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Marketing and Regulatory Programs

Animal and Plant Health Inspection Service

APHIS

Field Release of the Arundo Scale, *Rhizaspidiotus donacis* (Hemiptera: Diaspididae), an Insect for Biological Control of *Arundo donax* (Poaceae) in the Continental United States

Environmental Assessment, December 2010

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I. Purpose and Need for the Proposed Action

The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine (PPQ), Pest Permitting Branch (PPB) is proposing to issue permits for release of an armored scale insect, *Rhizaspidiotus donacis* (Leonardi) (Hemiptera: Diaspididae). The agent would be used by the applicant for the biological control of *Arundo donax* L. (giant reed, carrizo cane) in the continental United States. Before permits are issued for release of *Rhizaspidiotus donacis* (*R. donacis*), the APHIS–PPQ PPB must analyze the potential impacts of the release of this agent into the continental United States.

This environmental assessment[1] (EA) has been prepared, consistent with USDA–APHIS' National Environmental Policy Act (NEPA) implementing procedures (Title 7 of the Code of Federal Regulations (CFR) part 372). It examines the potential effects on the quality of the human environment that may be associated with the release of *R. donacis* to control infestations of *Arundo donax* (*A. donax*) within the continental United States. This EA considers the potential effects of the proposed action and its alternatives, including no action.

The applicant's purpose for releasing *R. donacis* is to reduce the severity of infestations of *A. donax* in the United States. It is an extremely invasive weed of riparian habitats and irrigation canals of the Rio Grande River Basin and the Southwestern United States. *A. donax* is native to the Old World from the Iberian Peninsula of Europe to south Asia, including North Africa and the Arabian Peninsula. It has been cultivated in the Old World for thousands of years and has been widely introduced around the world as an ornamental and for its fiber uses. It was introduced into North America in the early 1500s by the Spanish for its fiber uses and quickly became naturalized. It is now found throughout the southern half of the United States from Maryland to California; however, it is most invasive along muddy banks of creeks and rivers in the Southwestern United States.

A. donax infestations in riparian habitats lead to loss of biodiversity, stream bank erosion, altered channel morphology, damage to bridges, increased costs for chemical and mechanical control along transportation corridors, and impediment of law enforcement activities on the international border. Additionally, this invasive weed competes for water resources in an arid region where these resources are critical to the environment, agriculture, and municipal users. *A. donax* is a severe threat

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[1] Regulations implementing the National Environmental Policy Act of 1969 (43 United States Code 4321 et seq.) provide that an environmental assessment "shall include brief discussions of the need for the proposal, of alternatives as required by section 102(2)(E), of the environmental impacts of the proposed action and alternatives, and a listing of agencies and persons consulted" 40 CFR § 1508.9.

to riparian areas where it displaces native plants and animals by forming massive stands that pose a wildfire threat (Frandsen and Jackson, 1994). It may reduce stream navigability (Dudley, 2000). It consumes excessive amounts of water and competes for water resources in an arid region prone to perennial droughts. Under optimum conditions, it can attain growth rates of 0.7 meters (m) per week or 10 centimeters (cm) per day, putting it among the fastest growing plants (Perdue, 1958; Bell, 1997). Under ideal growth conditions, *A. donax* can produce more than 20 metric tons of above-ground dry mass per hectare (Perdue, 1958).

Existing *A. donax* management options are ineffective, expensive, temporary, and have nontarget impacts. In addition, release of *R. donacis* is expected to augment the impact of another biological control organism previously released against *A. donax*. For these reasons, the applicant has a need to release *R. donacis* into the environment, an effective, host-specific, biological control organism for the control of *A. donax*.

II. Alternatives

This section will explain the two alternatives available to the APHIS–PPQ–PPB—no action (no issuance of permits) and issuance of permits for environmental release of *R. donacis*. Although APHIS' alternatives are limited to a decision on whether to issue permits for release of *R. donacis*, other methods available for control of *A. donax* are also described. These control methods are not decisions to be made by the APHIS–PPQ–PPB and their use is likely to continue whether or not permits are issued for environmental release of *R. donacis*, depending on the efficacy of *R. donacis* to control *A. donax*. These are methods presently being used to control *A. donax* by public and private concerns.

A third alternative was considered but will not be analyzed further. Under this third alternative, the APHIS–PPQ–PPB would have issued permits for the field release of *R. donacis*, but the permits would contain special provisions or requirements concerning release procedures or mitigating measures. No issues have been raised that would indicate that special provisions or requirements are necessary.

A. No Action

Under the no action alternative, the APHIS–PPQ–PPB would not issue permits for the field release of *R. donacis* for the control of *A. donax*. The release of this biological control agent would not take place. The following methods are presently being used to control *A. donax*. These methods will continue under the "no action" alternative, and will likely continue even if permits are issued for release of *R. donacis*.

1. Chemical Control

A. donax may be controlled using herbicides. Glyphosate is a broad-spectrum herbicide that is commonly used on a variety of wetland and aquatic plants, such as water hyacinth (*Eichhornia crassipes*), giant salvinia (*Salvinia molesta*), saltcedar (*Tamarix spp*.), and others, including *A. donax*. Glyphosate has proven to be effective against *A. donax* (Finn and Minnesang, 1990; USDA–Forest Service, 1993). One of the reasons for its effectiveness is that glyphosate is a systemic herbicide and, when used at appropriate times, it is translocated to the roots, killing the entire plant. A number of techniques were developed for its use, including 1) use as a foliar spray, 2) cutting plant stems and spraying, or painting the herbicide on the surface of the cut, and 3) cutting stems, letting plants re-sprout, and treating the re-sprouts with herbicide.

Additionally, an herbicide (Habitat®) with another active ingredient, imazapyr, has been developed and registered for use on *A. donax*. In general, Habitat® requires one to two applications and control may be achieved for several years. Removal of dead canes may be necessary if stem densities are great enough to inhibit recovery of native vegetation after treatment.

2. Mechanical Control

Mechanical methods of *A. donax* control include use of prescribed fire, heavy machinery (e.g. bulldozer, Hydro-axe), hand-cutting, chipper, etc.). Removal of dead canes may be necessary if there is a possibility that cut vegetation might create a flood hazard during high water events or if biomass density is great enough to inhibit recovery of native vegetation. Burning is a cost-effective way of removing biomass if it does not threaten native vegetation. Another, but more costly, means of removal is chipping. Equipment and labor are expensive relative to other forms of removal; however, the small dry chips that are produced pose little threat in terms of regeneration, and they do not form debris dams. Biomass removal by vehicle is expensive and, generally, not preferred due to its lack of cost-effectiveness. The use of heavy machinery, such as the Hydro-axe, is extremely expensive and slow, cutting only about 3 to 4 acres per day (Bell, 1997).

3. Biological Control

The Arundo wasp, *Tetramesa romana* Walker (Hymenoptera: Eurytomidae) was approved for release in April 2009. It currently occurs in Texas and California. However, it is not expected that *Tetramesa romana* (*T. romana*) alone will completely control *A. donax*. The stem galling of *A. donax* caused by *T. romana* results in stunted stems and sometimes death of the stems. When both *T. romana* and *R. donacis* are present, *A. donax* plants become severely stressed with extreme stunting and virtually no leaf production.

B. Issue Permits for Environmental Release of *R. donacis*

Under this alternative, the APHIS–PPQ–PPB would issue permits upon request and after evaluation of each application for the field release of the armored scale insect *R. donacis* against *A. donax*. These permits would contain no special provisions or requirements concerning release procedures or mitigating measures.

Biological Control Agent Information

a. Taxonomy

Order: Hemiptera

Family: Diaspididae

Genus: *Rhizaspidiotus*

Species: *donacis* (Leonardi)

Common name: Arundo scale

b. Geographical Range of *R. donacis*

R. donacis is limited to mild Mediterranean climates of Europe (Portugal, Spain, southeastern France, and southern Italy. It is not known whether *R. donacis* will be able to establish throughout the range of *A. donax,* but it is likely to be a subset of this range. It appears likely that *R. donacis* will not establish north of USDA's Plant Hardiness Zone 8b (Goolsby, 2009). This corresponds to areas with minimum average temperatures of 10 to 20 °F, such as Gainesville, Florida, and Charleston, South Carolina.

c. Life History of *R. donacis*

The life cycle of *R. donacis* follows the generalized diaspidid (armored scale insect) life cycle described by Koteja (1990). The life cycle can be summarized as follows: mobile crawlers emerge from the body of the female, exit the protective scale cover or armor, and disperse to new plant tissue. Crawlers settle on leaf collars, stem nodes, or rhizomes (horizontal, usually underground stem that often sends out roots and shoots from its nodes) to insert mouthparts and begin feeding. Crawlers molt to the second instar, called a white cap. Second instars are immobile, and continue to grow in size and add concentric layers to their scale cover. The late second instar female scale is inseminated by the mobile, winged, male scale. The female scale molts to the adult instar. The immobile adult female continues to feed and develop for several months before producing live crawlers.

The male scale has a different life cycle. Male crawlers molt to the second instar. At the end of the second instar, they emerge as winged adults at precisely the right time to mate with the late second instar, immobile females.

Based on observations of native field collections of *R. donacis*, many crawlers settle on rhizomes, but only if the soil substrate is suitable (dry and sandy/rocky substrates are most conducive to crawler survival) (Goolsby, 2009). Settled crawlers insert their mouthparts into the plant and feed on plant cell fluids.

The timing of the molts from first to second nymphal instar and from second instar to adult, and survival through these transitions varies among diaspidid species and within species seasonally (Kuwana, 1923; Carroll and Luck, 1984; Polavarapu et al., 2000); however, the overall duration of immature development for *R. donacis* is consistent with studies on other species that are capable of producing more than one generation per year. Observations of populations collected in the native range suggest that *R. donacis* completes two generations per year in the field, although the generations may differ in length (Malumphy, 1997). However, Goolsby (2009) observed only one generation per year for *R. donacis* in Italy. The length of time for one life cycle of *R. donacis* is 6 to 6.5 months (Goolsby, 2009).

III. Affected Environment

A. donax is a bamboo-like perennial that grows to 8 m tall, with thick, well-developed rhizomes. Plants are typically terrestrial but tolerate periodic flooding. In California, from the late 1700s to early 1800s, *A. donax* was often planted for erosion control in flood channels and as wind breaks. More recently, it has become problematic in riparian corridors throughout the Southwestern United States and northern Mexico. Dense, impenetrable stands typically develop, which often displace native vegetation, diminish wildlife habitat, and increase flooding and siltation in natural areas. *A. donax* is also adapted to a periodic fire regime. The canes are readily flammable throughout much of the year, and the presence of *A. donax* increases the susceptibility of riparian corridors to fire. Large stands of *A. donax* can significantly increase water loss from underground aquifers in semi-arid regions due to a high evapotranspiration rate, which is estimated at roughly three times greater than that of the native riparian vegetation. *A. donax* is cultivated as an ornamental, for industrial cellulose, and to produce reeds for woodwind instruments. It is an alternate host for beet western yellows virus, sugarcane mosaic virus, and maize dwarf mosaic virus.

A. donax reproduces vegetatively from rhizomes and stem fragments. Fragments disperse with water, mud, and human activities. Under optimal conditions, plants grow and spread rapidly during the warm season. Intact rhizomes buried under about 1 to 3 m of silt can develop new shoots. Under experimental conditions, rhizome fragments readily develop new shoots from a depth of 25 cm, whereas stem fragments mostly re-sprout from a depth less than 10 cm. Viable seed has not been observed in North America or in the native range (DiTomaso and Healy, 2003).

A. Areas Affected by *A. donax*

1. Native and Introduced Range

A. donax is native to Europe from the central Atlantic coast of Portugal, inland along the major rivers of the Iberian Peninsula, along the Mediterranean coast from Spain to Greece, including the warmer parts of the Adriatic Coast. In north Africa along the Mediterranean, the populations are discontinuous from the Western Sahara, Morocco, and Algeria, to the Arabian Peninsula. Remote populations are known from the Sahara in stable oases. Populations in China are not considered to be native. In addition to *A. donax*, other *Arundo* species are native to the Mediterranean, including *A. plinii* Turra, *A. collina* Tenore, and *A. mediterranea* (Danin et al., 2002; Danin, 2004; Danin et al., 2006). The only other known *Arundo* species outside of the Mediterranean is *A. formosana* in Taiwan.

A. donax has a nearly worldwide distribution in tropical to warm-temperate regions. In the United States, it is invasive from northern California across the Southwestern and Southeastern United States to Maryland. It is widely distributed in Mexico, and Central and South America. The most severe infestations in the United States are in Arizona, California, and Texas, especially the Santa Ana River Basin and Rio Grande Basin.

2. Present and Potential Distribution in North America

A. donax is well established in North America, although it continues to spread into new areas. Figure 1 shows the areas that are climatically suitable based on CLIMEX[2] parameters from Europe. While the predicted CLIMEX distribution broadly agrees with the actual distribution, *A. donax* has naturalized further north. It has been documented in South Bend, Indiana, and Coeur'd'alene, Idaho.

Some of the most severely infested areas are in the Rio Grande Basin and in the coastal rivers of southern California. A continuous stand of

[2] CLIMEX is "software to predict the effects of climate on species. (See http://www.climatemodel.com/climex.htm.)

A. donax occurs from just south of Laredo to Del Rio, Texas. The swath of *A. donax* is nearly 0.5 miles wide along this stretch of the Rio Grande River. Further upriver, near Big Bend National Park, stands of *A. donax* are increasing in size and density. Heavy rains during the summer of 2007 stimulated new growth, and flood waters distributed propagules downstream. Aerial surveys conducted by USDA researchers in the fall of 2007 revealed much more *A. donax* than had been previously seen in the 2002 surveys (Goolsby, 2008).

The spread of *A. donax* into new areas appears to be from earthmoving equipment and roadway mowers (Goolsby, 2008). Once established in a watershed, rhizomes and canes move downstream during flood events to establish new stands. The movement of *A. donax* for biofuel trials also presents another means of spread. The State of Florida evaluated a request to plant *A. donax* on a plantation south of Lake Okeechobee. Concerns presented by the Florida Exotic Pest Plant Council were that it could not be contained from entering the Everglades following high rainfall events, such as major hurricanes (Florida Native Plant Society, 2006). This business venture is no longer planned for Florida, but instead is being considered for St. Augustine County in east Texas (Loder, 2007).

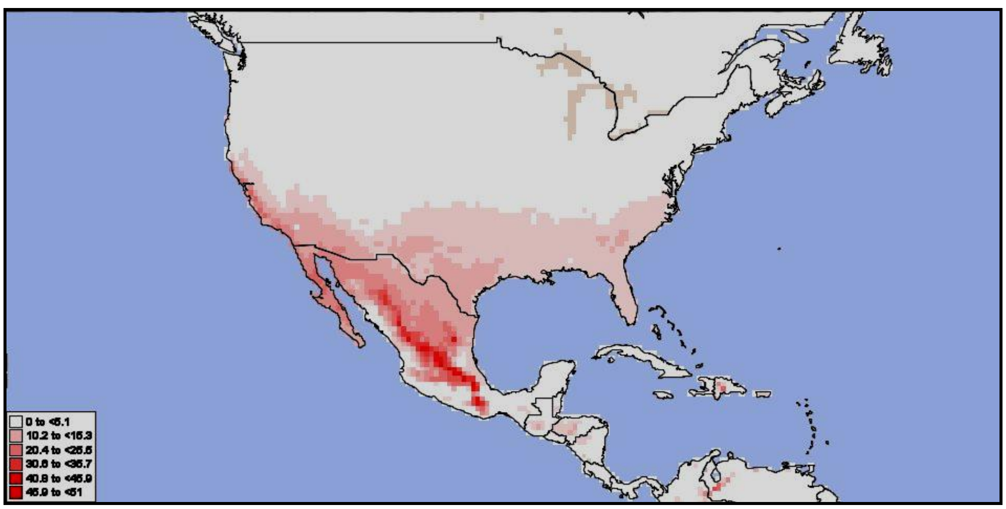

Figure 1. Areas in North America (red to pink) that are climatically suitable for *Arundo donax*.

3. Habitat

A. donax typically grows on sites with a low slope in riparian areas, floodplains, ditches, and irrigation canals. In the Eastern United States, with average rainfall above 30 inches, it can grow in upland sites, such as windbreaks or in ornamental settings. *A. donax* occurs in a wide range of soils types with variable fertility, but grows best in well-drained, moist soils. Plants tolerate some salinity and extended periods of drought; however, they do not survive in areas with prolonged or regular periods of freezing temperatures (DiTomaso and Healy, 2003).

B. Plants Related to *A. donax* and Their Distribution

Taxonomically Related Plants

Grass species (Poaceae) that were used in testing the specificity of *R. donacis* to *A. donax* are listed below and in appendix A. Information regarding plants taxonomically related to *A. donax* is included in this document because native plant species which are closely related to *A. donax* have the most potential to be attacked by *R. donacis*.

Andropogon glomeratus (Walter) Britton et al. (bushy bluestem) is native to the Southern United States and north to New York and south to northern South America.

Aristida purpurea Nutt. var. longiseta (Steud.) Vasey (red threeawn) is native from western Canada to northern Mexico and grows in well-drained soils.

Arundinaria gigantea (Walter) Muhl. (giant cane) is native to the Southeastern United States.

Arundo formosana Hack. (fountain reed), a smaller relative of *A. donax*, is native to Taiwan, the Ryukyu Islands of Japan, and the Philippines. It is a very minor ornamental plant in northern California.

Bouteloua hirsuta Lag. (hairy grama) is a bunchgrass native to most of the United States and south to Guatemala.

Chasmanthium latifolium (Michx.) Yates (inland sea oats) is native from the Middle Atlantic States of the United States west to Texas and grows along waterways and in moist woods.

Cortaderia selloana (Schult. & Schult. f.) Asch. & Graebn. (pampas grass) is an ornamental grass native to Brazil and the southern part of South America. Pampas grass has been planted in the southeast and southwest of the United States, and is invasive in some areas.

Cynodon dactylon (L.) Pers. (Bermuda grass) is a pasture and turf grass native to Africa that now grows worldwide except in the coldest and driest areas.

Cyperus articulatus L. (jointed flatsedge) is an obligate wetland plant native to the area from South Carolina and Florida to Texas, and south to South America, as well as Africa and Asia.

Danthonia spicata (L.) P. Beauv. ex Roem. & Schult. (poverty oatgrass) is native throughout most of North America from the subarctic through central Mexico.

Dichanthelium acuminatum (Sw.) Gould and Clark (tapered rosette grass) is native to most of North America and south to Colombia and Ecuador, as well as in the Caribbean. It is endangered in Tennessee.

Digitaria cognata (Schult.) Pilg (fall witchgrass) is native from Ontario, Canada, through the Eastern half of the United States and into northern Mexico.

Elymus virginicus L. (Virginia wildrye) is native throughout most of Canada and the United States.

Eragrostis intermedia Hitchc. (plains lovegrass) is a native grass ranging from the Southern United States to Costa Rica.

Eragrostis spectablilis (Pursh) Steud. (purple lovegrass) is native to southeastern Canada, the Eastern two-thirds of the United States, and south to Belize.

Eriocaulon decangulare L. (tenangle pipewort) grows in moist to wet soils from the mid-Atlantic region of the United States through the Southeast, and Mexico to Nicaragua. It is endangered in Tennessee.

Leptochloa dubia (Kunth) Nees (green sprangletop) is a native to Florida, Oklahoma to Arizona, and south through Mexico. It is best adapted to deep sandy soils in Florida, and to rocky hills and canyons in the rest of its range.

Leptochloa fusca (L.) Kunth subsp. *uninervia* (J. Presl) N. Snow (=*L. uninervia*) (red sprangletop) is native to the southern half of the United States and much of Mexico, the Caribbean, and Central and South America. This species is now an invasive species in rice fields in Spain and Italy.

Leptochloa panicea (A. Retzius) J. Ohwi subsp. *brachiata* (=*L. filiformis*) (Mexican sprangletop) is native to the Southern half of the United States and much of Mexico, the Caribbean, and Central and South America. It has naturalized in Africa and Australia.

Leptochloa virgata (L.) P. Beauv. (tropic sprangletop) is native to Texas and Florida in the United States, and also to Tamaulipas and Veracruz, Mexico, as well as to much of Central and South America and the Caribbean.

Molinia caerulea (L.) Moench (purple moor grass) is a perennial bunch grass native to temperate areas of Eurasia. It has been introduced as an ornamental to northeastern Canada and the United States where it has invaded damp areas.

Muhlenbergia capillaris (Lam.) Trim. (hairawn muhly) is a bunchgrass native to the Southeastern United States and the Bahamas.

Oryza sativa L. (rice) is of Asian origin and is grown in tropical, subtropical, and warm-temperate areas around the world.

Panicum amarum Elliot. (bitter panicgrass) is native to coastal dunes along the Atlantic and gulf coasts of the United States and the gulf coast of northern Mexico, as well as in swamp edges and wet sandy soils in this range.

Panicum hirsutum Sw. (hairy panicum) is a native that grows from southern Texas to Argentina and in the Caribbean.

Panicum virgatum L. (switchgrass) is a native that grows mainly east of the Rocky Mountains from southern Canada through Central America and in Cuba.

Pennisetum ciliare (L.) Link (buffelgrass) is native to Africa, Western Asia, and India. It has been introduced to and become highly invasive in the Southern United States and Mexico and elsewhere as a forage crop.

Phragmites australis (Cav.) Trin. ex Steud. (common reed) is similar in appearance and habitat to *A. donax*. *P. australis* is found nearly worldwide in temperate and tropical wet habitats. An introduced ecotype from Europe is invading northeastern North America. This exotic ecotype is the target of a biological control program in the United States.

Saccharum officinarum L. (sugarcane) is grown in the Southeastern United States, as well as in other tropical/subtropical regions throughout the world. It is native to tropical Asia and Oceania.

Schizachyrium scoparium (Michx.) Nash (little bluestem) is native to most of Canada, the United States, and northern Mexico.

Schoenoplectus maritimus (L.) Lye (alkali bulrush) grows from Canada into South America, as well as in Africa, Eurasia, and Oceania. It may actually be native to Eurasia.

Sorghum bicolor (L.) Moench (sorghum) is a native of Africa that is grown through much of the world.

Spartina alterniflora (*S. alterniflora*) Loisel. (smooth cordgrass) is an obligate wetland species native to saltmarshes along the Atlantic coast of Canada, the Atlantic and gulf coasts of the United States, the Caribbean, and northern South America to Uruguay. It is an introduced invasive along the Pacific coast of California, Oregon, and Washington, as well as in Western Europe and New Zealand.

Spartina spartinae (Trin.) Merr. ex Hitchc. (Gulf cordgrass) is a native bunch grass that grows mainly along the Atlantic coast of Florida, the gulf coast of the United States, and Mexico to Costa Rica. In South America it is native to Venezuela, Argentina, and Paraguay.

Sporobolus wrightii Munro ex Scribn. (alkali sacaton) is a native growing in Texas and Oklahoma, west to California, and south to central Mexico.

Tridens albescens (Vasey) Wooton & Standl. (white tridens) is native to Texas, Oklahoma, Kansas, New Mexico, Arizona, and northern Mexico.

Tripsacum dactyloides (L.) L. (eastern gamagrass) is native to the Eastern and Central United States, and south through Mexico to northern South America.

Triticum aestivum L. (wheat) originated in central and Western Asia, but is planted in many of the temperate areas of the world.

Typha domingensis Pers. (narrowleaf cattail) is an obligate wetland plant native to the lower two-thirds of the United States and south into much of South America. It grows through much of the tropics and warm temperate areas.

Uniola paniculata L. (sea oats) is a native that grows on sand dunes along the coast from Maryland to Veracruz, Mexico, as well as in the Bahamas and Cuba.

Zea mays L. (corn) is native to Mexico but is grown through much of the world.

IV. Environmental Consequences

A. No Action

1. Impact of Spread of *Arundo donax*

a. Beneficial Uses

A. donax is grown for woodwind reeds, although there is currently no commercial production in North America (Perdue, 1958; Obataya and Norimoto, 1995). The highest quality reeds come from the native range in

Europe. It is also used in basketry, for fishing rods, livestock fodder, and medicine. Currently, the most significant use of this plant is its proposed use as biofuel (Szabo et al., 1996). There are a few small-scale research plantings of *A. donax* in Texas and Georgia. Use of *A. donax* as a biofuel has sparked considerable controversy in Florida, which may have caused entrepreneurs to consider establishing an *Arundo* plantation in Texas (Florida Native Plant Society, 2006). The use of invasive species as biofuels is considered to be extremely risky. Raghu et al. (2006) presents the case that the long-term environmental consequences of using invasive species will far outweigh the short-term gains for energy use. USDA research on biofuels precludes the use of Federal dollars for research on invasive plants.

b. Nontarget Plants

Nontarget plants growing in riparian areas are severely impacted by *A. donax* throughout North America. *A. donax* grows in dense stands that prevent normal regeneration of native riparian vegetation. In many areas, *A. donax* is burned yearly to keep standing vegetation to a minimum. In other areas, accidental wildfires enter riparian zones infested with *A. donax* damaging riparian plants. In both cases native plants, especially trees that are not fire adapted, are killed by the hot fires. *A. donax* survives the wildfires due to its extensive below-ground rhizomes. It regrows quickly after fires, shading out emerging seedlings, thus increasing its dominance over native riparian vegetation.

c. Ecosystem Function

Widespread effects of *A. donax* on ecosystems have been documented on several continents, including Australia, North America, Oceania, and Africa. The Global Invasive Species Database lists *A. donax* as one of the worst 100 invaders (see http://www.issg.org/database/species/ecology.asp?si=112). *A. donax* can increase sediment deposition in natural and manmade channels resulting in reduced channel depth and greater flooding (Frandsen and Jackson, 1994). In addition, during flooding, debris dams of *A. donax* may collect adjacent to flood control structures, bridges, and culverts, exacerbating flooding (Frandsen and Jackson, 1994). *A. donax* produces profuse quantities of biomass (Perdue, 1958; Sharma et al., 1998; Spencer et al., 2006) that are quite flammable at the end of the growing season. As a result, it has changed control of ecosystem processes in some Californian riparian zones from flood-regulated to fire-regulated (Rieger and Kreager, 1989).

d. Protected Species

A. donax threatens most native plants and, thereby, native wildlife growing in the same habitat. The least Bell's vireo, southwestern willow flycatcher, and yellow-billed cuckoo are negatively impacted by *A. donax* because it does not provide the structural habitat and food sources that native vegetation provides (Frandsen and Jackson, 1994; Dudley and Collins, 1995). In Sonoma Creek, California, *A. donax* was associated with about 50 percent of the reduction in the total number and biomass of arthropods that were found on native vegetation (Herrera and Dudley, 2003). Protected aquatic species (such as the arroyo toad, red-legged frog, western pond turtle, Santa Ana sucker, arroyo chub, unarmored three-spined stickleback, tidewater goby, and steelhead trout) are negatively affected by *A. donax* because it provides little shade over streams and leads to increased water temperatures that are unsuitable for wildlife (Hoshovsky, 1988).

e. Human Health

There are a few reports of allergies to *Arundo* pollen. It is listed on www.pollenlibrary.com as a moderate allergen.

f. Water Usage

Large stands of *A. donax* can increase water loss from underground aquifers in semi-arid regions due to a high evapotranspiration rate, which is estimated at roughly 3 times greater than that of the native riparian vegetation. *A. donax* consumes an estimated 56,200 acre-feet of water annually from the Santa Ana River alone (Zembal, 2007).

2. Impact from Use of Other Control Methods

The continued use of chemical herbicides, and mechanical and biological controls at current levels would be a result if the "no action" alternative is chosen.

a. Chemical Control

The most common herbicide used for *A. donax* is glyphosate which may require continued application for 3 to 5 years for local control (Newhouser et al., 1999; Dudley, 2000). The herbicide imazypyr is also used for control along ditches and canals. However, chemical control methods are not feasible for large-scale infestations covering hundreds of river miles, such as the infestation in the Bi-National Rio Grande Basin. Broadcast applications of herbicides could have adverse impacts on nontarget vegetation if not carefully applied.

b. Mechanical Control

Mechanical methods of *A. donax* control include use of prescribed fire, heavy machinery (e.g. bulldozer, Hydro-axe,), hand-cutting, chipper, etc. Biomass removal may be necessary if there is a possibility that cut vegetation might create a flood hazard during high water events. Chipping is a costly method of removal. Equipment and labor are expensive relative to other forms of removal; however, the small dry chips that are produced pose little threat in terms of regeneration, and they do not form debris dams. Biomass removal by vehicle is expensive and generally not preferred due to its lack of cost-effectiveness. The use of heavy machinery, such as the Hydro-axe, is extremely expensive and slow, cutting only about 3 to 4 acres per day (Bell, 1997). Mechanical eradication with a backhoe has been ineffective because the rhizome fragments buried under the soil will readily re-sprout. Prescribed burning has not been successful because it cannot kill the rhizomes, and generally promotes *A. donax* regeneration over native riparian species.

c. Biological Control

The Arundo wasp, *Tetramesa romana* Walker (Hymenoptera: Eurytomidae) was approved for release in April 2009. It currently occurs in Texas and California. It is not expected that *Tetramesa romana* (*T. romana*) alone will completely control *A. donax*. However, the stem galling of *A. donax* caused by *T. romana* results in shortened internodes, stunted stems, and sometimes death of the stems.

These environmental consequences may occur even with the implementation of the biological control alternative, depending on the efficacy of *R. donacis* to reduce *A. donax* in the continental United States.

B. Issue Permits for Environmental Release of *R. donacis*

1. Impact of *R. Donacis* on Nontarget Plants

Host specificity of *R. donacis* to *A. donax* has been demonstrated through scientific literature, field observations, and host-specificity testing. If an insect species only attacks one or a few closely related plant species, the insect is considered to be very host-specific. Host specificity is an essential trait for a biological control organism proposed for environmental release.

a. Scientific Literature

Both the original description of *R. donacis* (as *Targionia donacis*, revised as *Rhizaspidiotus donacis* by Ferris (1943) and other collections from the native range (reviewed by Balachowsky, 1932; 1951) in France (Balachowsky, 1930; 1933; 1951), Spain (Balachowsky, 1935; Gómez-Menor Ortega, 1958; Martin-Mateo, 1983), Italy (Lupo, 1957), and North Africa (coastal Algeria) (Balachowsky, 1928) indicate that *R. donacis* has been collected only from *A. donax*, with the exception of one report from Turkey (Uygun et al., 1998) indicating a collection from common reed (*Phragmites australis*).

b. Field Collections and Observations

Extensive surveys by Alan Kirk (USDA-ARS, European Biological Control Laboratory (EBCL), Montpelier, France) throughout the Western Mediterranean, including Morocco, confirmed the widespread presence of *R. donacis* on *A. donax*. Occasionally, this scale was found on *Arundo plinii* in Spain.

c. Host Specificity Testing

(1) Site of Quarantine and Field Studies

Host-specificity tests are tests of how many plant species *R. donacis* attacks/eats. Field studies were conducted throughout Mediterranean Europe and in North America. Most studies were conducted near the ARS–European Biological Control Laboratory in Montpelier, France. *R. donacis* is native within 37 miles of the research grounds at the Campus Baillarguet Internacional. Laboratory studies were conducted at the USDA–APHIS Mission Biological Control Laboratory, Mission/Edinburg, Texas.

(2) Test Plant List

(The list of plant species used for host-specificity testing of *R. donacis* is shown in appendix A.)

A. donax belongs to the plant family Poaceae (grasses) and the subfamily Arundinoideae. Representatives of all of the subfamilies closely related to Arundinoideae (Chloridoideae, Centothecoidae, Panicoidae, and Micrairoideae) were included in the host range testing except for Micrairoideae which is not represented in North America. Representatives from more distant subfamilies within the Poaceae (Aristidoideae, Danthonioideae, Pooideae, and Bambusoideae) were also tested.

Within the Arundinoideae are the following core genera: *Arundo, Dregeochloa*, *Hakonechloa, Molinia*, and *Phragmites*. Representatives from all of these genera were tested except *Dregochloa*, which is found only in southern Africa, and *Hakonechloa*, an uncommon exotic, ornamental species in North America. A plant in the genus *Molinia* was obtained, but it is also a rarely used exotic ornamental. Of these genera, *Phragmites* is the most critical because it occurs with *A. donax* throughout a large part of its introduced range, and *R. donacis* has been reported on *Phragmites australis* in the literature. There are no native *Arundo* species in North or South America. The only other *Arundo* species present in North America is *A. formosana*. This plant is native to Taiwan and is an uncommon, exotic, ornamental in the San Francisco Bay Area. None of the other Mediterranean *Arundo* species (*A. plinii*, *A. collina*, or *A. mediterranea*) are present in North America.

To evaluate the genetic diversity of *A. donax*, the two dominant genotypes in the Rio Grande Basin (RGB) were collected from San Juan, Texas, in the Lower Rio Grande Valley and Laredo, Texas, 150 miles upriver. The Laredo genotype is the dominant genotype in the RGB above Laredo and, therefore, is representative of the vast biomass of the invasive population.

Considerable emphasis was placed on selection of *Phragmites* test plants. There is only one *Phragmites* species present in North America (*P. australis*), but there is a considerable body of knowledge associated with *P. australis* because of its worldwide distribution and invasiveness in northeastern North America (Tewksbury et al., 2002). Populations of *P. australis* from Rhode Island, California, and Texas were collected and used in testing.

Within the Poaceae, the main agricultural grasses, including corn, wheat, sorghum, and rice were tested. Genetic material of these grasses was obtained from USDA–ARS Germplasm Repositories in Idaho, Georgia, and Colorado. Whole rice plants were obtained from the USDA–ARS laboratory in Beaumont, Texas.

Several habitat associates of *A. donax* were selected that represented plants that *R. donacis* could come into contact with in the western or gulf coast areas of North America. All of the habitat associates are native non-economic species, except pecans, which are a native economic species.

Discussion of Host-Specificity Testing

In quarantine host-specificity testing, most plant species supported no *R. donacis* scales through any developmental stage. In no choice tests, there was low level survival and development of *R. donacis* on *S. alterniflora* and three *Leptochloa* species, less than 1 percent as compared to 43 percent development to the adult stage on *A. donax*. In additional testing of *S. alterniflora* no settling or development occurred on the plant, confirming that it is not expected to be a host of *R. donacis*. In field host range studies in Europe, *R. donacis* was not found on any other plant than *A. donax*.

***Quarantine Host Range Tests* (Goolsby, 2009).** In no choice tests (host-specificity tests where the target insect is offered only one test plant species and not offered the choice of either *A. donax* and the test plant species), 200 *R. donacis* crawlers were released on each test plant species. Crawlers that did not settle on plant tissues died within 2 to 3 days of release and, thus, were not expected to be observed at the time of plant dissection, 3 to 4 months after release of crawlers onto each plant. Early second-instar scales (sex not determinable) were uncommon on *A. donax*, *A. formosana*, and non-*Arundo* plants and did not vary in abundance between plant species (appendix B). Late second-instar females were also uncommon on *A. donax* (observed on 4 of 29 shoots), and did not differ in abundance between *A. donax* and the one non-*Arundo* plant on which they were observed, *Cynodon dactylon* (appendix B).

Adult males (indicated by empty scale coverings) were significantly more abundant on *A. donax* than on any non-*Arundo* plant species, while not differing from *A. formosana* (appendix B). Adult males were 2.5-fold more abundant on *A. donax* (316 adult males found on 29 shoots) than on *S. alterniflora* (13 found on 3 shoots), and were 7 to 30-fold less abundant on 3 *Leptochloa* spp. than on *A. donax* (appendix B). Live adult females, representing the most long-lasting and damaging scale stage, were found on only one non-*Arundo* species, *Leptochloa virgata*, with three adults found on two shoots. Live adult female abundance per *L. virgata* plant was 41-fold lower than on *A. donax*, on which 599 adult females were found on 29 shoots (appendix B). *Arundo donax* was 6.9-fold higher than *A. formosana* in live adult female counts (appendix B).

As an additional measure of development by females, counts of live and dead adult females were combined. Combined living and dead adult females were found on two *Leptochloa* species: *L. fusca* subsp. *univervia* (three dead females on one of three plants tested) and *L. virgata* (four dead adult females, in addition to the three live females noted earlier, on one of the two plants tested). Dead adult females were also found on *S. alterniflora* (total of 20 dead females found across two of three plants). These adults were originally reported as live because the grass leaf they were on died and it is not clear whether they would have survived. These values can be compared to *A. donax*, on which 669 live and dead adult females were found across 29 total plants. Average combined live and dead adult females per plant were 3.4-fold higher on *A. donax* than on *S. alterniflora*, 6.6-fold higher than on *L. virgata*, and 23-fold higher than on *L. fusca* subsp. *uninervia* (appendix B).

Total live scales were significantly higher on *A. donax* than any other plant species (appendix B). Forty of the 47 non-*Arundo* plant species did not support any *R. donacis* scales through any developmental stage. Total live scales were 3-fold more abundant on *A. donax* than on *A. formosana*, 7.6-fold more abundant than on *S. alterniflora*, 11-fold more abundant than on *Chasmanthium latifolium*, 17 to 100-fold more abundant than on *Leptochloa* spp., 55-fold more abundant than on *P. australis* (exotic Rhode Island, USA genotype), and 100-fold more abundant than on *Cynodon dactylon*, all significant differences in mean comparisons.

A followup no-choice test was performed involving *A. donax* from Laredo, Texas, and the four non-*Arundo* plant species on which small numbers of *R. donacis* males and/or females completed their immature development in prior host range tests. These species were further challenged by releasing 1,000 crawlers on each plant. The plants were dissected 3 months after crawler release. The results of the high rate tests are shown in appendix C. Survival and development of *R. donacis* on *S. alterniflora* and *Leptochloa* spp. was very low, less than 1 percent as compared to 43 percent development to the adult stage on *A. donax*. Mortality of crawlers under field conditions is likely to be much greater, thus further limiting the host range on *R. donacis*.

In August 2010, additional quarantine choice and dispersal tests were conducted to ensure that *S. alterniflora* would not serve as a host for *R. donacis*. *Rhizaspidiotus donacis* crawlers were given the choice to disperse, settle, and develop on their host plant, *A. donax,* or the nontarget *S. alterniflora*. In these studies, no settling or development occurred on *S. alterniflora*. In another study, the ability of *R. donacis* crawlers to be wind dispersed from *A. donax* and then settle and develop on *S. alterniflora* was tested. Although it was found in this study that *R. donacis* crawlers can be dispersed by wind, they did not settle and develop on *S. alterniflora*. These studies confirm that *S. alterniflora* is not expected to be at risk from *R. donacis*.

Field Host Range Studies **(Goolsby, 2009).** In field survey of non-targets in Mediterranean Europe, hundreds of the nontarget plant species of concern were collected and dissected. No *R. donacis* or any other diaspidid scales were observed on any *Leptochloa fusca* subsp. *uninervia* plants collected in Valencia, Seville, or Tortosa, Spain, whereas *R. donacis* was common on *A. donax* at the three sites. No *R. donacis* was observed on *A. donax* in the colder inland rice growing area of Merida/Badahoz where *Leptochloa fasicularis* was found.

No *R. donacis* were observed on *Spartina versicolor* at El Saler (Valencia). This site was the most intact natural area on the Mediterranean coast, and the two species have been growing together for many thousands of years. *R. donacis* was common on all the *A. donax* stands in this natural area. In southeastern France, near Leucate, two populations of *Spartina foliosa* were collected and examined, one within 500 m and the second 6 cm from *A. donax*. *Chortinaspis subterranea* (Diaspidae) individuals were collected from 4 of 11 stems at the second site, and heavy populations of *R. donacis* were observed on adjacent *A. donax*. No *R. donacis* were observed on *S. foliosa*.

In addition, other grasses growing with *A. donax,* identified as *Agropyrum, Cynodon, Elymus*, *Thinopyrum, Panicum,* and *Chloris,* were sampled at the above locations in Spain. Ten to 30 of each species within 0.5 m of *R. donacis* populations were collected, dissected, and evaluated. No *R. donacis* individuals were found on the above grass species.

In a field host exposure test, 20 *Leptochloa dubia* plants were returned to quarantine facilities for dissection and inspection after 6 months in the field. Plants were green and in good shape. Individual leaf blades and stems were separated and inspected for any evidence of *R. donacis*. No *R. donacis* individuals of any life stage were detected. This indicates that despite repeated exposure to multiple cohorts of crawlers emanating from the adjacent *A. donax*, *L. dubia* was not a field host for the scale (Goolsby, 2009).

2. Impact of *R. donacis* on *A. donax*

R. donacis is one of the most damaging insects to *A. donax* in its native range. The scale attacks the rhizome and developing underground buds by feeding on plants cells that carry out photosynthesis and cellular respiration and can store food for the plant. Damage symptoms include side shoot distortion with thin, brittle, short canes. Crawler feeding often causes distortion and a witch's broom effect (an abnormal brushlike growth of weak, closely clustered shoots). Other effects over time include gradual thinning, leaf reduction, and a sickly, yellowish-clouded appearance of canes. The overall effect is diminished vigor with *A. donax* stands characterized by thin, brittle, naked canes.

Assessment of impact on *A. donax* by the previously released *T. romana* combined with *R. donacis* was conducted in a quarantine greenhouse study (Goolsby, 2009). *T. romana* alone and *T. romana* plus *R. donacis* caused significant damage to *A. donax* by suppressing leaf and stem elongation and by stimulating the production of side branches during a 12-week period. The *R. donacis* plus *T. romana* treatment produced only slightly greater plant impacts as compared to *T. romana* alone, most likely because of the longer developmental time of *R. donacis*. The impact of *R. donacis* from the crawler to late second instar is not as great as the effect caused by the larger adult female. A longer study that fully encompassed the entire 6-month development period of *R. donacis* may have shown more impact by *R. donacis* combined with *T. romana*. No negative interactions were observed between the two biological control agents during the 12-week study. Continued observation of the test plants revealed that damage by *R. donacis* was significant 4 to 6 months after release. Large colonies of the scale formed at the base of the rhizome, which appeared to further suppress any regrowth, even 8 to 10 months after release. These results are consistent with field observations in Europe. In Europe, *R. donacis* causes long-term debilitation of *A. donax* stands.

3. Uncertainties Regarding the Environmental Release of *R. donacis*

Once a biological control agent, such as *R. donacis*, is released into the environment and becomes established, there is a slight possibility that it could move from the target plant (*A. donax*) to attack nontarget plants. Host shifts by introduced weed biological control agents to unrelated plants are rare (Pemberton, 2000). Native species that are closely related to the target species are the most likely to be attacked (Louda et al., 2003).

If other plant species were to be attacked by *R. donacis*, the resulting effects could be environmental impacts that may not be easily reversed. Biological control agents, such as *R. donacis*, generally spread without intervention by man. In principle, therefore, release of this biological control agent at even one site must be considered equivalent to release over the entire area in which potential hosts occur and in which the climate is suitable for reproduction and survival.

In addition, this agent may not be successful in reducing *A. donax* populations in the continental United States. Worldwide, biological weed control programs have had an overall success rate of 33 percent; success rates have been considerably higher for programs in individual countries (Culliney, 2005). Actual impacts on *A. donax* by *R. donacis* will not be known until after release occurs and post-release monitoring has been conducted. It is expected that *R. donacis* will work together with the previously released biological control agent, *T. romana*, to reduce populations of *A. donax*.

4. Cumulative Impacts

"Cumulative impacts are defined as the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agencies or person undertakes such other actions" (40 CFR 1508.7).

Many Federal and State agencies, as well as private entities, conduct programs to manage *A. donax*, as well as other invasive weeds. Chemical and mechanical methods, as described previously in this document, are used in a wide range of habitats. Some of these control programs are listed below.

Dept. of Homeland Security, Customs and Border Protection: The Border Patrol is planning to use mechanical and chemical methods to control *A. donax* along the United States and Mexican border in Webb County, Texas, to assist in law enforcement activities associated with illegal border crossings (DHS, 2008).

Dept. of State, International Boundary and Water Commission (IBWC), El Paso, Texas: The IBWC use annual mowing along the sections of the Rio Grande to manage access to the River.

U.S. Fish and Wildlife Service, International Services: Chemical control is used to stop the spread of *A. donax* at the Cuatro Cienegas nature preserve in Coahuila, Mexico

U.S. Dept. of Interior, National Park Service, Big Bend National Park, Texas: Park staff use a combination of fire and herbicides to manage *A. donax*.

Texas Dept. of Parks and Wildlife, Bentsen State Park, Mission, Texas: Park staff use herbicides to control *A. donax* and *Phragmites* growing in the alternate river channels.

Lower Rio Grande Valley Irrigation and Drainage Districts, Brownsville, Harlingen, Mercedes, McAllen, and La Hoya, Texas: All of the irrigation districts report that they use mechanical control, shredders, and backhoes for control of *A. donax* along irrigation canals and drainage ditches.

Maverick Irrigation District, Eagle Pass, Texas: The district reports the use of mechanical and chemical control to manage *A. donax* along irrigation canals and drainage ditches.

Texas Dept. of Transportation (TXDot), Austin, Texas: The State vegetation coordinator reports that TXDot uses mechanical and chemical control to maintain populations of *A. donax* growing along roadsides. The problem is most severe in south-central Texas near College Station.

Team Arundo Del Norte, California: A consortium of homeowner associations, municipalities, and the State of California combine their resources to use chemical control, mechanical removal, and revegetation to restore ecologically sensitive rivers and creeks in northern California.

Team Arundo Del Sur, California: A consortium of homeowner associations, municipalities, and the State of California combine their resources to use chemical control, mechanical removal and revegetation to restore ecologically sensitive rivers and creeks in southern California.

California Dept. of Transportation (CalDOT), Sacramento, California: CalDOT uses mechanical and chemical control to manage *A. donax* along highways and bridges in the State.

Private landowners throughout the southern tier of the United States use a variety of methods to control *A. donax* where it has become invasive on private land.

Santa Ana Watershed Association (SAWA), California: SAWA has removed over 2,000 acres of *A. donax* from the Santa Ana watershed to restore habitat for native species, including the southwestern willow flycatcher.

USDA, Agriculture Research Service is conducting releases of the previously released biological control agent *T. romana* in the vicinity of Laredo, Texas.

Release of *R. donacis* is not expected to have any negative cumulative impacts in the continental United States because of its host specificity to

A. donax. Effective biological control of *A. donax* will have beneficial effects for weed management programs, and may result in a long-term, non-damaging method to assist in the control of *A. donax*, and prevent its spread into other areas potentially at risk from invasion.

5. Endangered Species Act

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

A. donax has been documented to be the cause of the extinction of endemic fish species in the Rio Nadadores in Coahuila, Mexico, near Cuatro Cienegas (McGaugh et al., 2006). This region is rich in biodiversity, including fresh water stromatolites. The U.S. Fish and Wildlife Service, Pronatura Noreste, and the University of Texas at Austin are trying to eradicate *A. donax* from the most sensitive areas of Cuatro Ciénegas Natural Area. In California, least Bells' vireo (*Vireo bellii pusillus* Coues) is threatened by *A. donax* invasion (Boose and Holt, 1999). On the Rio Grande, Correl's false dragon head, *Physostegia correllii*, is a rare species which is severely impacted by *A. donax.*

a. Plants

There are 13 federally listed species in the plant family Poaceae in the continental United States. APHIS has determined that environmental release of *R. donacis* will have no effect on *Alopecurus aequalis* var. *sonomensis* (Sonoma alopecurus), *Poa atropurpurea* (San Bernardino bluegrass) and its designated critical habitat, *Poa napensis* (Napa bluegrass), or *Zizania texana* (Texas wild-rice) and its designated critical habitat. These species occur in either the subfamily Pooidae or Ehrhartordeae, both distantly related subfamilies to Arundinoideae. Some species belonging to the subfamily Pooideae were tested (*Elymus virginicus*, *Sporobolus wrightii*, and *Triticum aestivum*) but no development occurred on these plants. *Alopecurus pratensis* L. (meadow foxtail) is currently being tested against *R. donacis* as a surrogate for *Alopecurus aequalis* var. *sonomensis.* Preliminary results have indicated that no crawlers have settled on the plant (100 percent mortality of crawlers (J. Goolsby, pers. comm.).

The remaining listed grass species occur in the subfamily Chlordoideae. In host specificity testing, there was some minor development on some species belonging to this subfamily (*Cynodon dactylon, Leptochloa spp.,* and *S. alterniflora*). Species of *Leptochloa* and *Spartina* exist in the native range of the scale and were surveyed and challenged in a host exposure test. Neither these species nor other species of Chlorodoideae are hosts for *R. donacis* in Europe. *R. donacis* would be unable to survive on

Neostapfia colusana (Colusa grass), *Orcuttia californica* (California Orcutt grass), *Orcuttia inaequalis* (San Joaquin Orcutt grass), *Orcuttia pilosa* (hairy Orcutt grass), *Orcuttia tenuis* (slender Orcutt grass), *Orcuttia viscida* (Sacramento Orcutt grass), *Tuctoria greenei* (Greene's tuctoria), or *Tuctoria mucronata* (Solano grass) because part of their life cycle occurs in vernal pools. *Orcuttia* plants grow underwater for 3 months or more and have evolved specific adaptations for aquatic growth (Keeley, 1998). *Neostapfia colusana* occurs in large or deep vernal pools with substrates of high mud content. *Tuctoria greenei* is known only from vernal pools in the Central Valley of California. *Tuctoria mucronata* is an annual grass that germinates in temporary pools, producing slender leaves that float on the water's surface, and then, when the pools dry out for the summer, producing shoots and flowers (the inflorescence is 1.5 to 6 cm long) (NatureServe, 2009). Finally, all of the above listed vernal pool grasses are annual grasses. *R. donacis* is a terrestrial scale insect that feeds on rhizomes and stem node tissue of long-lived, perennial *Arundo* spp. *Rhizaspidiotus donacis* has a 6 month or longer life cycle. The life cycle of those vernal pool grasses would be too short to support the development of *R. donacis.* Therefore, APHIS has determined that the release of *R. donacis* may affect, but is not likely to adversely affect *N. colusana*, *O. californica, O. inaequalis, O. pilosa, O. tenuis, O. viscida, T. greenei,* or *T. mucronata*.

Swallenia alexandrae (Eureka dunegrass), a perennial plant in the subfamily Chlordoideae, grows in an environment that is hostile to both *Arundo donax* and *R. donacis*. It is located in four dunes in the Eureka Valley, Inyo County, California. All four populations are on lands managed by Death Valley National Park. Death Valley is the hottest and driest place in North America. Summer temperatures often top 120 °F (49 °C). Average rainfall is less than 2 inches (5 cm). The high summer temperatures would be lethal to *R. donacis*, which is a Mediterranean insect (J. Goolsby, pers. comm.). The Eureka dunes also experience winter freezes. The distribution of *R. donacis* in Europe is limited to only the climates warm enough for citrus to be grown. Therefore, both the high and low temperature extremes would be unsuitable for establishment of *R. donacis* (J. Goolsby, pers. comm.). Therefore, APHIS has determined that release of *R. donacis* may affect, but is not likely to adversely affect *S. alexandrae.*

b. Animals

A. donax has been found to be used by some wildlife, although it provides little value for native wildlife in comparison to native vegetation, especially when it forms large, monotypic stands. Two endangered bird species, least Bell's vireo (*Vireo bellii pusillus*) and the southwestern willow flycatcher (*Empidonax traillii extimus*), have been found to use *A. donax* as a nest host (Pike et al., 2002; Kus, 2000). However, the recovery plan for the southwestern willow flycatcher indicates that this bird rarely nests in *A. donax*, and also indicates that in California, *A. donax* is spreading rapidly, forming dense, monotypic stands unsuitable for flycatchers (FWS, 2002). Least Bell's vireos have been found nesting on *A. donax* along the Santa Clara River and the San Luis Rey River. In the U.S. Fish and Wildlife Service's 5-year review of the least Bell's vireo (FWS, 2006), habitat loss and invasion of riparian habitat by introduced exotic plant species (primarily *A. donax*) is listing factor 1 for the species. *R. donacis* is not expected to cause rapid, drastic reduction of *A. donax*, but could potentially decrease the reproductive capacity of *A. donax*. Thus, *A. donax* would not be rapidly removed from the environment, leaving nesting habitat for these species. Therefore, release of *R. donacis* may affect, but is not likely to adversely affect, nesting by the least Bell's vireo or the southwestern willow flycatcher, and may potentially benefit their designated critical habitat as *A. donax* does not provide suitable habitat for these birds.

In Texas, *A. donax* provides migratory habitat for the Gulf Coast jaguarundi (*Herpailurus* (=*Felis*) *yagouaroundi cacomitli*) and ocelot (*Leopardus* (=*Felis*) *pardalis*). However, *R. donacis* is not expected to cause rapid, drastic reduction of *A. donax*, but could potentially diminish the vigor of *A. donax*, resulting in stands which are characterized by thin brittle naked canes. Thus, *A. donax* would not be rapidly removed from the environment, leaving migratory cover for these species. Therefore, release of *R. donacis* may affect, but is not likely to adversely affect the gulf coast jaguarundi or ocelot.

S. alterniflora is an important component of the wintering habitat of the whooping crane (*Grus americana*). In additional host specificity testing conducted in August 2010, *R. donacis* did not develop on *S. alterniflora*. Therefore, APHIS has determined that release of *R. donacis* may affect, but is not likely to adversely affect the whooping crane or its critical habitat.

APHIS submitted a biological assessment to the U.S. Fish and Wildlife Service (Service) in June 2009 and again in January 2010, requesting Service concurrence. Numerous email and telephone communications have occurred between APHIS and the Service to clarify aspects of the release of *R. donacis*. In a letter dated September 13, 2010, the Service concurred with APHIS's determinations that release of *R. donacis* may affect, but is not likely to adversely affect, the plants *N. colusana*, *O. californica*, *O. inaequalis, O. pilosa*, *O. tenuis, O. viscida, T. greenei, T. mucronata,* and *S. alexandrae,* or the animals *V. bellii pusillus*, *E. traillii extimus*, *L. pardalis*, *H. yagouaroundi cacmitli*, and *G. americana* or their designated critical habitats.

V. Other Issues

Consistent with Executive Order (EO) 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,” APHIS considered the potential for disproportionately high and adverse human health or environmental effects on any minority populations and low-income populations. There are no adverse environmental or human health effects from the field release of *R. donacis*, and the release will not have disproportionate adverse effects to any minority or low-income populations.

Consistent with EO 13045, “Protection of Children From Environmental Health Risks and Safety Risks,” APHIS considered the potential for disproportionately high and adverse environmental health and safety risks to children. No circumstances that would trigger the need for special environmental reviews are involved in implementing the preferred alternative. Therefore, it is expected that no disproportionate effects on children are anticipated as a consequence of the field release of *R. donacis*.

EO 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….”

APHIS is consulting and collaborating with Indian tribal officials to ensure that they are well-informed and represented in policy and program decisions that may impact their agricultural interests in accordance with EO 13175, “Consultation and Coordination with Indian Tribal Governments.”

VI. Agencies, Organizations, and Persons Consulted

The Technical Advisory Group for the Biological Control Agents of Weeds (TAG) recommended the release of *R. donacis* on July 6, 2009. TAG members that reviewed the release petition (Goolsby, 2009) included representatives from the Bureau of Indian Affairs, APHIS, Cooperative State Research, Education, and Extension Service, Forest Service, U.S. Geological Survey, Environmental Protection Agency, U.S. Army Corps of Engineers, Bureau of Land Management, Bureau of Reclamation, the National Plant Board, and representatives from Canada and Mexico.

This EA was prepared and reviewed by APHIS. The addresses of participating APHIS units, cooperators, and consultants (as applicable) follow.

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

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Plant Protection and Quarantine
Pest Permitting
4700 River Road, Unit 133
Riverdale, MD 20737

U.S. Department of Agriculture
Kika de la Garza Subtropical Agricultural Research Center
Beneficial Insects Research Unit
2413 E. Hwy. 83
Weslaco, TX 78596

VII. References

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Appendix A. Host Plant Test List for *R. donacis* (Goolsby, 2009)

Order	Family	Sub-family	Scientific Name	Common Name	Indigenous to U.S.	Indigenous to Mexico	Grain/ Forage	Ornamental	Habitat Associate
Cyperales	Poaceae	Arundinoideae	*Arundo donax* L. Laredo, TX	giant reed	No	No	No	Yes	-
"	"	"	*Arundo donax* L. San Juan, TX	giant reed	No	No	No	Yes	-
"	"	"	*A. formosana* Hack.	fountain reed	No	No	No	Yes	No
"	"	"	*Phragmites australis* (Cav.) Trin. ex Steud. Rhode Island (exotic European ecotype)	common reed	No	No	No	No	No
"	"	"	*Phragmites australis* (Cav.) Trin. ex Steud. Mercedes, TX	common reed	Yes	Yes	No	No	Yes
"	"	"	*Phragmites australis* (Cav.) Trin. ex Steud. San Benito, TX	common reed	Yes	Yes	No	No	Yes
"	"	"	*Phragmites australis* (Cav.) Trin. ex Steud. Colorado River, CA	common reed	Yes	Yes	No	No	Yes
"	"	"	*Molinia caerulea* (L.) Moench	Moore grass	No	No	No	Yes	No
"	"	Aristidoideae	*Aristida purpurea* Nutt. var. *longiseta* (Steud.) Vasey	red three awn	Yes	Yes	No	No	No
"	"	Centothecoideae	*Chasmanthium latifolium* (Michx.) Yates	inland sea oats	Yes	Yes	No	Yes	Yes
"	"	Chloridoideae	*Bouteloua hirsuta* Lag.	hairy grama	Yes	Yes	Yes	No	No
"	"	"	*Cynodon dactylon* (L.) Pers.	Bermuda grass	No	No	Yes	Yes	Yes
"	"	"	*Dichanthelium acuminatum* (Sw.) Gould and Clark	tapered rosette grass	Yes	Yes	Yes	No	No
"	"	"	*Eragrostis intermedia* Hitchc.	plains lovegrass	Yes	Yes	Yes	No	No
"	"	"	*Eragrostis spectablilis* (Pursh) Steud.	purple lovegrass	Yes	Yes	Yes	Yes	No
"	"	"	*Leptochloa dubia* (Kunth) Nees	green sprangletop	Yes	Yes	Yes	No	No

"	"	"	*Leptochloa fusca* (L.) Kunth subsp. *uninervia* (J. Presl) N. Snow	Mexican sprangletop	Yes	Yes	No	No	No
"	"	"	*Leptochloa panicea* (A. Retzius) J. Ohwi subsp. *Brachiata*	red sprangletop	Yes	Yes	No	No	No
"	"	"	*Leptochloa virgata* (L.) P. Beauv.	tropic sprangletop	Yes	Yes	No	No	No
"	"	"	*Muhlenbergia capillaris* (Lam.) Trim.	hairawn muhly	Yes	Yes	Yes	Yes	No
"	"	"	*Spartina alterniflora* Loisel.	smooth cordgrass	Yes	No?	No	No	Yes
"	"	"	*Spartina spartinae* (Trin.) Merr. ex Hitchc.	Gulf cordgrass	Yes	Yes	No	No	Yes
"	"	"	*Tridens albescens* (Vasey) Wooton & Standl.	white Tridens	Yes	Yes	Yes	No	Yes
"	"	"	*Uniola paniculata* L.	sea oats	Yes	Yes	No	No	Yes
"	"	Danthonioideae	*Cortaderia selloana* (Schult. & Schult. f.) Asch. & Graebn.	pampas grass	No	No	No	Yes	No
"	"	"	*Danthonia spicata* (L.) P. Beauv. ex Roem. & Schult.	poverty oatgrass	Yes	Yes	Yes	No	No
"	"	Panicoideae	*Andropogon glomeratus* (Walter) Britton et al.	bushy bluestem	Yes	Yes	Yes	Yes	Yes
"	"	"	*Digitaria cognata* (Schult.) Pilg.	fall witchgrass	Yes	Yes	Yes	No	No
"	"	"	*Panicum amarum* Elliot.	bitter panicgrass	Yes	Yes	Yes	No	No
"	"	"	*Panicum hirsutum* Sw.	hairy panicum	Yes	Yes	No	No	Yes
"	"	"	*Panicum virgatum* L.	switchgrass	Yes	Yes	Yes	Yes	No
"	"	"	*Pennisetum ciliare* (L.) Link	buffelgrass	No	No	Yes	No	Yes
"	"	"	*Saccharum officinarum* L.	sugarcane	No	No	Yes	No	No
"	"	"	*Schizachyrium scoparium* (Michx.) Nash	little bluestem	Yes	Yes	Yes	Yes	Yes

“	“	“	*Sorghum bicolor* (L.) Moench	sorghum	No	No	Yes	No	No
“	“	“	*Tripsacum dactyloides* (L.) L.	eastern gamagrass	Yes	Yes	Yes	No	Yes
“	“	“	*Zea mays* L.	corn	No	No	Yes	No	No
“	“	Pooideae	*Elymus virginicus* L.	Virginia wildrye	Yes	No	Yes	No	Yes
“	“	“	*Sporobolus wrightii* Munro ex Scribn.	alkalai sacaton	Yes	Yes	Yes	No	Yes
“	“	“	*Triticum aestivum* L.	wheat	No	No	Yes	No	No
“	“	Bambusoideae	*Arundinaria gigantea* (Walter) Muhl.	giant cane	Yes	No	No	Yes	Yes
“	“	“	*Oryza sativa* L.	rice	No	No	Yes	No	No
“	Cyperaceae	----	*Cyperus articulatus* L.	jointed flatsedge	Yes	Yes	No	No	Yes
“	“	----	*Schoenoplectus maritimus* (L.) Lye	alkali bulrush	Yes?	Yes?	No	No	Yes
Eriocaules	Eriocaulaceae	----	*Eriocaulon decangulare* L.	tenangle pipewort	Yes	Yes	No	No	No
Typhales	Typhaceae	----	*Typha domingensis* Pers.	narrowleaf cattail	Yes	Yes	No	No	Yes
Arecales	Arecaceae	----	*Sabal mexicana* Mart.	Rio Grande palmetto	Yes	Yes	No	Yes	Yes
Juglandales	Juglandaceae	----	*Carya illinoinensis* (Wangenh.) K. Koch	pecan	Yes	Yes	Yes	Yes	Yes
Salicales	Salicaceae	----	*Salix exigua* Nutt.	narrowleaf willow	Yes	Yes	No	No	Yes
Asterales	Asteraceae	----	*Baccharis neglecta* Britton	dryland Baccharis	Yes	Yes	No	No	Yes
“	Oleaceae	----	*Fraxinus berlandieriana* DC.	Rio Grande ash	Yes	Yes	No	Yes	Yes

Appendix B. Results of No-Choice Host Range Tests for *Rhizaspidiotus donacis* (Goolsby, 2009). (Values are mean numbers of scale insects per plant.*)

Test Plant Species	Reps	Live Whitecaps/ Early 2nd Instar	Live Late 2nd Instar	Adult Male**	Live Adult Female	Live+Dead Adult Female	Total Live All Stages
		mean ±SE	mean ±SE	mean ±SE	mean ±SE	mean ±SE	mean ±SE
Arundo donax Laredo, TX	13	2.30±1.99	0.85±0.48	9.62±2.83	24.15±7.10	27.23±7.66	37.15±10.71
Arundo donax San Juan TX	16	0.38±0.38	0	11.94±2.34	17.81±4.56	19.69±4.60	30.13±5.60
Arundo donax pooled Laredo and San Juan, TX	29	1.24±0.92[a]	0.38±0.22[a]	10.90±1.79[a]	20.66±4.02[a]	23.07±4.24[a]	33.28±5.63[a]
Arundo formosana	3	0	0	7.33±3.67[a]	3.00±1.53[b]	5.00±2.89[b]	11.00±5.57[b]
Phragmites australis Charlestown RI (Exotic European ecotype)	5	0.40±0.4[a]	0	0.20±0.20[b]	0	0	0.60±0.60[b]
Phragmites australis Mercedes, TX	4	0	0	0	0	0	0
Phragmites australis San Benito, TX	3	0	0	0	0	0	0
Phragmites australis Colorado River CA	6	0	0	0	0	0	0
Molinia caerulea	3	0	0	0	0	0	0
Aristida purpurea var. *longiseta*	3	0	0	0	0	0	0
Chasmanthium latifolium	2	0.50±0.50[a]	0	0	0	0	0.50±0.50[b]
Bouteloua hirsuta	3	0	0	0	0	0	0
Cynodon dactylon	3	0	0.33±0.33[a]	0	0	0	0.33±0.33[b]
Dichanthelium acuminatum	3	0	0	0	0	0	0
Eragrostis intermedia	3	0	0	0	0	0	0
Eragrostis spectablilis	3	0	0	0	0	0	0
Leptochloa fusca subsp. *uninervia*	3	0.33±0.33[a]	0	1.00±1.00[b]	0	1.00±1.00[b]	1.33±1.33[b]
Leptochloa panicea subsp. *Brachiata*	3	0	0	0.33±0.33[b]	0	0	0.33±0.33[b]
Leptochloa virgata	2	0	0	0.50±0.50[b]	1.50±1.50[b]	3.50±3.50[b]	2.00±2.00[b]

Muhlenbergia Capillaris	3	0	0	0	0	0	0
Spartina alterniflora	3	0	0	4.33±4.33[b]	0	6.67±6.17[b]	4.33±4.33[b]
Spartina spartinae	3	0	0	0	0	0	0
Tridens albescens	3	0	0	0	0	0	0
Uniola paniculata	3	0	0	0	0	0	0
Cortaderia selloana	5	0	0	0	0	0	0
Danthonia spicata	1	0	0	0	0	0	0
Andropogon glomeratus	3	0	0	0	0	0	0
Digitaria cognata	3	0	0	0	0	0	0
Panicum amarum	3	0	0	0	0	0	0
Panicum hirsutum	3	0	0	0	0	0	0
Panicum virgatum	3	0	0	0	0	0	0
Pennisetum ciliare	3	0	0	0	0	0	0
Saccharum officinarum	3	0	0	0	0	0	0
Schizachyrium scoparium	3	0	0	0	0	0	0
Sorghum bicolor	3	0	0	0	0	0	0
Tripsacum dactyloides	3	0	0	0	0	0	0
Zea mays	3	0	0	0	0	0	0
Elymus virginicus	1	0	0	0	0	0	0
Sporobolus wrightii	3	0	0	0	0	0	0
Triticum aestivum	3	0	0	0	0	0	0
Arundinaria gigantea	3	0	0	0	0	0	0
Oryza sativa	3	0	0	0	0	0	0
Cyperus articulatus	3	0	0	0	0	0	0
Schoenoplectus maritimus	3	0	0	0	0	0	0
Eriocaulon decangulare	3	0	0	0	0	0	0
Typha domingensis	4	0	0	0	0	0	0
Sabal mexicana	3	0	0	0	0	0	0
Carya illinoinensis	3	0	0	0	0	0	0
Salix exigua	3	0	0	0	0	0	0
Baccharis neglecta	3	0	0	0	0	0	0
Fraxinus berlandieriana	3	0	0	0	0	0	0

* Two hundred crawlers placed on each plant. Means within the same column with the same letter are not significantly different in least-square comparisons of means to pooled *A. donax* from Laredo and San Juan, TX (in bold above) (P > 0.05).
** Completion of male development to the winged adult stage is inferred from empty 2nd instar scale cover.

Appendix C. Results of No-Choice Host Range Tests for *Rhizaspidiotus donacis* in which 1,000 Crawlers Were Released Per Plant (Goolsby, 2009). (Values are mean numbers of scale insects per plant.*)

Test Plant Species	Reps	Live Whitecaps/ Early 2nd Instar	Live Late 2nd Instar	Adult Male**	Live Adult female	Live+Dead Adult Female	Total Live All Stages
		mean ±SE	mean ±SE	mean ±SE	mean ±SE	mean ±SE	mean ±SE
Arundo donax Laredo, TX	2	12.5±8.5[a]	6.00±0.00	249±24.0[a]	129±40.0[a]	177±53[a]	398±25.5[a]
Leptochloa fusca subsp. *uninervia*	3	0	0	1.00±1.00[b]	0	0.67±0.67[b]	1.00±1.00[b]
Leptochloa panicea subsp. *brachiata*	3	0.33±0.33[b]	0	1.67±1.67[b]	0	7.00±7.00[b]	2.00±1.53[b]
Leptochloa virgata	2	0	0	1.50±1.50[b]	5.00±5.00[b]	6.50±6.50[b]	6.50±6.50[b]
Spartina alterniflora	3	0	0	0	0.33±0.33[b]	1.67±0.33[b]	0.33±0.33[b]

Decision and Finding of No Significant Impact
for
Field Release of the Arundo Scale, *Rhizaspidiotus donacis* (Hemiptera: Diaspididae), an Insect for Biological Control of *Arundo donax* (Poaceae) in the Continental United States
December 2010

The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine (PPQ) Pest Permitting Branch (PPB), is proposing to issue permits for release of an insect, *Rhizaspidiotus donacis* (Hemiptera: Diaspididae), into the environment in the continental United States. This species would be released by the applicant for the biological control of *Arundo donax* (Poaceae), an invasive weed. Since *Rhizaspidiotus donacis* is not native or established in any State, territory or possession of the United States, APHIS must analyze the potential impacts of the release of this organism into the continental United States prior to issuing a permit for release into the environment in accordance with USDA APHIS National Environmental Policy Act implementing regulations (7CFR Part 372). Therefore, APHIS has prepared an environmental assessment (EA) that analyzes the potential environmental consequences of this action. The EA is available from:

U.S. Department of Agriculture
Animal and Plant Health inspection Service
Plant Protection and Quarantine
Registrations, Identification, Permits, and Plant Safeguarding
4700 River Road, Unit 133
Riverdale, MD 20737
http://www.aphis.usda.gov/plant_health/ea/index.shtml

The EA analyzed the following two alternatives in response to a request for permits authorizing environmental release of *R. donacis*: (1) no action, and (2) issue permits for the release of *R. donacis* for biological control of *A. donax*. A third alternative, to issue permits with special provisions or requirements concerning release procedures or mitigating measures, was considered, then subsequently dismissed, because no issues were raised that indicated that special provisions or requirements were necessary. The No Action alternative, as described in the EA, would likely result in the continued use at the current level of chemical, mechanical, and biological control methods for the management of *A. donax*. These control methods described are not alternatives for decisions to be made by the PPB, but are presently being used to control *A. donax* in the United States and may continue regardless of permit issuance for field release of *R. donacis*. Notice of the EA was made available in the Federal Register on November 12, 2010 for a 30-day public comment period. Eleven comments were received on the EA. Ten were in favor of the release of *R. donacis*. One was an anonymous comment expressing general disapproval of APHIS activities. This comment did not provide any substantial concerns regarding *R. donacis* that required additional consideration in the EA.

I have decided to authorize the PPB to issue permits for the environmental release of *R. donacis*. The reasons for my decision are:

- This biological control agent is sufficiently host specific and poses little, if any, threat to the biological resources, including non-target plant species, of the continental United States.

- The release may affect but is not likely to adversely affect federally listed threatened and endangered species or their habitats in the continental United States. APHIS received a letter of concurrence with this determination from the U.S. Fish and Wildlife Service.

- *R. donacis* poses no threat to the health of humans or wild or domestic animals.

- No negative cumulative impacts are expected from release of *R. donacis*.

- There are no disproportionate adverse effects to minorities, low-income populations, or children in accordance with Executive Order 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations" and Executive Order 13045, "Protection of Children from Environmental Health Risks and Safety Risks."

- While there is not total assurance that the release of *R. donacis* into the environment will be reversible, there is no evidence that this organism will cause any adverse environmental effects.

I have determined that there would be no significant impact to the human environment from the implementation of any of the action alternatives and, therefore, no EIS needs to be prepared.

Dr. Michael J. Firko
Director
Registrations, Identification, Permits, and Plant Safeguarding
Plant Health Programs
APHIS, Plant Protection and Quarantine

12/15/2010
Date