



Animal and Plant Health Inspection Service
U.S. DEPARTMENT OF AGRICULTURE

Horntail Snail Cooperative Eradication Program in Broward, Collier, Miami-Dade and Palm Beach Counties, Florida

Final Environmental Assessment—February 2022

Agency Contact:

Kai Caraher
National Policy Manager
Plant Protection and Quarantine
Animal and Plant Health Inspection Service
U.S. Department of Agriculture
4700 River Road
Riverdale, MD 20737-1231

In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at [How to File a Program Discrimination Complaint](#) and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

Mention of companies or commercial products in this report does not imply recommendation or endorsement by the U.S. Department of Agriculture (USDA) over others not mentioned. USDA neither guarantees nor warrants the standard of any product mentioned. Product names are mentioned solely to report factually on available data and to provide specific information. This publication reports research involving pesticides. All uses of pesticides must be registered by appropriate State and/or Federal agencies before they can be recommended.

CAUTION: Pesticides can be injurious to humans, domestic animals, desirable plants, and fish and other wildlife—if they are not handled or applied properly. Use all pesticides selectively and carefully. Follow recommended label practices for the use and disposal of pesticides and pesticide container.

Table of Contents

I. Introduction	1
A. Purpose and Need	2
II. Alternatives.....	3
A. No Action Alternative	3
B. Preferred Alternative.....	3
III. Potential Environmental Consequences	7
A. No Action Alternative	7
1. Environmental Quality.....	7
2. Ecological Resources	8
3. Human Health and Safety	9
B. Preferred Alternative.....	10
1. Environmental Quality.....	10
2. Ecological Resources	11
3. Human Health and Safety	15
C. Other Considerations.....	17
1. Executive Order (EO) 12898—Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations and EO 13985—Advancing Racial Equity and Support for Underserved Communities through the Federal Government	17
2. EO 13045—Protection of Children from Environmental Health Risks and Safety Risks.....	17
3. Historical and Cultural Resources	18
IV. Listing of Agencies Consulted	19
V. References	20
Appendix 1. Map of horntail snail distribution in Miami-Dade County	22

List of Figures

Figure 1. Horntail snail. Photo by Elijah J. Talamas, FDACS-Division of Plant Industry.....	2
---	---

List of Acronyms and Abbreviations

a.i.	active ingredient
APHIS	Animal and Plant Health Inspection Service
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
EA	Environmental assessment
EO	Executive Order
ESA	Endangered Species Act
FDACS	Florida Department of Agriculture and Consumer Services
FDEP	Florida Department of Environmental Protection
IFAS	University of Florida's Institute of Food and Agricultural Sciences
MBTA	Migratory Bird Treaty Act of 1918
NEPA	National Environmental Policy Act
NOEC	No observable effect concentration
NOEL	No observable effect level
PPE	Personnel protective equipment
SITS	Stock Island tree snail
U.S.C	United States Code
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service

Horntail Snail Cooperative Eradication Program in Broward, Collier, Miami-Dade and Palm Beach Counties, Florida—Final Environmental Assessment, February 2022

I. Introduction

The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), in cooperation with the Florida Department of Agriculture and Consumer Services (FDACS) is considering options for actions it can take to eradicate the horntail snail, *Macrochlamys indica* Benson (Ariophantidae), from Miami-Dade County, Florida. The Program includes the counties of Broward, Collier, and Palm Beach based on their proximity to Miami-Dade County, although the horntail snail is not currently found in these counties. This program is like the cooperative eradication program for the giant African snail (*Lissachatina fulica* (Bowdich), formerly *Achatina fulica*) in Miami-Dade County.

In June 2020, a citizen notified the University of Florida (IFAS) of a potential new snail they found in the Coconut Grove neighborhood, Miami-Dade County, Florida. The University identified the snail as *M. indica* (Figure 1). On August 10, 2020, USDA-APHIS/FDACS collected 30 specimens from the location the citizen found the snails and confirmed the identification (FDACS, 2020). In August, FDACS inspectors contacted 12 landscapers in and around the core area to conduct tracebacks and identify areas that should be surveyed. As of January 20, 2021, the Program found a total of 5,248 snails. This includes 94 positive residential properties out of 1,314 residential properties surveyed and 21 positive ornamental plant nurseries out of 1,100 inspected. Hold orders were issued to 89 plant nursery locations. The Program has physically removed and destroyed the snails found.

The Program created a website to share information about the horntail snail and the Program (<https://www.fdacs.gov/Agriculture-Industry/Pests-and-Diseases/Plant-Pests-and-Diseases/Horntail-Snail-Eradication>, last accessed January 28, 2022). The Program coordinated a grower/industry meeting with the Miami-Dade County Agriculture Manager and IFAS to share information about the horntail snail and the outbreak. A map of the horntail snail area is in appendix 1. It is unknown how and when the horntail snail entered the United States or how the area became infested.

The horntail snail is a pest native to India where it feeds on a wide variety of commercially grown plants including cole crops, beans, lettuce, moringa, yams, chrysanthemum and cucurbits (FDACS, 2020). Recently, the snail was found causing damage to citrus and guava seedlings in a nursery at a fruit research station India (Singh et al., 2020). The snail will consume seedlings in entirety; in India, the snail has been reported to cause between 10-65% mortality of neem seedlings (as cited in (Singh et al., 2020)). The snail may also feed on dead members of its own species (FDACS, 2020).

The horntail snail's shell is 16-18.5 millimeters (mm) in diameter (about the size of a dime) and is amber colored. The snail has a flap of flesh that extends backward onto or around the shell when it is alive and relaxed. This characteristic separates the snail from other terrestrial snails in Florida. A mature horntail snail, about four months of age, lays 45-900 eggs per year in soil or moist spaces (FDACS, 2020). Eggs are 3-3.5 mm in size and are round, translucent, and tough (FDACS, 2020). The snail will burrow into the ground or seek cool, damp places during dry, hot weather (FDACS, 2020). The snail is active at night and after rainfall (FDACS, 2020).



A. Purpose and Need

USDA-APHIS has the responsibility for taking actions to exclude, eradicate, and control plant pests under the Plant Protection Act of 2000 (7 United States Code (U.S.C.) 7701 et seq.). USDA-APHIS, in cooperation with the FDACS, is proposing a program to prevent further spread of the horntail snail and eradicate it from Miami-Dade County, Florida. Spread can occur naturally and through the movement of nursery stock, soil, landscape material, and other objects the snail hides in or attaches to. Because of this, the Program includes Broward, Collier, and Palm Beach Counties based on their proximity to Miami-Dade County. This Program is needed because of the snail's plant pest potential.

USDA-APHIS prepared this environmental assessment (EA) to comply with the provisions of the National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. §§ 4321 et seq.) as prescribed in implementing regulations adopted by the Council on Environmental Quality (CEQ) (40 CFR parts 1500-1508), USDA's NEPA regulations at 7 CFR part 1b, and USDA-APHIS NEPA implementing procedures (7 CFR part 372) for the purpose of evaluating the potential effects of the proposed action on the human environment (40 CFR § 1508.1(m)).

USDA-APHIS published the draft EA to Regulations.gov (APHIS-2021-0083-0001) on December 27, 2021 for a 30-day public comment period. USDA-APHIS published a notice of availability for the draft EA in local newspapers in Florida, its social media accounts, the Plant Protection and Quarantine Stakeholder Registry, and on its website at <https://www.aphis.usda.gov/aphis/newsroom/stakeholder-info/stakeholder-messages/plant-health->

[news/horntail-snail-ea-comment-period](#) (last accessed January 28, 2022). The comment period closed on January 26, 2022. There were no public comments on the draft EA.

II. Alternatives

A. No Action Alternative

NEPA regulations require the scope of analysis to include a no action alternative in comparison to other reasonable courses of action. Under the no action alternative, USDA-APHIS would not participate in the eradication of the horntail snail in Broward, Collier, Miami-Dade, and Palm Beach Counties, FL. Other Federal or non-Federal entities, such as FDACS or landowners, could take control measures.

B. Preferred Alternative

The horntail snail cooperative eradication program (preferred alternative) is a cooperative effort between USDA-APHIS and FDACS. Under the preferred alternative, Program personnel survey properties to delimit the infestation, physically remove horntail snails, and apply the pesticide (molluscicide) metaldehyde.

The Program conducts surveys at nighttime when the snails are active. The Program uses visual inspection and canine detection. The Program sets a 200-yard arc survey boundary around each positive find. No quarantines are in place. However, the Program may place ‘stop sale/hold orders’ on nurseries that have a positive find. Plant nurseries enter into compliance agreements with the Program that include specific survey and control requirements to ensure their plant material is snail-free prior to movement off the premises.

Regular and extensive hand picking is effective in reducing snail numbers, but the small size of the snail makes it difficult to see and remove all snails. However, when done in combination with other control methods, particularly in newly infested areas, hand-removal contributes to eradication efforts. Snails may be disposed of by freezing or immersion in alcohol or boiling water.

Metaldehyde is a commonly used molluscicide that has a wide variety of agricultural and non-agricultural uses. Formulations vary, but applications are typically made as bait incorporated into a granule or pellet. Slugs and snails that encounter the bait are exposed to metaldehyde through ingestion or absorption. Metaldehyde disrupts the snails and slugs’ mucus-secreting cells which results in dehydration and eventual death.

The Program proposes to use four metaldehyde formulations to treat horntail snail infestations. The Program would follow label instructions on application rate and frequency, as well as any label restrictions. Table 1 lists the product name, application rate, application frequency, and application method the Program proposes to use. OR-CAL® Slug and Snail Bait 3.25% (Sublabel

B) and Deadline® T&O 4% contain a bittering agent to reduce the chance of incidental exposure to birds and mammals, as well as domestic pets. OR-CAL® Slug-fest 25% and Durham® Metaldehyde Granules 7.5% are applied by hand as targeted treatments and OR-CAL Slug and Snail Bait and Deadline are applied with a broadcast spreader.

The Program creates a treatment grid based on properties with a positive snail detection. Properties adjoining and adjacent to positive properties are included in the treatment grid. All greenspace on positive and negative properties in a treatment grid would receive a broadcast treatment of OR-CAL Slug and Snail Bait or Deadline at the label rates. In addition to the broadcast treatment, on positive properties the Program would make an application of Slug-fest or Durham at the site of the snail find, applying the product within 1 foot of the site. The Program applies a second treatment of metaldehyde to the properties within the treatment grid at least 14 or 21 days after the first application or according to label treatment schedules. A 10-foot treatment buffer from aquatic areas is followed for metaldehyde bait and liquid applications. In buffer areas, the Program uses physical removal to treat snail infestations.

The Program uses gastropod (snail) traps to aid in the detection of horntail snail. The traps contain a food product bait such as fermenting yeast and flour dough or a synthetic lure which is topped with 1-inch of metaldehyde-treated soil. The Program mixes 5 to 10 fluid ounces of OR-CAL Slug-fest with 10 gallons of water and adds this dilution to the soil in the trap until the soil is moistened. The Program places the traps in wet and shady areas at a minimum of three feet apart in areas known to have infestations as well as in areas to confirm control measures were successful. Traps containing metaldehyde will only be used in commercial nurseries and will not be used in residential areas. The overall length of time a snail trap is used in a location will vary with the risk associated with the location. The Program anticipates using traps in an area for at least 6 months after the last detection of a snail. The Program recommends servicing traps daily, when possible, to allow for immediate response to the presence of the horntail snail. The synthetic lure remains attractive to snails for 10 days; however, the Program recommends replacing the bait and lure frequently, preferably daily, due to secondary invaders like flies and the tendency for the lure to dry out. The Program prefers to replace the metaldehyde-treated soil regularly and when the trap is saturated with snails following label instructions. The Program uses traps in areas specified on the label (Table 1).

Table 1. Metaldehyde formulations the Program proposes to use for horntail snail eradication.

Product	Application rate	Frequency	Property status for properties other than plant nurseries	Application method
<p>OR-CAL® Slug-fest All Weather Formula, 25% metaldehyde, liquid</p> <p>EPA Reg. No. 71096-4</p> <p>SLN FL-</p>	<p>118 fl. oz per treated acre (2 pounds (lb) active ingredient (a.i.) per acre (A))</p> <p>For use in traps, mix 5 to 10 fl. oz with 10 gallons of water and fill the bottom of each trap with up to one-inch of pre-moistened soil and then apply the slug-fest solution to the soil until moist</p>	<p>As needed but no more than 6 applications per year</p>	<p>Positive</p> <p>Used in infested areas where the Program collected snails and egg laying likely occurred</p> <p>Positive/Negative when used in snail traps</p>	<p>Targeted spray in areas where snails are detected using a 2-gallon backpack sprayer or hand-pulled tank sprayer</p> <p>Used to target small infested areas; also used in areas difficult to reach with the preferred pellet formulations. Applications are made within 1-foot of a snail find.</p> <p>Used in gastropod traps (SLN) to aid in the detection of snails. Place traps in wet shady areas at a minimum of 3 feet apart in areas specified on the SLN label</p>
<p>Durham® Metaldehyde Granules 7.5% metaldehyde</p> <p>EPA Reg. No. 5481-103</p>	<p>2 lb a.i./A</p>	<p>As needed but no more than 6 applications per year</p>	<p>Positive</p> <p>Used in infested areas where the Program collected snails and egg laying likely occurred</p>	<p>Targeted broadcast by hand in areas where snails are detected</p> <p>Used to target small infested areas; also used in areas difficult to reach with the preferred pellet formulations. The granules are sand core granules coated with the metaldehyde. Applications are made within 1-foot of a snail find.</p>

Product	Application rate	Frequency	Property status for properties other than plant nurseries	Application method
Deadline® T&O 4%, pellet with bittering agent EPA Reg. No. 5481- 511 EPA SLN No. FL- 140001	2 lb a.i./A	As needed	Positive/Negative Use to treat snail positive, adjoining, and adjacent properties	Broadcast using a hand- held spreader The Program would use this pesticide as a second choice to OR-CAL Slug and Snail Bait, which also contains a bittering agent
OR-Cal® Slug and Snail Bait Sublabel A – Agricultural Label, 3.25% metaldehyde Sublabel B – Residential Label, 3.25% metaldehyde, with bittering agent (Bitrex) EPA Reg. No. 71096-7	Sublabel A: 2 lb a.i./A Sublabel B: between 18 to 20 pellets per linear foot depending on use site	Sublabel A: As needed but no more than 6 applications/ year Sublabel B: 2 to 6 times per year, depending on use site	Positive/Negative Use to treat snail positive, adjoining, and adjacent properties	Broadcast using a hand- held spreader The Program prefers this pesticide for broadcast applications, because it has a bittering agent and would use this more widely than other Program pesticides

Prior to treatment with metaldehyde, the Program obtains signed consent forms from residents/landowners. The Program provides residents/landowners with a 24-hour notice that treatment will occur. Once treated, the Program gives residents/landowners a notice with the date and time the treatment occurred and the time they can enter the treated area. The metaldehyde re-entry time is 12 hours; there is no reentry time associated with snail traps.

Pesticide 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 horntail snail has been eradicated.

III. Potential Environmental Consequences

The initial horntail snail detection was in the Coconut Grove neighborhood of Miami-Dade County, Florida. In addition to Miami-Dade County, the proposed Program area includes Broward, Collier, and Palm Beach Counties due to their proximity to Miami-Dade County and the ability of the horntail snail to move through nursery stock, soil, landscape material and other objects the snail hides in or attaches to.

The four counties are mixed residential, commercial (including plant nurseries), and industrial and have several state and county parks. There are several public gardens in the Program area such as the Vizcaya Museum and Gardens, the Kampong National Tropical Botanical Garden and the Fairchild Tropical Botanical Garden in Miami-Dade County; the Morikami Museum and Japanese Garden in Palm Beach County; the Flamingo Garden and the Plantation Garden in Broward County; and the Naples Botanical Garden in Collier County. National parks found in the four counties include the Everglades National Park, the Biscayne National Park, and the Big Cypress Nature Preserve. See appendix 1 for a map of the outbreak area in Miami-Dade County.

This section evaluates the potential environmental impacts associated with each of the alternatives. The no action alternative is compared to the potential of the preferred alternative to affect environmental quality, ecological resources, and human health and safety. The potential impacts may be direct, indirect, and of short or long duration. The impacts may also be either beneficial or adverse.

A. No Action Alternative

This section includes a short description of the environmental baseline for the environmental quality, ecological resources, and human health and safety in the proposed program area.

1. Environmental Quality

Air pollutants in the four counties are primarily ozone and particulate matter (USEPA, 2020a). Most of the water ways in the four counties are impaired (USEPA, 2010). Sources of water pollution in the four counties can be wastewater, other liquid wastes, stormwater runoff, solid waste and agricultural sources (USEPA, 2010; Miami-Dade County, 2019; Collier County, 2020; FDEP, 2021). In Broward County, the phosphorus levels in freshwater and marine waters exceed the target limit (FDEP, 2021). In Southern Florida, groundwater is the primary drinking water source, and because of its close proximity to the surface, it is vulnerable to contamination (Haag et al., 1996; Collier County Pollution Control, 2019; Miami-Dade County, 2019).

Under the no action alternative, USDA-APHIS would not positively or negatively impact the air, water, and soil resources in the program area.

2. Ecological Resources

Ecological resources include plant and animal species and the habitats where they live and includes protected species. Protected species refers to migratory birds protected under the Migratory Bird Treaty Act of 1918 (MBTA), as amended, and threatened and endangered species and their critical habitats as protected under the Endangered Species Act (ESA).

The horntail snail would be expected to damage susceptible native vegetation, including rare species, when populations become sufficiently high. It is expected to cause damage to commercial agricultural crops and horticultural plants. There are 21 threatened and endangered plant and fern species in the proposed Program area, however these plants are not known hosts of the horntail snail.

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. 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). The horntail snail would compete for resources with native snails. The horntail snail is known to feed on other dead horntail snails, but it is not known if it consumes live snails or other snails in the Ariophantidae family or other mollusk families. The presence of the horntail snail would result in additional pesticide applications in both residential and other areas as snail populations increase and spread. It's difficult to quantify the potential increase in pesticide loading that would occur, however it is anticipated that pesticide applications would increase over the long term as snail populations increase and spread. In addition to increased pesticide loading, there is the potential for the use of pesticides that pose a higher comparative risk to human health and the environment than metaldehyde, the pesticide the Program proposes to use under the preferred alternative.

While other federal and non-federal entities may take control actions on their own, without USDA-APHIS participation, the horntail snail population would likely continue to increase and spread as people inadvertently move the snail in soil, stone, plants, plant debris, and other material. With limited state funding for horntail snail management, the snail could spread outside of its current range and expand to other areas of Florida and the United States. Since there are not any interstate regulations regarding quarantines or Federal restrictions for horntail snail infested areas, the snail would likely spread under this alternative.

(1) *Migratory Bird Treaty Act*

Federal law prohibits an individual 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 (16 U.S.C. §§ 703-712; 50 CFR § 21).

Mild winters and diverse habitats attract migratory birds in both the winter and summer in the proposed horntail snail program area. Florida is in the Atlantic Flyway for migratory birds (USFWS, 2020).

Under the no action alternative, USDA-APHIS will not improve habitat conditions for migratory birds, nor will it inadvertently disturb migratory birds.

(2) *Bald and Golden Eagle Protection Act*

The Bald and Golden Eagle Protection Act (16 U.S.C. § 668) prohibits the take of bald or golden eagles unless permitted by the U.S. Fish and Wildlife Service (USFWS). The term “take” is defined as “pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest, or disturb” (50 CFR § 22.3). Disturb means to agitate or bother to a degree that causes . . . injury . . . a decrease in its productivity . . . or nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior (§ 22.3).

In southern Florida, including Broward, Collier, Miami-Dade and Palm Beach Counties, the bald eagle (*Haliaeetus leucocephalus*) is regularly occurring (Cornell University, 2019a). In Miami-Dade County the golden eagle may also be (rarely) found (Cornell University, 2019b; Tropical Audubon Society, 2020).

USDA-APHIS conducted a literature review and did not find evidence of the horntail snail impacting bald eagles or golden eagles. Therefore, the no action alternative is unlikely to have any negative impacts on nesting bald eagles; golden eagles do not nest in Florida (Cornell University, 2019b).

(3) *Endangered Species Act*

Section 7 of the ESA and ESA’s implementing regulations require Federal agencies to ensure that their actions are not likely to jeopardize the continued existence of federally listed threatened and endangered (T&E) species or result in the destruction or adverse modification of critical habitat.

Federally listed species and species proposed for listing in the program area include mammal, bird, reptile, amphibian, fish, insect, and plant species. The full host range for the horntail snail is not known; however, the horntail snail is not known to feed on T&E plant species. The horntail snail is not expected to harm directly other T&E species in the county.

3. Human Health and Safety

Broward, Collier, Miami-Dade, and Palm Beach Counties are urbanized. According to census data, the 2019 population of Broward County was 1.95 million, Collier County was 384,902,

Miami-Dade County was 2.71 million and Palm Beach County was 1.49 million (U.S. Census Bureau, 2019).

Under the no action alternative, USDA-APHIS would not participate in the eradication of the horntail snail. Currently, the horntail snail is found mostly in residential settings where plant loss would be confined to landscape and garden plants. The Program has found the snail in several plant nurseries. Expansion of the snail to other areas could pose a threat to agriculture. Commercial producers with horntail snail in their agricultural and nursery crops may experience loss of market share, loss of property, increase in control costs, and compromised mental and physical health from increased stress. Homeowners would also experience damage and loss of landscape plants and could incur costs should they chose to treat the snail with commercially available products.

As mentioned above, the presence of the horntail snail would result in additional pesticide applications in both residential, commercial, and other areas as snail populations increase and expand. In addition to increased pesticide loading there is the potential for the use of other pesticides that pose a higher comparative risk to human health and the environment than metaldehyde, a pesticide proposed for use under the preferred alternative.

B. Preferred Alternative

This section considers the potential environmental consequences for the preferred alternative by summarizing information associated with environmental quality, ecological resources, and human health and safety in the proposed program area. The specific location of a snail population is not likely to alter the type or frequency of any direct or indirect impacts.

1. Environmental Quality

Hand removal of snails will not impact air, soil, or water resources. The most frequent types of ground disturbance would be from vehicles and Program personnel walking to conduct program actions. Many of the activities associated with the program will result in temporary soil surface disturbance or compaction. Since the horntail snail currently occurs in highly disturbed areas where soil quality is already impacted by human activities, the program in these areas will have negligible negative impacts.

Vehicle emissions associated with getting to and from project sites would be minor relative to the ongoing and future emissions from urbanization, highway traffic, and agricultural production. Future actions that could increase emissions (e.g., housing developments and road expansions leading to more traffic) are difficult to quantify because emissions from mobile sources are subject to changing fuel mileage and emissions standards and regulations. Nevertheless, the contribution from the preferred alternative would remain minor compared to the overall emissions in the four counties.

Impacts from Program use of metaldehyde to air, soil and water quality are not anticipated because of the Program's use pattern and its environmental fate. Metaldehyde is stable to hydrolysis (chemical breakdown from chemical reaction with water) and photolysis (chemical breakdown from reaction to light). Metaldehyde shows degradation in the presence of microbes with a reported aerobic soil metabolism half-life of 67 days. Degradation by microbial processes is also supported by field data that demonstrates a half-life of metaldehyde of less than 15 days in water and sediment (Calumpang et al., 1995; Coloso et al., 1998; Bieri, 2003). The primary degradation products of metaldehyde are acetaldehyde and carbon dioxide which have been shown to represent 11 and 74%, respectively, of the parent in laboratory studies (USEPA, 2006b). Metaldehyde may impact some soil dwelling invertebrates after repeated use in the same area, but due to the limited areas of treatment and selective toxicity, impacts are not expected to be widespread or affect other soil dwelling invertebrates. Metaldehyde has a solubility of 200 milligrams (mg)/Liter (L) with a range of adsorption coefficient values (Koc) of 57 to 173. Adsorption coefficient values determine how mobile a pesticide may be in soil. The higher the Koc value the more likely it is to bind to soil and not occur in solution in runoff. The Koc values reported for metaldehyde suggest mobility in soil. Metaldehyde is expected to be moderately persistent with an aerobic half-life of 67 days and an anaerobic half-life typically greater than 200 days (USEPA, 2006b, 2020c).

Label restrictions prohibiting applications to water and granular formulation will reduce the likelihood of runoff. Drift and runoff potential from spot liquid applications is also expected to be low since a large coarse droplet size will be used and all liquid applications will be made by hand to targeted spots (1-foot around a snail find) under vegetated areas. Metaldehyde runoff from snail traps is also unlikely as the metaldehyde-treated soil is contained within the trap and does not contact the ground and traps are placed under vegetation which provides some protection from rain events. The potential for runoff to occur from applications to treat the horntail snail will further be reduced by treatment restrictions for the program that require a 10-foot application buffer from all water bodies. This 10-foot application buffer applies to the snail traps, which reduces the likelihood the traps dislodge into water bodies during extreme rain events. The use of a granular formulation and large coarse droplets in the spot liquid applications along with a lack of volatility of metaldehyde suggests that air quality will not be impacted in the treatment areas.

2. Ecological Resources

Metaldehyde is moderately toxic to mammals and birds from acute dosing studies that demonstrate a median lethality value of 238 milligrams (mg)/kilogram (kg) for the rat, and a range of 181 mg/kg for the Japanese quail to 1,030 mg/kg for the Peking duck (USEPA, 2020b). The house sparrow (*Passer domesticus*) has a 14-day acute oral LD₅₀ of 351 mg a.i./kg bw (USEPA, 2020c). Similar studies with the mallard show a median lethality value of 196 mg/kg

and a no observable effect level (NOEL) of 63 mg/kg. Dietary subacute exposure in birds demonstrates a range of median lethality values from 2,668 to 3,460 parts per million (ppm), suggesting slight toxicity. Sublethal acute and chronic studies in mammals reveal NOELs in acute exposures at 75 mg/kg/day, while in chronic exposures using the dog the NOEL was reported at 10 mg/kg/day (USEPA, 2006b). Chronic avian toxicity ranges from a no observable effect concentration (NOEC) of less than 49 ppm in the mallard to 497 ppm in a bobwhite reproduction study.

USEPA (2020c) estimates small birds and small mammals would need to consume 8 and 37 metaldehyde treated granular pellets, respectively, to reach the LD₅₀. USEPA concludes there is a potential for small birds and small mammals that feed on metaldehyde pellets to develop acute toxicity. USEPA estimated bobwhite quail would need to ingest 3 metaldehyde treated pellets to reach a sublethal concentration to cause a reduction in egg hatchability (USEPA, 2020c).

On June 29, 2020, USEPA summarized incidents of exposure to metaldehyde reported in the Incident Data System. One incident reported in 2006 involved two birds that were found dead after a granular formulation was applied to a yard; however, a residue analysis did not provide evidence to conclude the deaths were from the exposure (USEPA, 2020c). Small birds and small mammals may be exposed to metaldehyde treated granular pellets from Program applications; however, treatment areas are confined to the location of snail finds and generally are not large areas. The forage areas for birds and mammals are larger than the treatment areas, which reduces the risk of exposure to metaldehyde treated granular pellets. For liquid applications, the primary exposure route for birds and mammals would be from the consumption of contaminated plants and invertebrates (USEPA, 2020c). The Program uses liquid formulations to target small infested areas within 1-foot of a snail find and in areas that are difficult to reach with pellet formulations. The Program does not apply liquid formulations to plants. For snail traps, the program moistens soil with a metaldehyde liquid formulation and places the soil inside the trap. Based on its use pattern, the Program finds the exposure of nontarget species to the liquid formulation would be minimal.

Conservative estimates of exposure for birds and mammals ingesting terrestrial invertebrates that have consumed metaldehyde would not result in acute or chronic direct risk to those populations. The selective nature of the formulation as well as the localized treatment areas would result in low direct risk to terrestrial insectivores.

Indirect impacts to birds and mammals that depend on terrestrial invertebrate prey are also not anticipated because treatments are localized, typically occurring in residential/developed settings, and would be much less than the foraging areas for most terrestrial vertebrates. In addition, metaldehyde is selective for certain invertebrates, and other prey would be available in the small areas where treatments would occur. Impacts to some soil dwelling terrestrial invertebrates could occur; however, these effects would be localized to the areas of treatment, and specific to those invertebrates that would be attracted to the bait. Impacts have been noted to

terrestrial isopods as well as some beetles in some cases, but effects were well above expected environmental concentrations (Bieri, 2003; Santos et al., 2010). Risk to insects such as sensitive lepidopterans would not be anticipated because the product is not applied to foliage as a spray where most lepidopterans forage and could be exposed. Applications occur directly to the soil by hand using a granular formulation or as a coarse droplet for spot liquid applications; therefore, drift onto foliage where lepidopterans forage is not anticipated to occur. In addition, the materials in the formulation that are attractive to the pest species are not components that would typically attract lepidopteran insects.

Metaldehyde is practically nontoxic to the adult honey bee for both the acute oral ($LD_{50} > 87$ micrograms (μg) a.i./bee) and contact exposure (48 hr $LC_{50} > 113$ μg a.i./bee) (USEPA, 2020c). The Program expects minimal exposure to bees based on its use pattern of soil applications and not foliar applications.

The Program prefers to use metaldehyde formulations that contain a bittering agent to reduce the palatability of metaldehyde to non-target species. This would provide some deterrence to wildlife. Exposure and risk to domestic animals is discussed below under Human Health and Safety.

In aquatic systems, fish and aquatic invertebrates show low sensitivity to metaldehyde with acute median lethality values of greater than 100 mg/L, or ppm, or the highest test concentration for most test species. The most sensitive aquatic species appears to be the rainbow trout with reported median lethality values ranging from 7.3 to 69 ppm. *Daphnia magna*, a freshwater invertebrate, has an acute 48-h $LC_{50} > 77.6$ mg a.i./L (USEPA, 2020c). The lack of toxicity has also been demonstrated in field studies where metaldehyde has been used to treat aquaculture ponds for invasive snails. Calumpang et al. (1995) demonstrated no acute effects to carp and tilapia in metaldehyde-treated freshwater ponds, and Borlongan and Coloso (1996) found no acute effects to juvenile milkfish (*Chanos chanos*) in metaldehyde-treated brackish water ponds 7 days after treatment.

Label restrictions regarding applications near water including the requirement a 10-foot application buffer from aquatic resources, reduces the potential for exposure and results in a very low probability for any adverse effects to aquatic organisms. Conservative estimates of exposure demonstrate that potential metaldehyde residues would be below effect levels for fish and aquatic invertebrates. Conservative estimates of residues in aquatic systems did not account for the 10-foot application buffer or the granular formulation that is considered weather resistant and would be less susceptible to runoff than other formulations. The spot applications and trap placements would also adhere to the 10-foot application buffer from aquatic resources, and with conservative estimates of residues, is not expected to result in impacts to aquatic biota.

The bittering agent, denatonium benzoate appears to have low toxicity to fish with a reported 96-hour median lethality value of greater than 1,000 mg/L. Toxicity to invertebrates ranges from a

48-hour median lethality value of 13 mg/L for the water flea, *Daphnia magna*, to a 96-hour median lethality value of 400 mg/L for the shrimp (Johnson Mathey MacFarlen and Smith, 2007).

(1) *Migratory Bird Treaty Act*

While horntail snail eradication activities may temporarily disturb migratory birds, USDA-APHIS expects this disturbance to be negligible. Some examples of anticipated disturbance associated with program activities includes the use of vehicles and human noise. However, the current horntail snail outbreak is found in highly disturbed areas and the urban profile of the four counties indicate that disturbance of migratory birds from program activities in many locations will be minimal.

Metaldehyde treatments will not result in significant adverse direct or indirect impacts to migratory birds. Metaldehyde has moderate toxicity to birds. The selective nature of the metaldehyde formulation as well as the localized treatment areas would result in low direct risk to terrestrial insectivores. The Program prefers to use metaldehyde formulations that contain a bittering agent, which may reduce exposure of birds by reducing the palatability of the product.

(2) *Bald and Golden Eagle Protection Act*

If bald or golden eagles were discovered near a program area, the State agency responsible for the area would contact the USFWS and implement recommendations for avoiding disturbance at nest sites. For bald eagles, USDA-APHIS would follow guidance as provided in the National Bald Eagle Management Guidelines (USFWS, 2007). These guidelines include a 330 to 660-foot buffer from an active nest, depending on the visibility and level of activity near the nest. USDA-APHIS expects pesticide exposure to terrestrial and aquatic nontarget organisms to be negligible, and subsequently, the potential for risk of eagles to program pesticides is very low. USDA-APHIS expects disturbance from other activities such as survey or accessing treatment sites to be negligible.

(3) *Endangered Species Act*

Although removal of the horntail snail from the habitat of some federally listed species would be beneficial, program activities potentially could adversely affect listed species and their habitats. Possible adverse effects include toxicity of program pesticides to listed animal and plant species and trampling of listed plants during survey and treatment activities.

USDA-APHIS implements a 10-foot buffer from water resources. The Agency has determined that with the implementation of the buffer, the Program's use pattern and toxicity profile for metaldehyde, the proposed action may affect, but is not likely to adversely affect the Everglade snail kite (*Rostrhamus sociabilis plumbeus*) and its critical habitat, Eastern indigo snake (*Drymarchon corais couperi*), Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*) and its critical habitat, Florida grasshopper sparrow (*A. savannarum floridanus*), and Florida scrub jay (*Aphelocoma coerulescens*).

In Miami-Dade, County, the Stock Island tree snail (*Orthalicus reses*) occurs in Monkey Jungle, a local primate tourist attraction located at 14805 SW 216th St in Miami, FL. There is also a known population within the Everglades National Park in Miami-Dade County. Program activities would not likely occur in these locations. To protect the Stock island tree snail, horntail snails can only be handpicked within Stock Island tree snail habitat (hardwood hammocks and Monkey Jungle). Care must be taken not to remove any tree snails. Personnel removing horntail snails from the habitat must be able to recognize Stock Island tree snails before performing any hand removal of snails in its habitat. Program personnel will be provided with a photo of the Stock Island tree snails. Broadcast application of molluscicides and use of traps will not be used in hardwood hammocks to avoid potential impacts to SITS and other at-risk tree snail species. With the implementation of these protection measures, USDA-APHIS has determined that the program may affect but is not likely to adversely affect the Stock Island tree snail.

USDA-APHIS submitted a biological assessment to the USFWS on November 16, 2020 and received concurrence on April 27, 2021 with these determinations. The biological assessment is included in the administrative record for this EA.

Prior to implementing a horntail snail eradication program, program personnel will contact the appropriate USFWS office when applicable. Contact and coordination between USFWS and treatment applicants would not be required for pesticide treatments occurring outside of habitats where listed species occur. These areas may include, but are not limited to residential gardens, urban areas, and other highly managed areas such as industrial sites, farmsteads, lumberyards, parking areas, parks, petroleum tank farms, etc. If treatments occur in habitats where certain terrestrial listed species may occur, then USFWS personnel will review maps of the treatment areas and indicate whether listed species or critical habitat are present in or near the treatment area. This process would only apply to listed species identified in the biological assessment.

3. Human Health and Safety

The program applies pesticides in a way that minimizes significant exposure to soil, water, and air. USDA-APHIS personnel and contractors are required to comply with all U.S. Environmental Protection Agency (USEPA) use requirements and meet all recommendations for personnel protective equipment (PPE) during pesticide application. Adherence to label requirements and additional program measures designed to reduce exposure to workers (e.g., PPE requirements include long-sleeved shirt and long pants and shoes plus socks) and the public (e.g., mitigations to protect water sources and to limit spray drift, and restricted-entry intervals) result in low health risk to all human population segments from program use of pesticides. USDA-APHIS does not anticipate the metaldehyde formulations proposed for use in this program would persist in the environment or bioaccumulate. USDA-APHIS also uses metaldehyde in its eradication program for the giant African snail. The lack of significant routes of exposure to human health

and the environment suggest additive or synergistic impacts would not occur with metaldehyde use in the horntail snail eradication program and the giant African snail eradication program.

Metaldehyde is moderately toxic to mammals with an acute median lethality value of 283 milligrams/kilogram (mg/kg) in the rat. Dermal and inhalation toxicity is very low with median lethality values greater than the highest test concentration (USEPA, 2006a). Longer term exposure to metaldehyde results in NOEL of 10 mg/kg or higher, with the liver being the primary organ where effects have been noted. Developmental toxicity has not been observed in dosing studies at relevant doses; however, there is data to suggest that metaldehyde may be neurotoxic and potentially carcinogenic based on the presence of benign liver tumors in long term studies (USEPA, 2006a). Available acute effects data for the proposed formulations demonstrate equivalent or less toxicity to mammals.

Dietary exposure and risk from the proposed use of metaldehyde is expected to be low for all population segments. The population segment with the highest probability of exposure is children who may consume bait and soil containing metaldehyde. However, adherence to label language, notification of treatment to property owners, and the use of formulations with a bittering agent will reduce the potential for exposure and reduce the risk to children. The Program notifies landowners and residents prior to treatment and provides information cards with the date and time the treatment occurred and a reminder of the 12-hour reentry period. Worker exposure and risk will also be low based on the toxicity of metaldehyde, the method of application, and adherence to label language designed to minimize exposure (USEPA, 2006b).

Metaldehyde bait formulations contain common food materials that may be attractive to pets such as dogs. If consumed in enough quantities, adverse effects are expected (Richardson et al., 2003). USEPA summarized reports of poisoning of domestic animals, mostly dogs, from ingesting metaldehyde (USEPA, 2006b, 2020c). Between January 1, 2010 and July 1, 2020, 1,006 metaldehyde incidents of domestic animals were reported in the Incident Data System (USEPA, 2020c). Of these incidents, 147 animals died (USEPA, 2020c). Most of the cases involved ingestion of metaldehyde after applications to yards and gardens (not Program applications) or from the animal opening or tearing the packaging to access the product. The requirement for additional precautionary label language is designed to reduce risk of domestic pet exposure to metaldehyde (USEPA, 2007). Adherence to all precautionary label language, notification to landowners regarding treatments, and the use of bittering agent in some formulations will reduce the potential for adverse effects to domestic pets where metaldehyde may be used. FDACS monitors reports of pesticide poisoning and no reports of poisoning incidents from metaldehyde have been made for any of its use cases, including its use in the giant African snail eradication program which has used metaldehyde since 2013. The Program gives residents/landowners a notice with the date and time the treatment occurred and the time they can enter the treated area, which is 12 hours after treatment. This re-entry period would reduce exposure to domestic animals.

C. Other Considerations

1. Executive Order (EO) 12898—Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations and EO 13985—Advancing Racial Equity and Support for Underserved Communities through the Federal Government

EO 12898 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. EO 13985 “advances equity for all, including people of color and others who have been historically underserved, marginalized, and adversely affected by persistent poverty and inequality”. It instructs Agencies “to assess whether, and to what extent, its programs and policies perpetuate systemic barriers to opportunities and benefits for people of color and other underserved groups”.

The horntail snail has a wide host range and can cause damage to commercial crops and ornamental plants. Under the no action alternative, USDA-APHIS would not participate in control or eradication efforts and therefore would not pose affects on minority populations and low-income populations nor adversely affect underserved communities affected by persistent poverty and inequality.

Under the preferred alternative, the eradication efforts involve survey of landscapes on public and private properties and treatment of areas where the snail is found. Before the Program treats an area, it notifies property owners where treatments could occur. The notification process and information provided by the Program regarding reducing exposure to treatments, and the use of bittering agents in bait formulations of metaldehyde, will ensure that human health exposure and risk will be minimized, including minority and low-income populations and underserved communities. 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 are not expected to have disproportionate adverse effects to any minority or low-income family. The Program’s goal is the eradication of the horntail snail and this involves working with local communities to inform them about the snail and its impact and the approach the Program uses to eradicate the snail.

2. EO 13045—Protection of Children from Environmental Health Risks and Safety Risks

This EO 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.

Under the no action alternative, USDA-APHIS would not participate in the snail's eradication and therefore would not take actions that would cause disproportionate affects to children.

Under the preferred alternative, the pesticides proposed for use will not be used on commercial food items therefore no dietary exposure is expected. Oral ingestion could occur through the ingestion of granules or treated soil. Notification to homeowners and residents on when applications occur will reduce this type of exposure to children. Additionally, exposure to granules is not anticipated to occur in quantities that could result in adverse effects and the Program prefers to use metaldehyde formulations that contain a bittering agent designed to deter ingestion. Therefore, no disproportionate risks to children are anticipated from the use of metaldehyde formulations to eradicate the horntail snail.

3. Historical and Cultural Resources

EO 13175—*Consultation and Coordination with Indian Tribal Governments*, calls for agency communication and collaboration with Tribal officials for proposed Federal actions with potential Tribal implications. The Archaeological Resources Protection Act of 1979 (16 U.S.C. §§ 470aa-mm), secures the protection of archaeological resources and sites on public and Tribal lands. The Seminole and Miccosukee Tribes are in south Florida; however, no horntail snail detections have occurred on, or adjacent to, tribal property. USDA-APHIS will contact the tribes to initiate a dialogue regarding proposed activities to eradicate the horntail snail if the range of the snail expands into or near tribal property. If USDA-APHIS discovers any archaeological Tribal resources, it will notify the appropriate individuals.

The National Historic Preservation Act of 1966, as amended (16 United States Code (U.S.C.) §§ 470 et seq.), requires Federal agencies to consider the potential for impact to properties included in, or eligible for inclusion in the National Register of Historic Places (36 C.F.R. §§ 63 and 800) through consultation with interested parties where a proposed action may occur. This includes districts, buildings, structures, sites, and landscapes. The no action alternative does not pose adverse effects to these resources.

USDA-APHIS has considered potential impacts of the preferred alternative 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 40 historic properties within Broward County, 19 historic properties within Collier County, 187 historic properties within Miami-Dade County, and 73 historic properties within Palm Beach County are listed on the National Register of Historic Places, with many of these sites being structures (NPS, 2021). 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. Pesticides will not be

applied to the buildings, and other anticipated program actions (e.g., survey, hand removal of snails) will not directly affect the buildings or their properties. The use of metaldehyde on historic properties may temporarily alter public accessibility to accommodate the 12-hour re-entry period.

IV. Listing of Agencies Consulted

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

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

State Plant Health Director
Plant Protection and Quarantine
Animal and Plant Health Inspection Service
U.S. Department of Agriculture
8100 NW 15th Place
Gainesville, FL 32606

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

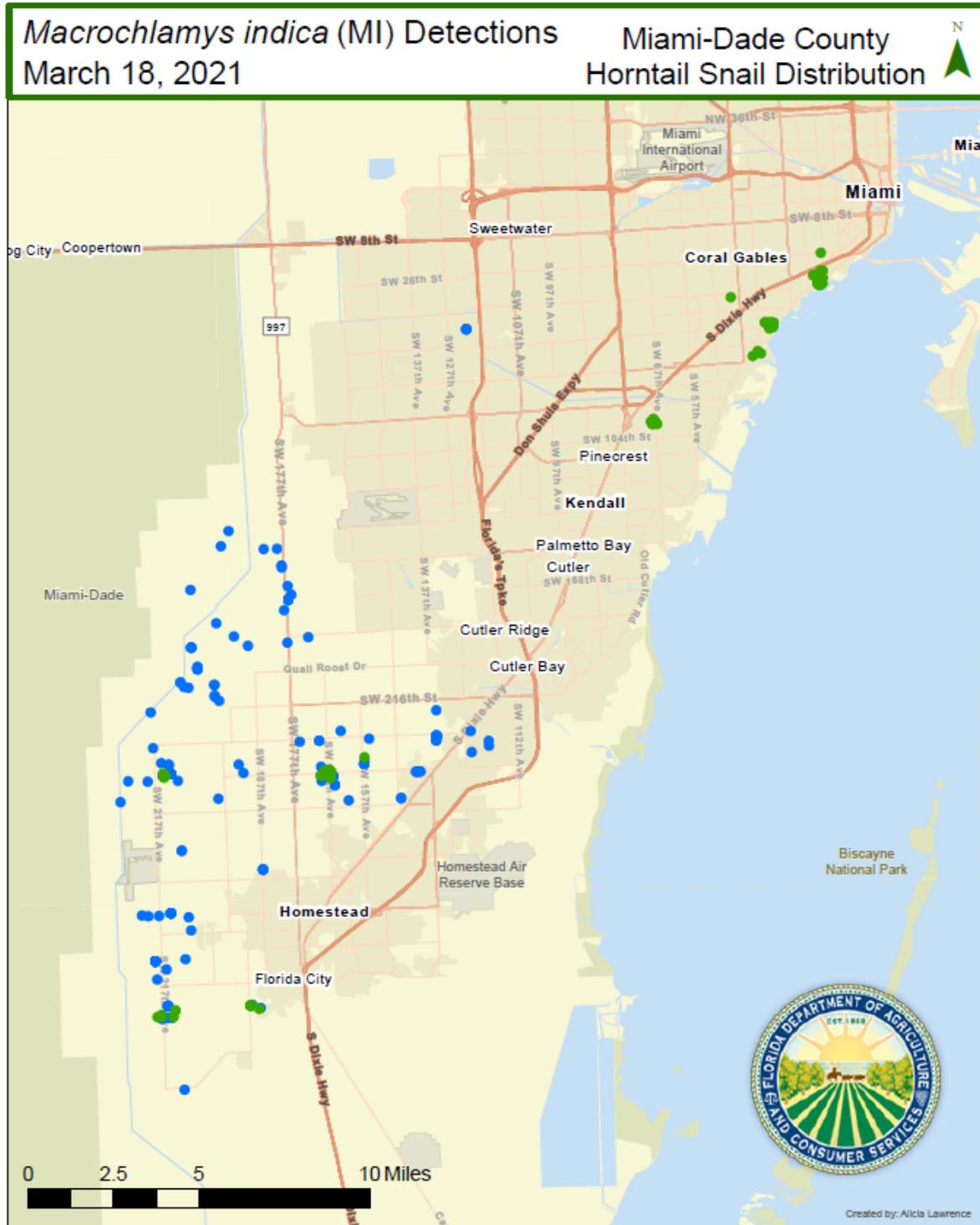
Florida Department of Agriculture and Consumer Services
Department of Plant Industry
The Doyle Conner Building
1911 SW 34th St.
Gainesville, FL 32608-7100

V. References

- Bieri, M. 2003. The environmental profile of metaldehyde. Pages 255–260 in I. F. Henderson, editor. Slugs and snails. . World Agriculture, British Crop Protection Council, Symposium Proceedings; 80.
- Borlongan, I. G. and R. M. Coloso. 1996. Use of metaldehyde as a molluscicide in milkfish ponds. *in* BCPC Symposium Proceedings No. 66: Slug and snail pests in agriculture.
- Calumpang, S. M. F., M. J. B. Medina, A. W. Tejada, and J. R. Medina. 1995. Environmental impact of two molluscicides: niclosamide and metaldehyde in a rice paddy ecosystem. *Bull. Environ. Contam. Toxicol.* 55:494–501.
- Collier County. 2020. Pollution Control Water Quality Reports and Maps. Surface water Reports. Accessed July 27, 2021 at <https://www.colliercountyfl.gov/your-government/divisions-f-r/pollution-control/water-quality-monitoring/pollution-control-water-resources-monitoring/pollution-control-water-quality->
- Collier County Pollution Control. 2019. Collier County Groundwater Quality Trend Report. Accessed July 27, 2021 at <https://www.colliercountyfl.gov/home/showpublisheddocument/90577/637117428044770000>.
- Coloso, R. M., I. G. Borlongan, and R. A. Blum. 1998. Use of metaldehyde as a molluscicide in semi-commercial and commercial milkfish ponds. *Crop Protection* 17:669–674.
- Cornell University. 2019a. Bald Eagle Range Map. All About Birds.
- Cornell University. 2019b. Golden Eagle Range Map. All About Birds.
- FDACS. 2020. Pest alert: The horntail snail, *Macrochlamys indica* Benson, detected in South Florida. Florida Department of Agriculture and Consumer Services, Division of Plant Industry.
- FDEP. 2021. Water Quality monitoring, Physical and Biogeochemical Conditions. Accessed 7/27/2021 at <https://bcgis.maps.arcgis.com/apps/dashboards/b98ad6a3c9534bed96ac12762a988a9d>. Florida Department of Environmental Protection, Broward County Environmental Lab.
- Garofalo, J. F., T. Weissling, E. R. Duke, J. Vedae, and L. Bishop. 2001. Snail and slug management in South Florida. Miami-Dade County/University of Florida Cooperative Extension Service.
- Haag, K. H., R. L. Miller, L. A. Bradner, and D. S. McCulloch. 1996. Water-Quality Assessment of Southern Florida: An Overview of Available Information on Surface and Ground-Water Quality and Ecology. USGS Water-Resources Investigations Report 96-4177. U.S. Geological Survey.
- Johnson Mathey MacFarlen and Smith. 2007. Material Safety Data Sheet for Bitrex.
- Miami-Dade County. 2019. Miami-Dade County: 2019 Water Quality Report.
- NPS. 2021. The National Register of Historic Places, National Register Database and Research, accessed July 29, 2021 at <https://www.nps.gov/subjects/nationalregister/database-research.htm>. U.S. Department of the Interior, National Parks Service.
- Richardson, J. A., S. L. Welch, S. M. Gwaltney-Brant, J. D. Huffman, and M. E. Rosendale. 2003. Metaldehyde toxicosis in dogs. *Comp Cont Educ Pract* 25:376-380.
- Santos, M. J. G., N. G. C. Ferreira, A. M. V. M. Soares, and S. Loureiro. 2010. Toxic effects of molluscicidal baits to the terrestrial isopod, *Porcellionides pruinosus*. *J. Soils Sediments* 10:1335-1343.

- Singh, S., R. K. Sandhu, and N. A. Aravind. 2020. Record of pestiferous land snail, *Macrochlamys indica* Godwin-Austen 1883 (Gastropoda: Ariophantidae), on citrus and guava plants in Punjab, India. *Records of the Zoological Survey of India* 120:293–296.
- Tropical Audubon Society. 2020. *South Florida's Birds*.
- U.S. Census Bureau. 2019. *Quick Facts, Broward, Collier, Miami-Dade, and Palm Beach Counties, Florida*.
- USEPA. 2006a. Metaldehyde: HED Chapter of the reregistration eligibility decision (RED) document. Page 79. U.S. Environmental Protection Agency.
- USEPA. 2006b. Metaldehyde: Reregistration eligibility decision (RED). Page 53. U.S. Environmental Protection Agency.
- USEPA. 2007. Amendment to metaldehyde: Reregistration eligibility decision (RED). Page 29. U.S. Environmental Protection Agency.
- USEPA. 2010. *Florida Water Quality Assessment Report*. U.S. Environmental Protection Agency.
- USEPA. 2020a. *Air Quality Index Report: Broward, Collier, Miami-Dade, and Palm Beach Counties, Florida*. U.S. Environmental Protection Agency.
- USEPA. 2020b. *ECOTOX database*. U.S. Environmental Protection Agency.
- USEPA. 2020c. Metaldehyde: Draft Ecological Risk Assessment for Registration Review. Page 58. U.S. Environmental Protection Agency, Office of Chemical Safety and Pollution Prevention.
- USFWS. 2007. *National Bald Eagle Management Guidelines*. U.S. Fish and Wildlife Service.
- USFWS. 2020. *Flyways*, August 18, 2020. U.S. Fish and Wildlife Service.

Appendix 1. Map of horntail snail distribution in Miami-Dade County



- Nursery Detections
- Residential Detections (residential properties are not being treated at this time)