in the treatment area due to the relatively small contribution of elements to background levels. As an example maximum iron levels were estimated based on the maximum application rate applied every two weeks for one year and then compared to the background levels of iron that have been reported in the Miami-Dade County area (2,176 milligrams per kilogram). Yearly loading of iron from proposed maximum use rates are approximately 0.5% of the reported background levels of iron for the area. This estimate is very conservative since it assumes all of the material applied is iron and is based on a yearly load assuming applications would occur every two weeks.

C. Cumulative Effects

No significant cumulative impacts are expected to occur from the proposed use of iron phosphate in this program. Some use of iron phosphate for control of snail pests may already occur in the program area however this use is expected to be very minor and restricted to home use only. An increase in use will result in the proposed treatment areas but this will not have any significant cumulative effects because of the low risk to human health and the environment. Iron is a naturally occurring mineral in the soil and based on the proposed use pattern and environmental characteristics would not be expected to have any cumulative impacts on water or air quality in the immediate area of treatment. Phosphorus is a concern in southern Florida where it has been linked to impaired water quality along with other nutrients, primarily from agricultural and urban sources. Water quality data collected in southern Florida from a range of different aquatic habitats (including a national wildlife refuge, Everglades National Park and water conservation areas) show total phosphorus concentrations can range widely from less than 2 ppb to greater than 3 parts per million (FDEP, 2009; SFMD, 2011). Conservative estimates of total phosphorus concentrations from proposed applications into shallow waterbodies such as wetlands would be an order of magnitude below the reported low range value, suggesting that any incremental contribution of phosphorus to surface water would be minimal.

D. Threatened and Endangered Species

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

APHIS initiated emergency consultation with the U.S. Fish and Wildlife Service (Service) in Vero Beach, Florida (South Florida Ecological Services Office) regarding the proposed eradication program. The Service reviewed the proposed program and maps for GAS eradication within Miami-Dade County and, based on their review of the information provided, determined that no candidate or federally listed endangered or threatened species are likely to be adversely affected by the proposed eradication program. The Service indicated that a species of particular interest, the federally-threatened Stock Island tree snail, *O. reses*, is known to reside in parts of Miami-Dade County and would be vulnerable to adverse effects from exposure to Sluggo®-AG; however, currently the snail is not believed to be within the proposed treatment area. The Service requests that Sluggo®-AG applicators cease application and notify the Service if the presence of *O. reses* is detected within the treatment area. Also, in the event that the eradication zone has to be expanded or changes are made to the Program that could affect federally-listed species, APHIS will notify the Service and reinitiate consultation, if necessary.

E. Other Considerations

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

EO 13045, "Protection of Children from Environmental Health Risks and Safety Risks," acknowledges that children, as compared to adults, may suffer disproportionately from environmental health and safety risks because of developmental stage, greater metabolic activity levels, and behavior patterns. This EO (to the extent permitted by law and consistent with the agency's mission) requires each Federal agency to identify, assess, and address environmental health risks and safety risks that may disproportionately affect children. Iron phosphate will not be used on commercial food items therefore no dietary exposure is expected. Any oral ingestion would only occur through the ingestion of granules or treated soil. Proper notification to homeowners regarding when applications occur will reduce this exposure potential. In cases where a child could consume soil from treated areas in a residential application the low toxicity of iron phosphate suggests that children would not be able to consume enough treated soil to reach a dose where an iron phosphate related effect could occur. Therefore, no disproportionate risks to children are anticipated as a consequence of applying iron phosphate bait to eradicate GAS.

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….". The Seminole and Miccosukee Tribes are in south Florida; however no GAS detections have occurred on, or adjacent to, tribal property. APHIS will contact the tribes to initiate a dialogue regarding proposed activities to eradicate the GAS in the event that the range of the snail expands. In addition to EO 13175, APHIS has considered potential impacts under Section 106 of the National Historic Preservation Act. Section 106 requires federal agencies to consider the impacts of their actions on historic properties. Approximately 170 historic properties exist within Miami-Dade County, with a majority of these sites being structures. Based on the criteria defined in Section 106 of what constitutes an adverse effect, the proposed program will not have a negative impact to historic or cultural sites but will provide beneficial impacts due to the protection from damage and nuisance that can occur from GAS infestations.

V. Listing of Agencies and Persons Consulted

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
PPQ–Emergency and Domestic Programs
4700 River Road, Unit 26
Riverdale, MD 20737

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
PPQ–Environmental Compliance
4700 River Road, Unit 150
Riverdale, MD 20737

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

Florida Department of Agriculture and Consumer Services
Division of Plant Industry
P.O. Box 147100
Gainesville, FL 32614

U.S. Fish and Wildlife Service
South Florida Ecological Services Office
1339 20th Street
Vero Beach, FL 32960

VI. References

Cowie, R.H. 2000. Non-indigenous land and freshwater molluscs in the islands of the Pacific: conservation impacts and threats. Pp 143-166, G. Sherley [ed.] *In:* Invasive species in the Pacific: A technical review and draft regional strategy. South Pacific Regional Environment Programme. Available http://www.issg.org/database/species/..%5Cspecies%5Creference_files%5CSPREP.pdf#page=150 *last accessed* September 22, 2011.

Cross, J.A. 1987. Public health importance of *Angiostrongylus cantonensis* and its relatives. Parasitology Today. 3(12): 367–369.

Edwards, C.A., Arancon, N.Q., Vasko-Bennett, M., Little, B., and Askar, A. 2009. The relative toxicity of metaldehyde and iron phosphate-based molluscicides to earthworms. Crop Protection. 28: 289–294.

EPA—see U.S. Environmental Protection Agency.

ERM—see Miami-Dade County Environmental Resource Management

FDEP—see Florida Department of Environmental Protection

Florida Department of Environmental Protection. 2009. State of Florida Numeric Nutrient Criteria Development Plan. 129 pp.

Garofalo, J.F., Weissling, T., Duke, E.R., Vedaee, J., and Bishop, L. 2001. Snail and slug management in South Florida. Miami-Dade County/University of Florida Cooperative Extension Service. Available http://miami-dade.ifas.ufl.edu/old/programs/commorn/publications/Snail-Slug-Factsheet.PDF *last accessed* September 22, 2011.

Kim, D.Y, Stewart, TB., Bauer, R.W., and Mitchell, M. 2002. *Parastrongylus* (=*Angiostrongylus*) *cantonensis* now endemic in Louisiana wildlife. Journal of Parasitology. 88: 1024–1026.

Kliks, M.M., and Palumbo, N.E. 1992. Eosinophilic meningitis beyond the Pacific Basin: the global dispersal of a peridomestic zoonosis caused by *Angiostrongylus cantonensis*, the nematode lungworm of rats. Social Science and Medicine. 34: 199–212.

Lowe S., Browne M., Boudjelas S., and De Poorter M. 2000. *100 of the World's Worst Invasive Alien Species A selection from the Global Invasive Species Database*. Published by The Invasive Species Specialist Group (ISSG**)** a specialistgroup of the Species Survival Commission (SSC) of the World Conservation Union (IUCN), 12pp.

Updated and reprinted version: November 2004.

Meyer, W.M., Hayes, K.A. and Meyer, A.L. 2008. Giant African snail, *Achatina fulica*, as a snail predator. American Malacological Bulletin, 24(1): 117–119.

Miami-Dade County Environmental Resource Management. 2002. Memorandum, Natural background concentrations in Miami-Dade County soil. Available http://www.miamidade.gov/derm/library/land/soil_study.pdf *last accessed* September 22, 2011.

Miami-Dade County Environmental Resource Management. 2009. Ambient air quality in 2009 in Miami-Dade County. Available http://www.miamidade.gov/derm/library/air_quality/Air_Monitoring-2009.pdf *last accessed* September 22, 2011.

Miami-Dade County Pollution Control Division. 2005. Memorandum, Background concentration of iron in groundwater in Miami-Dade County. Available http://www.miamidade.gov/derm/library/land/groundwater_study_iron.pdf *last accessed* September 22, 2011.

Numazawa, K., Koyano, S., Takeda, N., and Takayanagi, H. 1988. Distribution and abundance of the giant African snail, *Achatina fulica* Ferussac (Pulmonata: Achatinidae), in two islands, Chichijima and Hahajima, of the Ogasawara (Bonin) Islands. Japanese Journal of Applied Entomology and Zoology. 32: 176−181 (In Japanese, Abstract in English).

Payne, G., Weaver, K., Bennett, T., and Nearhoof, F. 1999. Everglades Phosphorus Criterion Technical Support Document. Florida Department of Environmental Protection, Everglades Technical Support Section, Tallahassee, FL. Available http://www.dep.state.fl.us/water/wqssp/everglades/pctsd.htm *last accessed* September 28, 2011.

PCD—see Miami-Dade County Pollution Control Division

Raut, S.K. and Barker, G.M. 2002. *Achatina fulica* Bowdich and Other Achatinidae as Pests in Tropical Agriculture. *In:* Barker, G. M. (ed.). Mollusks as Crop Pests. CABI Publishing, Wallingford, Oxon, UK. Pp. 55–114 (in litt.).

SFWMD—see Southern Florida Water Management District

Sheikh, P and Johnson, B. 2004. Phosphorus mitigation in the Everglades. CRS Report for Congress. Available http://www.policyarchive.org/handle/10207/bitstreams/1875.pdf *last accessed* September 28, 2011.

Slom, T. and S. Johnson. Eosinophilic Meningitis. Current Infectious Disease Reports 2003, 5:322–328.

Smith, J.W., and Fowler, G. 2003. Pathway Risk Assessment for Achatinidae with emphasis on the Giant African Land Snail *Achatina fulica* (Bowdich) and *Limicolaria aurora* (Jay) from the Caribbean and Brazil, with comments on related taxa *Achatina achatina* (Linne), and *Archachatina marginata* (Swainson) intercepted by PPQ. USDA-APHIS, Center for Plant Health Science and Technology (Internal Report), Raleigh, NC.

Smith, T.R., Whilby, L.A., and Derkson, A.I., 2010. 2010 CAPS Giant African Snail Survey Report. Florida Cooperative Agricultural Pest Survey Program Report No. 2010-02-GAS-01. Available http://www.freshfromflorida.com/pi/caps/images/pdf_2010_giant_african_snail_survey_report_03-11-2010.pdf *last accessed* September 22, 2011.

Southern Florida Water Management District. 2011. 2012 South Florida Environmental Report (Draft). Chapter 3: Chapter 3A: Water Quality in the Everglades Protection Area. Pp. 3A1-41. Available http://my.sfwmd.gov/portal/page/portal/pg_grp_sfwmd_sfer/portlet_prevreport/2012_sfer_draft/2012_SFER_draft_toc.html. *last accessed* September 29, 2011.

Srivistava, P.D. 1992. Problem of Land Snail Pests in Agriculure. A Study of the Giant African Snail. Chapter 6: Economic Status. Concept Publishing Co.

Thiengo, S.C., Faraco, F.A., Salgado, N.C., Cowie, R.H.and Fernandez, M.A. 2007. Rapid spread of an invasive snail in South America: the giant African snail, *Achatina fulica*, in Brasil. Biological Invasions. 9: 693–702.

USDA, APHIS—see U.S. Department of Agriculture, Animal and Plant Health Inspection Service.

U.S. Census Bureau. 2011. State and County Quick Facts, Miami-Dade County, Florida. http://quickfacts.census.gov/qfd/states/12/12086.html *last accessed* September 22, 2011.

U.S. Department of Agriculture, Animal and Plant Health Inspection Service. 2005. New Pest Response Guidelines. Giant African Snails: Snail Pests in the Family Achatinidae. USDA-APHIS-PPQ-Emergency and Domestic Programs, Emergency Planning, Riverdale, Maryland.

U.S. Environmental Protection Agency. 2011. Federal Water Quality Standards for the State of Florida. Available http://water.epa.gov/lawsregs/rulesregs/florida_index.cfm. *last accessed* September 29, 2011.

U.S. Environmental Protection Agency. 2010. Technical Support Document for U.S. EPA's Final Rule for Numeric Criteria for Nitrogen/Phosphorus Pollution in Florida's Inland Surface Fresh Waters. 142 pp. Available http://water.epa.gov/lawsregs/rulesregs/florida_index.cfm. *last accessed* September 29, 2011.

U.S. Environmental Protection Agency. 1997. Pesticide Fact Sheet: Iron (Ferric) Phosphate. 6 pp.

Venette, R.C. and Larson, M. 2004. Mini Risk Assessment Giant African Snail, *Achatina fulica* Bowdich [Gastropoda: Achatinidae]. Available http://www.aphis.usda.gov/plant_health/plant_pest_info/pest_detection/downloads/pra/afulicapra.pdf. *last accessed* September 22, 2011.

Zhou, W.C., Cai, J.F., Chen, D.N., and Wu, Y.F. 1998. Study of viability of the giant African snail in China. Acta Zoologica Sinica. 44: 138–143 (in litt).

Appendix A. Host Plants of the GAS

(From Venette and Larson, 2004)

Common name	**Scientific name**
African locust bean	*Parkia filicoidea*
African oil palm	*Elaeia quineensis*
Air potato	*Discorea bulbifera*
Aloe	*Aloe indica*
Alsophila	*Alsophila*
Amaranth	*Amaranthus*
Apple	*Malus*
Arabian coffee	*Coffea Arabica*
Aubergine	*Solanum melongena*
Aztec marigold	*Tagetes erecta*
Balsampear	*Momordica cochinchinensis*
Banana	*Musa*
Basella	*Basella alba*
Bauhinia	*Bauhinia acuminate*
Bean	*Phaseolus*
Betel	*Piper betel*
Bird of paradise	*Heliconia* spp.
Bittermelon	*Momordica charantia*
Blackeyed pea	*Vigna unguiculata*
Blimbi	*Averrhoa bilimbi*
Blue-sage	*Eranthemum* spp.
Bluestem	*Andropogon*
Boatlily	*Tradascantia spathacea*
Bottle gourd	*Lagenaria siceraria*
Bougainvillea	*Bougainvillea*
Breadfruit	*Atrocaropus altilis*
Brinjal (see aubergine)	
Broccoli	*Brassica oleracea* var. *botrytis*
Buckhorn	*Opuntia*
Bulrush	*Scirpus ternatanus*
Butterfly pea	*Centrosema*
Cabbage	*Brassica oleracea* var. *capitata*
Cacao	*Theobroma cacao*
Cactus	*Cereus*
Calophyllum	*Calophyllum inophyllum*
Canna	*Canna*
Cantaloupe	*Cucumis melo* var. *dudaim*
Carambola	*Averrhoa carambola*
Carrot	*Daucus carota*
Cassava	*Manihot esculenta*
Castor	*Ricinus communis*

Cathedral bells	*Bryophyllum (=Kalanchoe)*
Cauliflower (see broccoli)	
Cayenne pepper	*Capsicum annuum*
Chandelier plant (see cathedral bells)	
Cherimoya	*Annona cheirimoya*
Chili pepper	*Capsicum*
Chinese box	*Murraya*
Chinese chive	*Allium tuberosum*
Chrysanthemum	*Chrysanthemum coronarium* var. *coronarium*
Clitoria	*Clitora ternatea*
Coco yam	*Colocasia esculenta*
Coconut	*Cocos*
Coffee	*Coffea*
Elephant yam	*Amorphophallus paeoniifolius*
Cosmos	*Cosmos*
Cotton	*Gossypium herbaceum*
Cowpea	*Vigna savi*
Crinum	*Crinum* spp.
Crybaby tree	*Erythrina crist-galli*
Cucumber	*Cucumis edulis, C. sativus*
Dahlia	*Dahlia*
Dancing-lady orchid	*Oncidium*
Devil's tree	*Alstonia scholaris*
Dixie rosemallow	*Hibiscus mutabilis*
Dracaena	*Dracaena*
Drum stick	*Moringa oleifera*
Dumbcane	*Dieffenbachia sequine*
Edible banana	*Musa acuminate*
Edward rose (see rose)	
Elephant's ear	*Xanthosoma*
Eranthemum (see blue sage)	
Erythrina	*Erythrina*
Eucalyptus	*Eucalyptus*
False nettle	*Boehmeria*
Field mustard	*Brassica campestris* var. *rapa*
Field pumpkin	*Cucurbita pepo*
Fig	*Ficus hispida*
French plantain	*Musa paradisiaca*
Garden pea	*Pisum sativum*
Gardenia	*Gardenia angusta*
Garlic	*Allium oleraceum*
Giant taro	*Alocasia macrorrhizos*
Ginger	*Zingiber*

Globe amaranth	*Gomphrena globosa*
Goldenshower	*Cassia fistula*
Gourd	*Cucurbita*
Grape	*Vitis vinifera*
Graveyard flower	*Plumeria acuminate*
Great bougainvillea	*Bougainvillea spectabilis*
Green bean, soy bean	*Glycine max*
Hoary pea	*Tephrosia*
Horseradish tree (see drum stick)	
Hyacinth bean	*Lablab purpureus*
Impatiens	*Impatiens balsamina*
Indian bark	*Cinnamonum tamala*
Indian lettuce	*Lactuga indica*
Indian marigold	*Tagetes patula*
Indian mulberry	*Morinda citrifolia*
Indina oleander	*Nerium indicum*
Indian shot	*Canna indica*
Indigo	*Indigofera*
Indinesian gum	*Eucalyptus deglupta*
Jackfruit	*Artocaropus heterophyllus*
Jasmine	*Jasmin sambac*
Jute	*Corchorus capsularis*
Kalanchoe	*Kalanchoe pinnatum*
Knol kohl	*Brassica oleracea* var. *cauiorapa*
Kokko	*Albizzia lebbeck*
Kudzu	*Pueraria*
Laceleaf	*Anthurium* spp.
Lady’s finger	*Hibuscus esculentus*
Lagenaria	*Lagenaria*
Lal sag (see amaranth)	
Leadtree	*Leucaena*
Lemon	*Citrus lemon*
Lettuce	*Lactuga sativa*
Light-blue snakeweed	*Stachytarpheta jamaicensis*
Lily of the Incas	*Alstromeria*
Lime	*Citrus aurantifolia*
Lobia (see cowpea)	
Locoto	*Capsicum baccatum*
Luffa	*Luffa cylindrica*
Machete plant	*Erythrina berteriana*
Mahogany	*Sweitenia mahogani*
Maiden grass	*Miscanthus condensatus*
Maize	*Zea mays*
Marigold (see Indian marigold)	
Marshweed	*Limnophila* spp.

Madagascar periwinkle	*Lochnera rosea*
Mandarin orange	*Citrus reticulate*
Monthan (see banana)	
Moth orchid	*Phalaenopsis* spp.
Mulberry	*Broussonetia papyrifera*
Mung bean	*Phaseolus aureus, Vigna radiate*
Naupaka	*Scaveola*
Night queen	*Cestrum nocturnum*
Nightshade	*Solanum*
Nodeweed	*Synedrella nodiflora*
Okra	*Abelmoschus esculentus*
Oleander	*Nerium oleander*
Onion	*Allium cepa*
Orange	*Citrus sinensis*
Palm nut	*Areca catechu*
Pancratium	*Pancratium*
Papaya	*Carica papaya*
Paperflower (see bougainvillea)	
Passionfruit	*Passiflora*
Passionflower (see passion fruit)	
Patol	*Trichsanthes dioica*
Peacocksplume	*Falcataria moluccana*
Peanut	*Arachis hypogaea*
Pepper	*Piper*
Periwinkle	*Catharanthus roseus*
Peruvian groundcherry	*Physalis peruviana*
Pigweed (see amaranth)	
Pigeon pea	*Cajanus cajan*
Pineapple	*Ananas comosus*
Pink wood sorrel	*Oxalis carymbosa*
Pipturus	*Pipturus*
Poovan (see banana)	
Potato	*Solanum tuberose*
Potato yam (see air potato)	
Pothos	*Epipremnum pinnatum*
Pricklypear (see buckthorn)	
Puni	*Basella rubra*
Purple amaranth	*Amaranthus blitum*
Purslane	*Portulaca grandiflora*
Quickstick	*Gliricidia sepium*
Radish	*Raphanus sativus*
Rape	*Brassica napus* var. *napus*
Rape-jasmine	*Tabernaemontana divaricata*
Rattlesnakemaster	*Eryngium*
Rice	*Oryza sativa*

Robusta coffee	*Coffea canephora*
Rose	*Rosa* spp.
Rosemallow	*Hibiscus*
Rubbertree	*Hevea brasiliensis*
Sadabahar	*Lachnera rosea*
Sage	*Salvia*
Sanchezia	*Sanchezia nobilis vargeta*
Sanseviera	*Sansevieria trifasciata*
Scarlet pimpernel	*Anagallis arvensis*
Screw pine	*Pandanus tectorius*
Sensitive plant	*Mimosa*
Sesame	*Sesamum indicum*
Shishu	*Dalbergia sissoo*
Shoeback plant	*Hibiscus rosasinensis*
Silktree	*Albizzia*
Sinkwa towelsponge	*Luffa acutangula*
Slender amaranth	*Amaranthus viridis*
Snake gourd	*Trichosanthes anguina*
Solomon’s seal	*Polygonatum odoratum*
Sorghum	*Sorghum*
Soursop	*Annona muricate*
Spiderwisp	*Gynandropsis* (=*Chleome*)
Spinach	*Spinacia oleracea*
Spleenwort	*Asplenium nidus*
Sponge gourd	*Luffa aegyptiaca*
Striped brake	*Pteris quadriaurita*
Sugarbeet	*Beta vulgaris* var. *rapa*
Sugarcane	*Saccharum*
Sunflower	*Helianthus annuus*
Swamplily (see crinum)	
Sweet potato	*Ipomoea batatas*
Sweet potato cactus (see cactus)	
Synedrella (see nodeweed)	
Tagar (see nodeweed)	
Tahitian spinach	*Xanthosoma braziliense*
Tampala	*Amaranthus tricolor*
Tapioca (see cassava)	
Taro	*Alocasia*
Tea	*Camellia sinensis*
Teak	*Tectona grandis*
Theobroma	*Theobroma*
Thespesia	*Thespesia*
Tiplant	*Cordyline* spp.
Tobacco	*Nicotiana tabacum*
Tomato	*Solanum lycopersicum*

Towelsponge	*Luffa*
trattlepod	*Crotolaria*
Treedaisy	*Montanoa hibiscifolia*
Treemelon (see papaya)	
Type of East Asian (China) *Cucurbita*	*Edgaria darjeelingensis*
Vanda orchid	*Vanda*
Vanilla	*Vanilla*
Water yam	*Dioscorea alata*
Watermelon	*Citrullus lanatus*
White leadtree	*Leucaena leucocephala*
White mulberry	*Morus alba*
Wild pepper	*Heckeria*
Wild tantan	*Desmathus virgatus*
Winter squash	*Cucurbita maxima*
Woman's tongue (see koko)	
Woodnettle	*Laportea*
Yam	*Colocasia*
Yam bean	*Pachyrhizus erosus*
Zinnia	*Zinnia linearis*

Appendix B. Map of GAS-infested area