# CHAPTER 6. INVASIVE SPECIES

Invasive species are one of the most widespread and serious threats to Species of Greatest Conservation Need (SGCN) and their habitats in Louisiana. Furthermore, the threat of invasive species continues to expand, and is perhaps the single threat that can best be addressed by private landowners and managers. Therefore, during the revision of the Louisiana Wildlife Action Plan (WAP), a more comprehensive approach to this issue was taken. It is our hope that this chapter will raise public awareness of this pervasive threat to Louisiana's wildlife resources, and spur increased action. This chapter contains a list of invasive species that are known to occur or have the potential to occur within the next 10 years in Louisiana. This chapter also presents information on those invasive species that are considered to pose the greatest threat to SGCN and their habitats.

## A. The Invasive Species Problem

Important distinctions must be made between two closely related and oftentimes confusing terms in invasion biology, namely "exotic" and "invasive". These terms are discussed in detail in Mack et al. (2000) and McGlynn (1999), but will be defined in simple terms here. Exotic species, also known as alien, introduced, or non-native species, are simply those transferred to a new geographic location previously unoccupied by that species. Such transfer might occur through natural means (e.g., high winds, flooding, etc) or through anthropogenic means (e.g., movement of nursery stock, intentional stocking, etc.). No matter the means, exotic species that are introduced have a roughly 10% chance of success in their new range (Mack et al. 2000). A clear dichotomy exists between exotic species intentionally introduced and those accidentally introduced. The vast majority of vertebrates, especially fish, mammals, and birds, have been intentionally introduced, usually for game or aesthetic reasons, and, occasionally, at a great expense to our native organisms (Mack et al. 2000). However, with the exception of biological control agents, very few intentional introductions of invertebrates have occurred.

The term "exotic" alone should not necessarily connote negative impacts to ecosystems. For example, exotic plant and animal species also include a large number of organisms found in zoos, aquariums, arboretums, and botanical gardens, as well as many species sold at pet stores and nurseries. When cared for responsibly, these flora and fauna should not cause any detrimental effects to native species or habitats. The vast majority of problems caused by exotic species involve species that are also *invasive*.

Invasive exotic species are those that have escaped captivity or have been intentionally or accidentally released, and have aggressively spread and become established in an area by outcompeting native species. Once established, these species have the potential to cause significant harm to native species and natural communities. Invasive exotic species often have life history traits that allow them to outcompete other species, particularly native species. Such traits may include better-adapted root structures, faster growth rates, more efficient seed dispersal methods, a marked preference for disturbance, and higher fecundity rates. Only 1% of exotic species will reach invasive status (Mack et al. 2000).

Native species can become invasive as well, but such invasions are typically facilitated by humans. In those cases, a native species may undergo rapid or significant expansion into areas where it was not historically found, or it may simply become more common. Therefore, via novelty or abundance, the invasive native species is likely to have negative impacts to other native species. One such invasive native species is the Brown-headed Cowbird (*Molothrus ater*), which has become much more abundant in the United States as a result of habitat fragmentation and the resulting increase in edge habitat. This species is a brood parasite; female Brown-headed Cowbirds deposit eggs into the nests of other bird species ("hosts"), which then raise the cowbird chicks at the expense of the hosts' own young. Invasive species are not exclusively non-native therefore, however, the majority of problematic invasives are exotic. Hereafter, for the purposes of this chapter, invasive species will be synonymous with exotic invasive species (with the exception of feral Canada Geese).

Louisiana's humid subtropical climate puts it at high risk for invasive species introductions and increases the potential for those introductions to lead to established populations. Long, hot summers and short, mild winters, along with high precipitation levels, allow for a plethora of invasive species to survive year-round in Louisiana. Once established, these species can cause significant negative impacts to the invaded environment such as decreased food availability and habitat quality for native species, decreased species diversity, increased habitat fragmentation, and weakened ecosystem defenses. Invasive organisms, therefore, represent an additional stressor for native species, particularly SGCN, and natural communities.

Invasive species have far reaching consequences impacting industrial, agricultural, commercial, and private business sectors. The approximately 50,000 exotic invasive species in the U.S. cause major environmental damage and losses of approximately $137 billion annually (Pimentel et al. 2000). Those species that cause economic losses or become nuisances to humans are deemed "pests," a term, like "invasive," that may be applied to native or exotic organisms. To limit the spread of invasive species, federal and state governments have passed laws regulating the transport of exotic species and have created legal consequences for violators. Perhaps the most well-known of these laws is the Lacey Act of 1900. Under the Lacey Act it is unlawful to import, export, sell, purchase, or acquire fish, wildlife or plants that are taken, possessed, transported, or sold: (1) in violation of U.S. or Indian law or (2) in interstate or foreign commerce involving any fish, wildlife, or plants taken, possessed, or sold in violation of State or foreign law. In 2008, the Lacey Act was amended to restrict a wider variety of prohibited plants and plant products, including products made from illegally logged woods. These laws were put in place not only to protect native species and habitats from illegal harvest within the United States, but also to mitigate the astonishing costs of dealing with the consequences of invasive species. Whereas monetary figures of economic damages are difficult to comprehend, the greatest damages may come in the unknown extent of degradation to our habitats, as well as the decline of our native wildlife, especially SGCN.

Trapping, shooting, and utilization of herbicides and pesticides are the most common methods of control of many invasive species. However, the rate at which invasive species spread is frequently faster than the rate at which these removal techniques can be

implemented. This lag in response time is in part due to insufficient invasive species removal resources for land managers and state agencies. Sam Hamilton, the former director of the U.S. Fish and Wildlife Service, called invasive species "probably the single greatest threat in our country to our native wildlife." Invasive species will remain a major threat to our nation's natural environment if greater action is not taken towards funding more effective management programs for invasive species. Addressing gaps in invasive species legislation, along with properly educating the public about owning and safe-handling of known or potentially invasive species, may be the best chance of preventing further introductions and may help focus resources on addressing damage done thus far to our native wildlife and habitats.

**B. Additional Sources of Information on Invasive Species**

1. Laws and Regulations

- U.S. laws and regulations (www.fws.gov/invasives/laws.html)
- Louisiana regulations (http://www.invasivespeciesinfo.gov/laws/la.shtml)
- Lacey Act Information ( www.fws.gov/le/pdffiles/Lacey.pdf)

2. General Invasive Species Information

- Louisiana Invasive species (http://is.cbr.tulane.edu/index.html)
- Invasive species introduction pathways (www.invasivespeciesinfo.gov/docs/toolkit/pathways.doc)
- Invasive species distribution and mapping (http://www.eddmaps.org)
- Invasive species reporting (http://pest.ceris.purdue.edu/state.php?code=LA)
- Southeast Exotic Pest Plant Council (http://www.se-eppc.org/index.cfm)
- Aquatic Nuisance Species Taskforce (http://www.anstaskforce.gov/default.php)
- USDA APHIS (http://www.aphis.usda.gov/wps/portal/aphis/home/)
- USGS Aquatic Invasives Database (http://nas.er.usgs.gov/)
- BTNEP Invasive Species Website (http://invasive.btnep.org/InvasiveHome.aspx)
- USFWS Aquatic Nuisance Species (http://www.fws.gov/Fisheries/ANS/index.html)
- ISSG Global Invasive Species Database (http://www.issg.org/database/species/search.asp?st=100ss&fr=1&str=&lang=EN)

3. Identification and Control of Invasive Species

- A Field Guide for the Identification of Invasive Plants in Southern Forests (http://www.privatelandownernetwork.org/pdfs/IdentificationofInvasivePlantsinSouthernForests.pdf)

- A Management Guide for Invasive Plants in Southern Forests (http://www.privatelandownernetwork.org/pdfs/Management%20Guide%20for%20invasive%20plants%20in%20southern%20forests.pdf)
- Invasive Plant Responses to Silvicultural Practices in the South (http://www.privatelandownernetwork.org/pdfs/silvicsforinvasives.pdf)

**C. Louisiana Invasive Species List**

The list that follows includes all invasive species that are known to occur in Louisiana that have or are likely to have impacts on SGCN or their habitats, as well as such species that have the potential to invade within the next 10 years. This list is divided into four Tiers:

- Tier I – Currently having severe or widespread negative impacts on wildlife or natural communities in Louisiana. This includes species that have a limited distribution in the state, but that have severe impacts where found.
- Tier II – Currently having moderate negative impacts on wildlife or natural communities in Louisiana, but of limited concern and/or extent. This includes species that have severe impacts in other states, but that have not reached Tier 1 status in Louisiana.
- Tier III – Currently occurring (or have occurred recently), but that have no known or anticipated significant impacts on wildlife or natural communities in Louisiana.
- Tier IV – Species not known to currently occur, or known to have occurred in the recent past, but that have the potential to invade in the near future.

| Common Name | Scientific Name |
|---|---|
| **TIER I** | |
| Channeled Apple Snail | *Pomacea canaliculata & Pomacea maculata* |
| Argentine Ant | *Linepithema humile* |
| Red Imported Fire Ant | *Solenopsis invicta* |
| Rio Grande Cichlid | *Herichthys cyanoguttatus* |
| Grass Carp | *Ctenopharyngodon idella* |
| Common Carp | *Cyprinus carpio* |
| Silver Carp | *Hypophthalmichthys molitrix* |
| Bighead Carp | *Hypophthalmichthys nobilis* |
| Black Carp | *Mylopharyngodon piceus* |
| Lionfish | *Pterois volitans & P. miles* |
| European Starling | *Sturnus vulgaris* |
| House Sparrow | *Passer domesticus* |
| Norway Rat | *Rattus norvegicus* |
| Black Rat | *Rattus rattus* |
| Nutria | *Myocastor coypus* |

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| Feral/Domestic Cat | *Felis catus* |
| Feral Hog | *Sus scrofa* |
| Coral Ardisia | *Ardisia crenata* |
| Camphor Tree | *Cinnamomum camphora* |
| Elephant Ear | *Colocasia esculenta* |
| Bermuda Grass | *Cynodon dactylon* |
| Japanese Twin-Sorus Fern | *Deparia petersenii* |
| Air Yam | *Dioscorea alata & D. bulbifera* |
| Brazilian Waterweed | *Egeria densa* |
| Water Hyacinth | *Eichhornia crassipes* |
| Chinese Parasol Tree | *Firmiana simplex* |
| Hydrilla or Waterthyme | *Hydrilla verticillata* |
| Cogon Grass | *Imperata cylindrica* |
| Yellow Flag Iris | *Iris pseudacorus* |
| Chinese Privet | *Ligustrum sinense* |
| Japanese Climbing Fern | *Lygodium japonicum* |
| Torpedo Grass | *Panicum repens* |
| Holmwood Grass | *Paspalum modestum (=P. hydrophyllum)* |
| Vasey Grass | *Paspalum urvillei* |
| Trifoliate Orange | *Poncirus trifoliata* |
| Kudzu | *Pueraria montana* |
| McCartney Rose | *Rosa bracteata* |
| Cherokee Rose | *Rosa laevigata* |
| Common Salvinia (Water Spangles) | *Salvinia minima* |
| Giant Salvinia | *Salvinia molesta* |
| Smut Grass | *Sporobolus indicus* |
| Chinese Tallow Tree | *Triadica sebifera* |
| Tungoil Tree | *Vernicia fordii* |
| **TIER II** | |
| Asian Clam | *Corbicula fluminea* |
| Zebra Mussel | *Dreissena polymorpha* |
| Brown Widow | *Latrodectus geometricus* |
| Water Flea | *Daphnia lumholzi* |
| Asian Tiger Shrimp | *Penaeus monodon* |
| Formosan Termite | *Coptotermes formosanus* |
| Asian Tiger Mosquito | *Aedes albopictus* |
| Tawny Crazy Ant | *Nylanderia fulva* |
| European Honeybee | *Apis mellifera* |
| Cactus Moth | *Cactoblastis cactorum* |
| Puerto Rican Coqui | *Eleutherodactylus coqui* |

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| Rio Grande Chirping Frog | *Eleutherodactylus cystignathoides* |
| Greenhouse Frog | *Eleutherodactylus planirostris* |
| Florida Softshell | *Apalone ferox* |
| Brown Anole | *Anolis sagrei* |
| Rock Pigeon | *Columba livia* |
| Eurasian Collared-Dove | *Streptopelia decaocto* |
| House Mouse | *Mus musculus* |
| Giant Water Sensitive Plant | *Aeschynomene fluitans* |
| Tree-of-Heaven | *Ailanthus altissima* |
| Mimosa | *Albizia julibrissin* |
| Alligatorweed | *Alternanthera philoxeroides* |
| Chaff-Weed | *Alternanthera sessilis* |
| Giant Reed | *Arundo donax* |
| Mosquito Fern | *Azolla pinatta* |
| Australian Bluestem | *Bothriochloa bladhii* |
| King Ranch Bluestem | *Bothriochloa ischaemum* var. *songarica* |
| Little Quaking Grass | *Briza minor* |
| Paper Mulberry | *Broussonetia papyrifera* |
| Balloon Vine | *Cardiospermum halicacabum* |
| Nodding Thistle | *Carduus nutans* |
| Bushkiller | *Cayratia japonica* |
| Water Sprite | *Ceratopteris thalictroides* |
| Paraguayan Windmill Grass | *Chloris canterai* |
| Bull Thistle | *Cirsium vulgare* |
| Large-Head Horseweed | *Conyza bonariensis* |
| Deep-rooted Sedge | *Cyperus entrerianus* |
| Ricefield Flatsedge | *Cyperus iria* |
| Fuzzy Flatsedge | *Cyperus pilosus* |
| Purple Nutsedge | *Cyperus rotundus* |
| Fortune's Net-veined Holly Fern | *Cyrtomium fortunei* |
| Kleberg Bluestem | *Dichanthium annulatum* |
| Smooth Crabgrass | *Digitaria ischaemum* |
| Hairy Crabgrass | *Digitaria sanguinalis* |
| Dopatrium | *Dopatrium junceum* |
| Junglerice | *Echinochloa colona* |
| Barnyardgrass | *Echinochloa crus-galli* |
| Thorny Olive | *Elaeagnus pungens* |
| Autumn Olive | *Elaeagnus umbellata* |
| Elodea | *Elodea canadensis* |
| Centipedegrass | *Eremochloa ophiuroides* |

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| Reed Fescue | *Festuca arundinacea* |
| Groundivy | *Glechoma hederacea* |
| English Ivy | *Hedera helix* |
| West Indian Marshgrass | *Hymenachne amplexicaulis* |
| Moon Vine | *Ipomoea alba* |
| Mile-a-Minute Vine | *Ipomoea cairica* |
| Cypress Vine | *Ipomoea quamoclit* |
| Tie Vine | *Jacquemontia tamnifolia* |
| Japanese Lespedeza | *Kummerowia striata* |
| West India Camara | *Lantana camara* |
| Weeping Lantana | *Lantana montevidensis* |
| Shrubby Lespedeza | *Lespedeza bicolor* |
| Japanese Privet | *Ligustrum japonicum* |
| Glossy Privet | *Ligustrum lucdium* |
| Common Privet | *Ligustrum vulgare* |
| Indian Marshweed | *Limnophila indica* |
| Marshweed | *Limnophila x ludoviciana* |
| Asian Marshweed | *Limnophila sessiliflora* |
| Monkeygrass | *Liriope muscari* |
| Perennial Ryegrass | *Lolium perenne* |
| Japanese Honeysuckle | *Lonicera japonica* |
| Uruguay Seedbox | *Ludwigia hexapetala* |
| Peruvian Water Grass | *Luziola peruviana* |
| Catclaw Vine | *Macfadyena unguis-cati* |
| Big-foot Water Clover | *Marsilea macropoda* |
| Chinaberry | *Melia azedarach* |
| Parrotfeather | *Myriophyllum aquaticum* |
| Eurasian Watermilfoil (Spike Milfoil) | *Myriophyllum spicatum* |
| Brittle Naiad (Brittle Waternymph) | *Najas minor* |
| Nandina | *Nandina domestica* |
| Watercress | *Nasturtium officinale* |
| Sacred Lotus | *Nelumbo nucifera* |
| White Egyptian Lotus | *Nymphaea lotus* |
| Sacred Lotus | *Nelumbo nucifera* |
| Crested Floating Hearts | *Nymphoides cristata* |
| Duck Lettuce | *Ottelia alismoides* |
| Cuban Bulrush | *Oxycaryum cubense* |
| Stinkvine | *Paederia foetida* |
| Dallis Grass | *Paspalum dilatatum* |
| Common Bahia Grass | *Paspalum notatum* |

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| Beefsteak Plant | *Perilla frutescens* |
| Timothy Grass | *Phleum pratense* |
| Golden Bamboo | *Phyllostachys aurea* |
| Water Lettuce | *Pistia stratiotes* |
| Japanese Knotweed | *Polygonum cuspidatum* |
| Curly Pondweed | *Potamogeton crispus* |
| Spider Brake Fern | *Pteris multifida* |
| Bradford Pear | *Pyrus calleryana* |
| Sawtooth Oak | *Quercus acutissima* |
| Castor-Bean | *Ricinus communis* |
| Multiflora Rose | *Rosa multiflora* |
| Indian Toothcup | *Rotala indica* |
| Itch Grass | *Rottboellia cochinchinensis* |
| Britton's Wild Petunia | *Ruellia brittoniana* |
| Curly Dock | *Rumex crispus* |
| Indian Cupscale | *Sacciolepis indica* |
| Guyana Arrowhead | *Sagittaria guyanensis* |
| Brazilian Rattlebox | *Sesbania punicea* |
| Thin-Spike Bristle Grass | *Setaria pumila* ssp. *pallidefusca* |
| Jerusalem Cherry | *Solanum pseudocapsicum* |
| Tropical Soda Apple | *Solanum viarum* |
| Johnson Grass | *Sorghum halepense* |
| African Salt Cedar | *Tamarix africana* |
| Canary Island Salt Cedar | *Tamarix canariensis* |
| French Tamarisk | *Tamarix gallica* |
| Salt Cedar | *Tamarix ramosissima* |
| Mariana Maiden Fern | *Thelypteris torresiana* |
| Guinea Grass | *Urochloa maxima* |
| Para Grass | *Urochloa mutica* |
| Brazilian Vervain | *Verbena brasiliensis* |
| Vetch | *Vicia villosa* |
| Chinese Wisteria | *Wisteria sinensis* |
| Japanese Hawksbeard | *Youngia japonica* |
| **TIER III** | |
| Chinese Mystery Snail | *Cipangopaludina chinensis* |
| Japanese Mystery Snail | *Cipangopaludina japonica* |
| Spotted Jellyfish | *Phyllorhiza punctata* |
| Red-Rim Melania | *Melanoides tuberculata* |
| Blue Land Crab | *Cardisoma guanhumi* |
| Exotic *Pheidole* | *Pheidole sp.* |

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| Spotted Wing Drosophila | *Drosophila suzukii* |
| Mexican Rice Borer | *Eoreuma loftini* |
| Red-streaked Leafhopper | *Balclutha rubrostriata* |
| Red-bay Ambrosia Beetle | *Xyleborus glabratus* |
| Caribbean Huntsman Spider | *Heteropoda venatoria* |
| Southeast Asian Cellar Spider | *Crossopriza lyoni* |
| Pantropical Jumping Spider | *Plexippus paykulli* |
| Oscar | *Astronotus ocellatus* |
| Goldfish | *Carassius auratus* |
| Convict Cichlid | *Archocentrus nigrofasciatus* |
| Red-bellied Pacu | *Piaractus brachypomus* |
| Tessellated Blenny | *Hypsoblennius invemar* |
| Suckermouth Catfish | *Hypostomus sp.* |
| Paradisefish | *Macropodus opercularis* |
| Oriental Weatherfish | *Misgurnus anguillicaudatus* |
| Tilapia | *Oreochromis* sp., *Sarotherodon* sp., *Tilapia* sp. |
| Rudd | *Scardinius erythrophthalmus* |
| Green Swordtail | *Xiphophorus hellerii* |
| Southern Platyfish | *Xiphophorus maculatus* |
| Mediterranean Gecko | *Hemidactylus turcicus* |
| Flowerpot Snake | *Ramphotyphlops braminus* |
| Canada Goose (Feral only) | *Branta canadensis* |
| Mute Swan | *Cygnus olor* |
| Monk Parakeet | *Myiopsitta monachus* |
| Brazilian Water-hyssop | *Bacopa egensis* |
| Blyxa | *Blyxa aubertii* |
| Ethiopian Rattlebox | *Crotalaria brevidens* var. *intermedia* |
| Lanceleaf Rattlebox | *Crotalaria lanceolata* |
| Rattleweed | *Crotalaria retusa* |
| Showy Rattle | *Crotalaria spectabilis* |
| Eucalyptus | *Eucalyptus* spp. |
| Asian Spiderwort | *Murdannia keisak* |
| Crownvetch | *Securigera varia* |
| **Tier IV** | |
| Freshwater Jellyfish | *Craspedacusta sowerbyi* |
| Brown (Mexihalo) Mussel | *Perna perna* |
| (Asian) Green Mussel | *Perna viridis* |
| Pacific Oyster | *Crassostrea gigas* |
| Asian Oyster | *Crassostrea ariakensis* |
| Giant African Land Snails | *Achatina* sp., *Archachtina* sp., *Limicolaria* sp. |

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| Chinese Mitten Crab | *Eriocheir sinensis* |
| Green Crab | *Carcinus maenas* |
| Rusty Crawfish | *Orconectes rusticus* |
| Virile Crawfish | *Orconectes virilis* |
| Papershell Crawfish | *Orconectes immunis* |
| Emerald Ash Borer | *Agrilus planipennis* |
| Asian Longhorn Beetle | *Anoplophora glabripennis* |
| Africanized Honeybee | *Apis mellifera scutellata* |
| Gypsy Moth | *Lymantria dispar* |
| Purple Loosestrife | *Lythrum salicaria* |
| Snakehead family | *Channidae* |
| Walking Catfish family | *Clariidae* |
| Freshwater Electric Eel | *Electrophorus* spp. |
| Asian Swamp Eel family | *Synbranchidae* |
| Pencil Catfish family | *Trichomycteridae* |
| Tench | *Tinca tinca* |
| Cuban Treefrog | *Osteopilus septentrionalis* |
| Argentine Giant Tegu | *Salvator merianae* |
| Boa Constrictor | *Boa constrictor* |
| Burmese Python | *Python molurus* |
| Pythons | *Python* sp. |
| Brown Tree Snake | *Boiga irregularis* |
| Australian Pine | *Casuarina spp.* |
| "Cylindro" Blue Green Algae | *Cylindrospermopsis raciborskii* |
| Rooting Water Hyacinth | *Eichhornia azurea* |
| Indian Swampweed | *Hygrophila polysperma* |
| Water Spinach | *Ipomoea aquatica* |
| African Elodea | *Lagarosiphon major* & *L. muscoides* |
| Old World Climbing Fern | *Lygodium microphyllum* |
| Water Clovers | *Marsilea minuta* & *M. mutica* |
| Punktree | *Melaleuca quinquenervia* |
| False Pickerelweeds | *Monochoria hastata* & *M. vaginalis* |
| Marine Naiad | *Najas marina* |
| Little Floating Hearts | *Nymphoides indica* |
| Yellow Floating Heart | *Nymphoides peltata* |
| Roundleaf Toothcup | *Rotala rotundifolia* |
| Brazilian Peppertree | *Schinus terebinthifolius* |
| Aquatic Soda Apple | *Solanum tampicense* |
| Water Chestnut | *Trapa natans* |

## D. General Invasive Species Management Actions

The following management actions apply to many or all invasive species. Implementation of these actions will benefit multiple natural communities and SGCN. This list represents actions that were identified by the Louisiana Department of Wildlife and Fisheries (LDWF) WAP revision invasive species committee during the 2015 WAP revision, and should not be considered exhaustive. Given the extreme threat posed by invasives to SGCN, any and all opportunities for control and removal should be seized.

- Establish and maintain an occurrence database for emerging invasives, including rigorous documentation of newly discovered populations of such species.
- Document current range extent and ongoing expansion of invasives to allow for more effective management at the landscape level.
- Promote education about identification and impact of invasive plant and animal species on natural communities and methods for control or eradication.
- Promote the utilization of federal cost share programs (e.g., Natural Resource Conservation Service (NRCS) Farm Bill programs) to address invasive species problems.
- Encourage landowners to control invasive species whenever possible to benefit SGCN and natural communities.
- Control invasive species (Nutria, Feral Hogs, etc.) as appropriate, particularly when the species is documented to have specific negative impacts on SGCN or natural communities.
- Pursue the creation, implementation, and enforcement of regulations prohibiting the commercial sale of invasive exotic plants and animals that are not currently covered by existing regulations, in conjunction with increasing awareness about such species that are commonly used as ornamentals and promoting the use of native species for landscaping.
- Educate the public on preventative measures to curb the spread of invasive plants; Examples include cleaning protocols for equipment, vehicles, and clothing, mowing and/or hand removing invasive plants before seed production, targeting invasive plants along roadsides to prevent spread, and providing wash stations at trail heads, boat launches, and parking lots in parks and recreation areas.
- Conduct research into temperature and salinity tolerance of Tier I invasive aquatic plants to ensure the application of Best Management Practices for control following storm or freeze events.
- Work with partners, including Plant Conservation Alliance, NRCS and the Louisiana Department of Transportation and Development (DOTD), to develop native-based seed mixes to replace existing seed mixes that contain exotics.

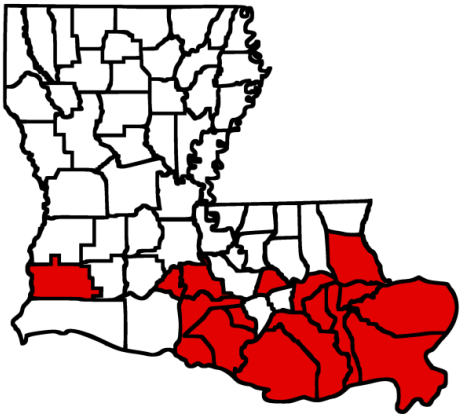
## E. Tier I Species Accounts

This section presents species accounts for each of the Tier I invasive species. These accounts include the following information:

- General information about the species
- Distribution in Louisiana
- Communities/SGCN Impacted
- Research Needs and Management Actions

**1. Apple Snail *(Pomacea canaliculata* and *Pomacea maculata):*** Apple Snails were first reported in the state in Gretna, LA in 2006, and have since spread throughout southeast Louisiana. *Pomacea* species attain much larger sizes than native snails, and can out-compete native species for resources, as well as cause habitat degradation by consuming large quantities of aquatic vegetation. Apple Snails have high fecundity and excellent dispersal capabilities, which further enhance their ability to outcompete native aquatic species. These snails may be introduced either accidentally or intentionally from aquaria, including via the improper disposal of aquatic plants infested with eggs or juvenile snails. Apple Snails serve as hosts for the Rat Lung Worm *(Angiostrongylus cantonensis)* which has been shown to infect humans and other mammals. Louisiana regulations prohibit the possession of live Apple Snails.

**Distribution:** Primarily southeast Louisiana, but expanding.



**Communities/Species Impacted:**

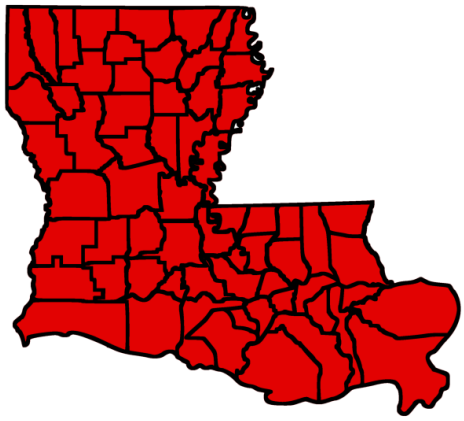
All freshwater aquatic systems throughout the state are potentially vulnerable to invasion by Apple Snails. Although exact impacts remain unknown, all native aquatic species are potentially at risk.

**Research Needs & Management Actions:**

- Quantify impacts to native aquatic species and communities due to competition or herbivory, including identifying which plant species Apple Snails consume.
- Investigate parasite prevalence in Apple Snails and transference to native species to determine potential detrimental impacts.
- Investigate salinity and temperature tolerances to determine potential limiting factors for Apple Snails.
- Develop effective trapping techniques to improve control.
- Engage local stakeholders in documentation of Apple Snail occurrence and active control of egg masses.
- Develop integrated pest control recommendations for Apple Snails, especially for smaller isolated water bodies where infestations can potentially be contained.

**2. Argentine Ant (*Linepithema humile*):** Introduced to the U.S. through the Port of New Orleans in the late 1800's, this species now occurs throughout the southern U.S. and areas of the arid west where there is irrigation. Although the species does not sting, like the more recognizable Red Imported Fire Ant, the Argentine Ant overwhelms by sheer number – "supercolonies" may contain millions of workers and thousands of queens. Elimination of colonies is therefore highly unlikely. In most studies, the species' distribution appears tightly linked to presence of available surface water.

**Distribution:** Statewide, primarily near water bodies. The shoreline of Toledo Bend Reservoir is densely infested.



**Communities/Species Impacted:**

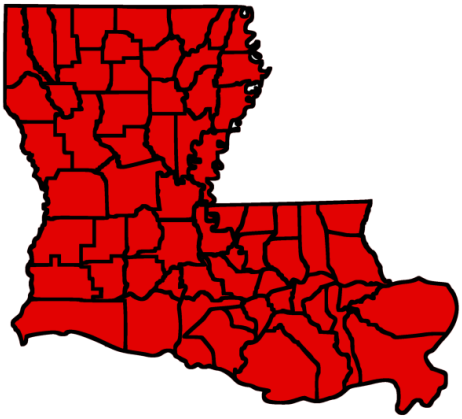
All terrestrial communities, with the greatest likelihood of occurrence in open, disturbed habitats near water. Terrestrial vertebrate and invertebrate species are at greatest risk, particularly those found near water, including species that occur in riparian zones.

**Research Needs & Management Actions:**

- Quantify impacts to ecosystem function and native wildlife, particularly nesting birds and reptiles.
- Determine current range, habitat utilization, and microhabitat requirements.
- Prioritize control efforts to target areas of highest density or areas of greatest potential impact to native species.
- Decrease likelihood of spread to un-infested areas by educating private landowners on basic identification and control measures.

**3. Red Imported Fire Ant (*Solenopsis invicta*):** The Red Imported Fire Ant is an invasive, exotic, pestiferous species that occurs throughout most of the southeastern U.S. This species out-competes native ants, causes significant reductions in other ground-dwelling arthropods, attacks and kills eggs and hatchlings of birds and reptiles, and causes shifts in entire communities. Impacts from the Red Imported Fire Ant, a disturbance dependent species, can be difficult to disentangle from effects of the disturbance itself, but the polygynous, or multi-queen form of this species, is altering ecosystems.

**Distribution:** Statewide.



**Communities/Species Impacted:**

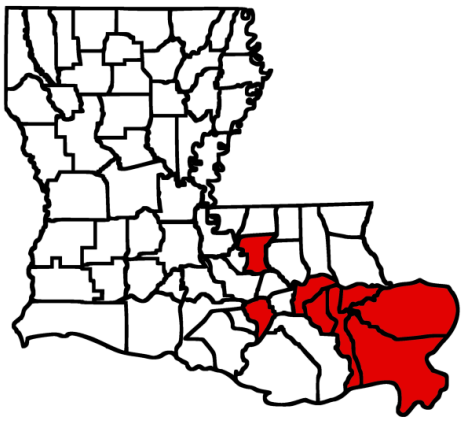
All terrestrial communities, including Barrier Islands, are impacted. The greatest likelihood of occurrence is in open, disturbed habitats near water, grasslands and open pine systems; rarely found in areas with dense canopy cover. Terrestrial vertebrates (including ground nesting birds and turtles) and invertebrate species.

**Research Needs & Management Actions:**

- Quantify impacts of monogyne (single queen) and polygyne (multi-queen) forms on native wildlife and ecosystem function.
- Examine efficacy of broad scale pesticide treatments on suppression or elimination of Red Imported Fire Ants on Barrier Islands or other colonial nesting waterbird sites and important Mottled Duck nest sites such as islands at Atchafalaya Delta WMA.
- Be cognizant of possible negative impacts to non-target species of ants when utilizing pesticides for management; fire ants may recolonize at greater rates and higher densities than the native species.

**4. Rio Grande Cichlid *(Herichthys cyanoguttatus):*** The Rio Grande Cichlid is native to south Texas and Mexico, but has spread through the aquarium trade to other parts of the U.S. This species is very similar to native sunfishes in habitat and prey preferences, but has been shown to be more aggressive. In its native range, it does co-exist with sunfish. Characteristics of community structure and composition within the native range may give insight into the interactions we can expect in Louisiana fish communities. Rio Grande Cichlids may impact native species by competing for nesting habitats or prey, as well as by direct predation on smaller native fishes and juveniles of larger species.

**Distribution:** The first reports of Rio Grande Cichlids in Louisiana were from City Park in New Orleans. Since then, specimens have been found in Bayou St. John, and other connecting water ways. An isolated population was reported in 2013 from Destrehan in St. Charles parish.



**Communities/Species Impacted:**

Native fish species are at greatest risk. All freshwater aquatic habitats in the southern half of the state are potentially at risk for invasion.

**Research Needs & Management Actions:**

- Quantify impacts to native aquatic species, including interactions with native fishes.
- Determine salinity and temperature tolerances of this species to determine the extent of potential range expansion, as well as movement during periods of cold weather.
- Develop effective trapping techniques for passive control of this species.
- Develop integrated pest management strategies for this species, especially in smaller isolated water bodies where elimination could be possible.

**5. Carp:** Five species of non-native carp are currently found in Louisiana, having been established through both deliberate and accidental releases. Four species, including Grass Carp, Silver Carp, Bighead Carp and Black Carp are collectively known as Asian Carp. Neither water temperature nor salinity gradients have thus far proved to be effective barriers to non-native carp, leaving the majority of Louisiana waters subject to invasion, with exceptions possibly due to water chemistry.

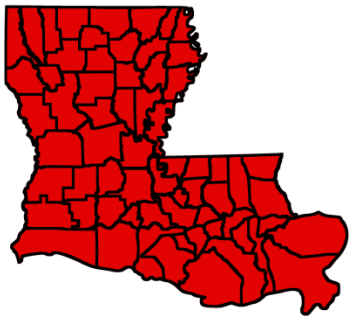
**a. Common Carp (*Cyprinus carpio*):** Common Carp were introduced from Europe into the U.S. in the late 1800s. Deliberate releases as a food fish and accidental releases from fish farms have aided in this species becoming so widespread that it is often mistaken as a native. Koi are a variety of Common Carp sometimes kept as ornamental fish in water gardens. Common Carp are omnivores that consume both phytoplankton and zooplankton which may include fish eggs and larvae. Common Carp increase turbidity by disturbing rooted vegetation while searching for food.

**b. Grass Carp (*Ctenopharyngodon idella*):** In 1963, Grass Carp (also called White Amur) were introduced into aquaculture facilities in Alabama and Arkansas to control vegetation. They escaped from the aquaculture ponds and since then have legally and illegally been introduced to many water bodies. Arkansas and Mississippi presently have no restrictions on the stocking and possession of Grass Carp, whereas Louisiana allows triploid Grass Carp to be stocked with a permit. Grass Carp can have a serious effect on aquatic ecosystems by decreasing aquatic vegetation; although used to control targeted aquatic weeds, this species is a generalist herbivore. Removal of submersed aquatic vegetation can change the phytoplankton community composition which could alter the food web of the water body.

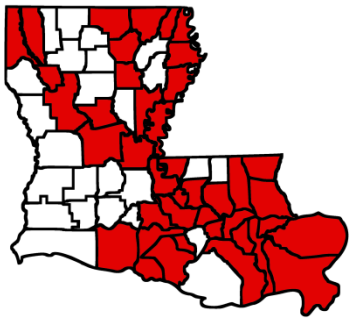
**c. Black Carp (*Mylopharyngodon piceus*):** This species is native to China and parts of eastern Russia. It consumes mollusks as well as crustaceans and insects. The first U.S. introduction was via a shipment of Grass Carp in the early 1970s. Black Carp was introduced to aquaculture facilities as a biological control agent for snails in the 1980s. The only known release of this carp to native waters occurred in 1994 when an aquaculture facility near the Missouri River was flooded, resulting in escape of Black Carp. At this time it is not known if Black Carp have established reproducing populations.

**d. Silver Carp (*Hypophthalmichthys molitrix*) and Bighead Carp (*Hypophthalmichthys nobilis*):** Silver Carp and Bighead Carp were first introduced into the U.S. for phytoplankton control and to improve water quality in aquaculture ponds around 1973. By the 1980s, both species were found in natural water bodies. These species are primarily planktivorous but are also detritivores.

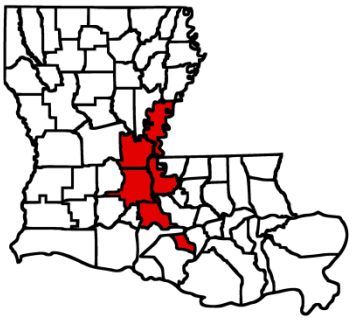
**Distribution:**



Common/Grass Carp



Silver/Bighead Carp



Black Carp

**Communities/Species Impacted:**

Many native aquatic species may be negatively impacted by Common and Grass Carp, through direct competition for resources or habitat degradation. Silver and Bighead Carp may cause negative impacts to native filter-feeding planktivores, such as Paddlefish and native mussels. Black Carp may consume native aquatic crustaceans and mollusks, including SGCN. Additionally, these species may harbor parasites and diseases that could spread to native fishes, including SGCN.

**Research Needs and Management Actions:**

- Determine salinity tolerances of all species of non-native carp.
- Increase accuracy of triploid confirmation for Grass Carp and Black Carp used as bio-control agents in aquaculture facilities.
- Conduct research into the necessary conditions for reproduction, including flow rate and water chemistry.
- Investigate community impacts of non-native carp on native species.
- Develop passive trapping methods to aid in reduction of numbers, possibly by using the jumping behavior of some species to assist in low by-catch trapping or by targeting areas of dense concentrations.
- Conduct research into the parasites and diseases carried by non-native carp and the potential impacts on native species.

**6. Lionfish (*Pterois volitans and P. miles*):** Lionfish are predatory marine fish native to the Pacific Ocean that became established in the Atlantic Ocean through aquarium releases, either accidentally or due to hurricane damage to the Miami Aquarium. These species are associated with reefs and other hard substrates. Lionfish are ambush predators that consume large quantities of prey and may alter reef fish communities by limiting prey availability or via direct predation. Juveniles have been documented offshore in Louisiana, indicating that some level of reproduction is occurring in the Gulf of Mexico. Currently this species has not been shown to occur in nearshore habitats, although there was an unconfirmed report of a Lionfish captured by a shrimp trawler in Terrebonne Bay in 2013.

**Distribution:** Throughout the Gulf of Mexico, usually associated with hard structures such as oil rigs, wrecks, reefs and rock outcroppings.

**Communities/Species Impacted:**

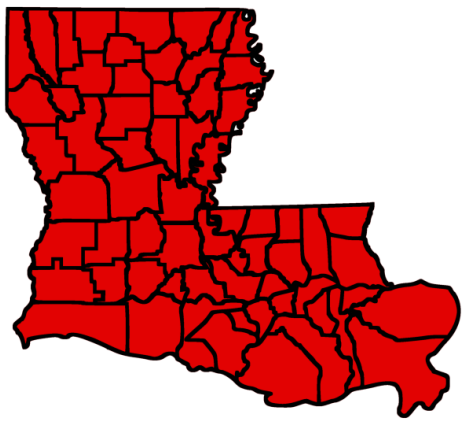
Native marine species associated with hard structure, including SGCN.

**Research Needs & Management Actions:**

- Quantify the direct and indirect impacts to reef fish communities through resource competition or direct predation of reef fish, as well as the potential for native-species to exert top-down control of Lionfish.
- Determine salinity, turbidity and temperature tolerances of Lionfish to determine invasion potential for near-shore habitats.
- Conduct inshore surveys, especially along jetties and reefs, as well as research into nesting, migration patterns, and distribution.
- Develop cost-effective control and removal techniques.
- Promote awareness of the invasive nature of these species, as well as the potential invasive qualities of other closely related species.

**7. European Starling (*Sturnus vulgaris*):** This highly pestiferous species was successfully introduced into the U.S. via New York in the early 1890's. Since that introduction, the species has spread across the country. Although potentially beneficial in some agricultural settings (e.g., removal of insect pests), this species forms extremely large roosts (i.e. millions of individuals in some winter roosts) that cause substantial economic burdens and potential environmental impacts. The degree of impact on native birds has been shown to vary, but negative impacts (e.g., nest usurping) have been documented for multiple native species, particularly cavity nesters.

**Distribution:** Statewide, particularly near agricultural or urban areas; less commonly encountered in heavily forested regions.



**Communities/Species Impacted:**

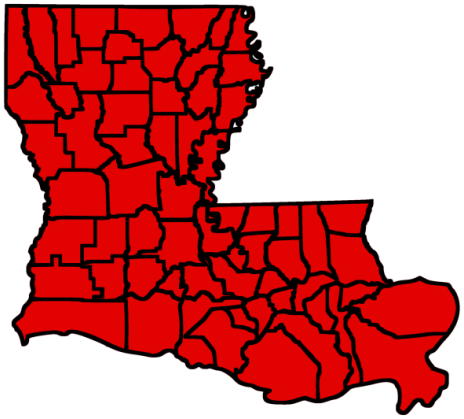
Terrestrial communities, particularly near agricultural and urban areas. Unlikely to be a major threat to any undisturbed, natural community. Cavity-nesting birds, such as woodpeckers (including Red-headed Woodpecker), and secondary cavity-nesting birds, such as Eastern Bluebird and Purple Martin, are most likely to be negatively affected.

**Research Needs & Management Actions:**

- Quantify impacts to ecosystem function and native wildlife, particularly cavity-nesting birds.
- Prioritize control efforts to target areas of highest density or areas of greatest potential impact to native species.

**8. House Sparrow (*Passer domesticus*):** Found on six continents, the house sparrow may be the most successful of all invasive bird species. The species was introduced to the U.S. via New York in the mid-1800's and rapidly spread, with multiple introductions, to the west coast by the early 1900's. Within 40 years of its introduction, government agencies were already attempting eradication. House Sparrows are particularly aggressive during nesting and usurp cavity nest sites from native birds, occasionally killing the native birds in the process. Successful eradication is not likely given the species' current geographic extent and abundance.

**Distribution:** Statewide, particularly near agricultural or urban areas; rarely encountered in heavily forested regions.



**Communities/Species Impacted:**

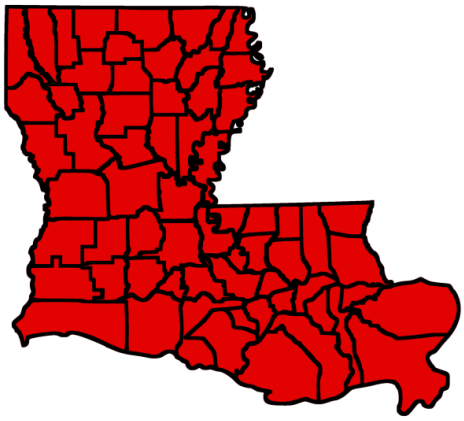
Terrestrial communities, particularly near agricultural and urban areas. Highly unlikely to be major threat to any undisturbed, natural community. Cavity-nesting birds, such as woodpeckers (including Red-headed Woodpecker), and secondary cavity-nesting birds, such as Eastern Bluebird and Purple Martin, are most likely to be affected by House Sparrows.

**Research Needs & Management Actions:**

- Quantify impacts to ecosystem function and native wildlife, particularly cavity-nesting birds.
- Prioritize control efforts to target areas of highest density or areas of greatest potential impact to native species.

**9. Norway Rat (*Rattus norvegicus*) and Black Rat (*Rattus rattus)*:** Originating in Asia, but now cosmopolitan, both of these invasive rodents damage crops, destroy or despoil great quantities of foods and stored grains, harbor diseases to which man is susceptible (Lowery 1974) and have negative impacts on native wildlife. Both species are omnivorous and have been documented to kill fish, young rabbits, mice, birds and other animals (Burger 1999). Island ecosystems are especially susceptible to disturbance by rats. Rats are also common disease and parasite vectors, including diseases that may impact native species and humans, such as typhus and bubonic plague (Chapman and Feldhamer 1982). Both of these species have high reproductive potential, with breeding occurring year round. Females are capable of producing up to 7 litters per year (Jackson 1982), with up to 12 young per litter.

**Distribution:** Statewide.



**Communities/Species Impacted:**

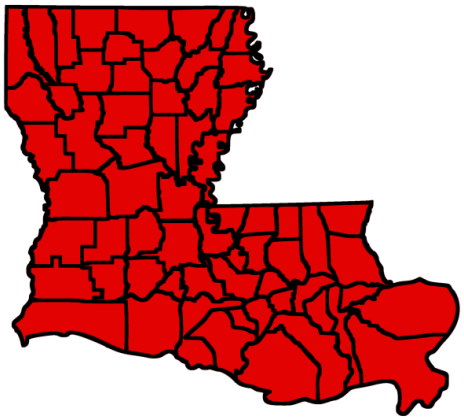
Barrier Islands are especially vulnerable to invasion by these species. Invertebrates, reptiles, amphibians, mammals and ground nesting birds, including colonial waterbirds, are most at risk of direct predation.

**Research Needs & Management Actions:**

- Quantify impacts of both species on native wildlife, particularly on Barrier Islands.
- Conduct research to determine the role these species play as disease vectors for native species.
- Investigate novel control methods to reduce the negative impacts of these species.
- Conduct trapping or other control methods to eliminate invasive rats from Barrier Islands where they are reducing productivity of SGCN, especially waterbirds.

**10. Nutria (*Myocastor coypus*):** Nutria are large herbivorous aquatic rodents brought to Louisiana from Argentina in the early 20th century for fur farming. Some animals were deliberately released into Louisiana marshes, and in other cases animals escaped confinement (Bernard 2002). Whether intentionally released or escaped, nutria are now established throughout the state. Nutria typically feed on the roots of semiaquatic and aquatic vegetation (Jones and Leopold 2001). This leads to a loss of vegetative cover, which in turn leaves the denuded substrate subject to erosion. The end result of this process is the conversion of marsh to open water.

**Distribution:** Statewide in fresh, brackish, and saltwater.



**Communities/Species Impacted:**

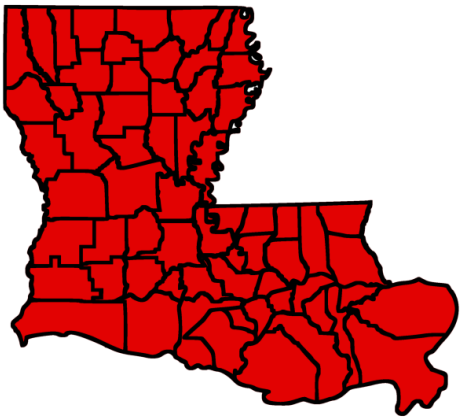
Aquatic communities, particularly Fresh, Intermediate, Brackish, and Salt Marsh, via herbivory, accelerated land loss, and direct destruction through burrow construction. Potentially all native species, including SGCN, that depend on marsh. Recent observations on a Louisiana Barrier Island implicate nutria as a nest predator (Furfey, personal communication).

**Research Needs & Management Actions:**

- Determine the role of Nutria as predators in colonies of beach-nesting birds.
- Continue to support the Coastwide Nutria Control Program.

**11. Feral/Domestic Cats (*Felis catus*):** Free-ranging, outdoor cats may be the number one anthropogenic-related cause of wildlife mortality in the U.S. Meta-analysis of several cat predation studies suggests that cats may kill more than 2.4 billion birds, more than 12 billion mammals, and more than 700 million reptiles and amphibians annually (Loss *et al.* 2013). Cats also spread infectious diseases and parasites such as rabies, toxoplasmosis and hookworms to native wildlife and humans. Few invasive species have been as thoroughly proven by science to cause significant impacts to native species, yet largely ignored.

**Distribution:** Statewide, typically with greater concentrations near urban centers.



**Communities/Species Impacted:**

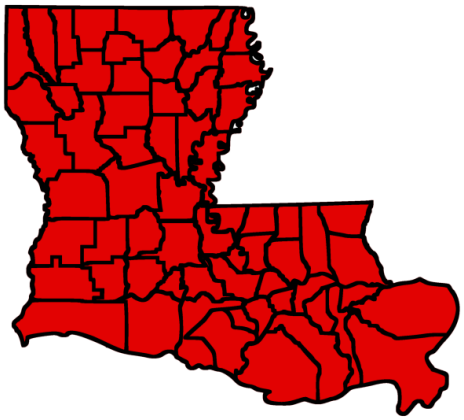
All terrestrial communities, including Barrier Islands. Terrestrial and, rarely, aquatic vertebrate and invertebrate species may be affected. Most prey targeted is <3.5 ounces, but items >1 pound may be taken.

**Research Needs & Management Actions:**

- Quantify impacts to migratory birds and terrestrial wildlife by outdoor cats, particularly at migrant stopover sites.
- Promote American Bird Conservancy's Cats Indoors® program.
- Educate public on human health impacts created by outdoor cats (e.g., rabies, toxoplasmosis, etc.).
- Provide education on why Trap, Neuter, and Release programs are not effective.
- Ensure laws and statutes regarding free-ranging cats are upheld and enforced.
- Promote humane removal from Barrier Islands and other migrant stopover sites.

**12. Feral Hogs (*Sus scrofa):*** Feral hogs, which are also commonly referred to as feral swine, wild hogs, wild boar, and Russian boar, are defined as swine or their offspring which have spent any portion of their life outside of confinement. Feral hogs are omnivores and commonly reach weights exceeding 250 lbs. This species reaches sexual maturity between six and eight months of age and is capable of producing two litters of piglets per year. The average litter size is six piglets, but litters of up to 20 piglets have been observed. Adult boars may lead somewhat solitary lives except when pursuing sows to breed. The sows and piglets typically travel in groups known as "sounders". These sounders may contain as many as 40 hogs. The overall population of feral hogs in Louisiana is unknown but surveys indicate that deer hunters alone harvest over 150,000 annually, with no reduction in visible hog damage on the landscape. These animals compete directly with native wildlife for mast crops, consume untold numbers of reptiles, amphibians and invertebrates, and prey opportunistically on deer fawns as well as eggs of ground-nesting birds and reptiles. Additionally, Feral Hogs uproot tree seedlings, consume native plants, initiate erosion problems, and contaminate waterways with coliform bacteria. They harbor a multitude of diseases contagious to other wildlife and humans such as swine brucellosis, pseudorabies, leptospirosis, salmonellosis and *Escherichia coli*.

**Distribution:** Statewide.



**Communities/Species Impacted:**

All communities are at risk, including marshes of all types, prairies, bogs, forested wetlands, and Barrier Islands. Terrestrial mammals, ground-nesting birds, reptiles, amphibians, and invertebrates may be affected. Additionally, native plants are consumed and otherwise destroyed. Watershed ecology may be significantly impacted.

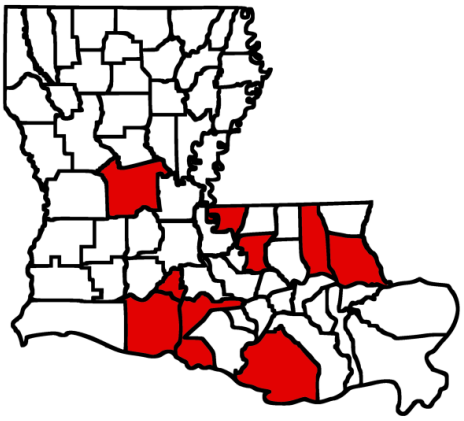
**Research Needs & Management Actions:**

- Research is needed on swine-specific toxicants and immunocontraceptives.
- Educate the public on disease transmission, zoonotic diseases, and the detriments of intentional translocation of this species.

- Promote control through hunting, trapping, and snaring.

**13. Coral Ardisia (*Ardisia crenata*):** Coral Ardisia is an evergreen shrub native to East Asia that has become naturalized in Florida, Georgia, Louisiana and Texas. It was introduced into the U.S. as an ornamental and is still used in landscaping. The presence of Coral Ardisia can significantly decrease native plant species richness, as densities may reach more than 100 plants/$m^2$ in infested areas (Langeland and Burks 2007). Such densities are partially due to the poor dispersal typical of this species, as well as high germination rates, which lead to dense stands in the vicinity of parent plants. This species is typically found in areas with moist rich soils and is tolerant of deep shade.

**Distribution:** Scattered throughout central and southern Louisiana. The true distribution is doubtless under reported.



Distribution from Thomas and Allen (1998) and field observations

**Communities/Species Impacted:**

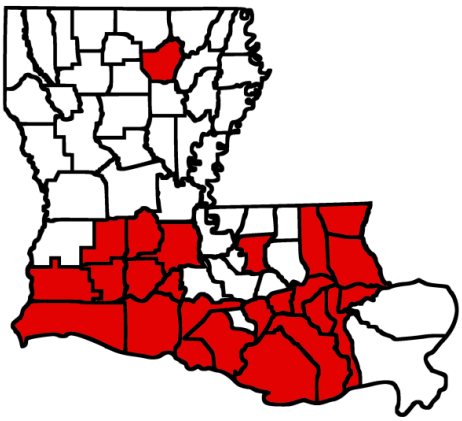
Bottomland Hardwood Forest, Mixed Hardwood-Loblolly Pine Forest, Salt Dome Hardwood Forest, Small Stream Forest, Southern Mesophytic Forest. Native plants may be negatively impacted, as well as any animal species that depend on those plant species.

**Research Needs & Management Actions:**

- Establish a Coral Ardisia occurrence database; rigorously document newly discovered populations.
- Conduct outreach to inform the public of the threat of Coral Ardisia and discourage its use in landscaping.
- Support control of Coral Ardisia; methods could include hand-pulling and/or herbicide application.

**14. Camphor Tree (*Cinnamomum camphora*):** Camphor Tree is a small to medium sized tree that can grow to about 50 feet tall. Crushed leaves emit a strong camphor odor, hence the common name. Camphor Tree is commonly seen in disturbed areas along roads and fence and hedge rows (Godfrey 1988). The fruits are consumed and spread by birds (Langeland et. al. 2008). In southern Louisiana, Camphor Tree can invade moist forests. It is especially problematic in Salt Dome Hardwood Forests on Cote Blanche and Weeks Islands, where it displaces native species. Despite its invasive nature, Camphor Tree is still available at nurseries and is planted in yards and urban areas.

**Distribution:** Moist rich soils mainly in the southern half of the state.



Distribution from Thomas and Allen (1998)

**Communities/Species Impacted:**

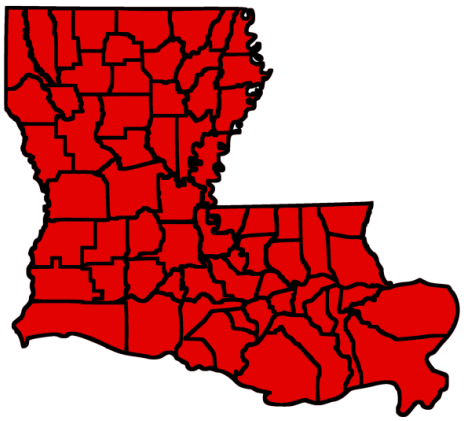
Natural communities impacted include: Bottomland Hardwood Forest, Live Oak Natural Levee Forest, and Salt Dome Hardwood Forest.

**Research Needs & Management Actions:**

- Support site-level control of this species.
- Document response and recovery of native species following control of Camphor Tree.
- Provide education regarding the invasive nature of this species, with the goal of eliminating use as an ornamental plant.

**15. Bermuda Grass (*Cynodon dactylon*):** Bermuda Grass is a sod-forming grass native to the tropics of Africa and Asia. It is a short grass that spreads vegetatively by both rhizomes and stolons ("runners"). Bermuda Grass is used as a forage grass for cattle and is often used for pastures and hay fields. Where it has not been intentionally introduced, Bermuda Grass is mostly encountered as a weed of disturbed areas. Bermuda Grass has some salt tolerance and is one of the only exotic species that competes well in Saline Prairies. This species can also be a weed of Calcareous Prairie and Coastal Prairie, and can dominate Sandbars.

**Distribution:** Statewide.



Distribution from Thomas and Allen (1993)

**Communities/Species Impacted:**

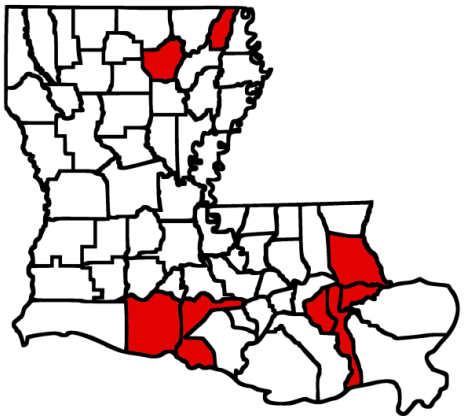
Calcareous Prairie, Coastal Prairie, Louisiana Beach, Saline Prairie, and Sandbars (can be dominant here). SGCN that utilize native grasslands, such as Northern Bobwhite, may be most impacted by Bermuda Grass.

**Research Needs & Management Actions:**

- Support control of local infestations in natural areas with either grass-selective or broad spectrum herbicides.
- Conduct research on the effectiveness of rest from grazing and prescribed fire on the persistence of Bermuda Grass.
- Discourage use of this species where native bunch grasses are a viable alternative.

**16. Air Yam (*Dioscorea bulbifera*):** Air Yam is an aggressive twining herbaceous vine native to either Asia or Africa, with morphological differences between plants from these continents. Air Yam found in the southeast U.S. is likely to be the African type. Plants die back to the ground line in winter, but dead vines serve as trellises for regrowth in the spring (Miller et al. 2010). In Florida, Air Yam is naturalized (Gucker 2009) and it extends across the Gulf States westward to Texas. This species is extremely fast growing, at a rate of roughly eight inches per day, and can climb up to 70 feet high. Air Yam spreads primarily through the profuse production of aerial tubers called bulbils (Langeland 2008). This fast reproduction via bulbils has already been documented in Louisiana. In a study of forest regeneration in Florida following Hurricane Andrew, Air Yam was found to impede regeneration of trees following canopy disturbance (Horvitz et al. 1998).

**Distribution:** Scattered, most frequent in southern Louisiana.



Distribution from USDA, NRCS (2013) and other reports

**Communities/Species Impacted:**

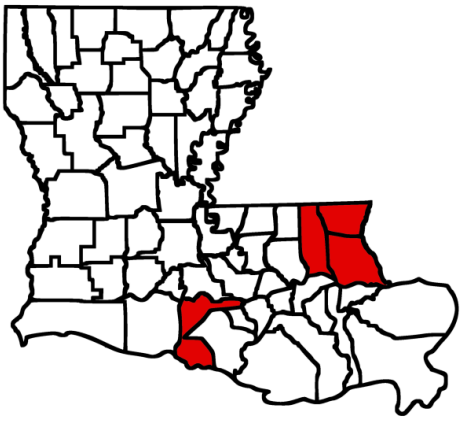
Barrier Island Live Oak Forest, Bottomland Hardwood Forest, Natural Levee Live Oak Forest, Salt Dome Hardwood Forest. SGCN that depend on the impacted natural communities, including Neotropical migrant birds which may be negatively impacted by decreased quality of stopover habitat associated with heavy infestations.

**Research Needs & Management Actions:**

- Conduct outreach to educate the public and land managers on the identification and negative impacts of this species, as well as on the options available for control.
- Support and organize efforts to control this species.

**17. Japanese Twin-Sorus Fern (*Deparia petersenii*):** Japanese Twin-Sorus Fern is currently a lesser known invasive, but is spreading in the southeastern U.S. This species is listed as an invasive in southern forests by Miller et al. (2010), but its impacts are apparently not known. Japanese Twin-Sorus Fern can be found growing among native ferns in rich woods, ravines, riparian forests, and wooded seeps (Nelson 2000). The distribution of this species in Louisiana is certainly under-reported.

**Distribution:** Eastern Florida Parishes, Weeks Island and possibly other salt domes.



Distribution based on specimens housed at LSU Herbarium

**Communities/Species Impacted:**

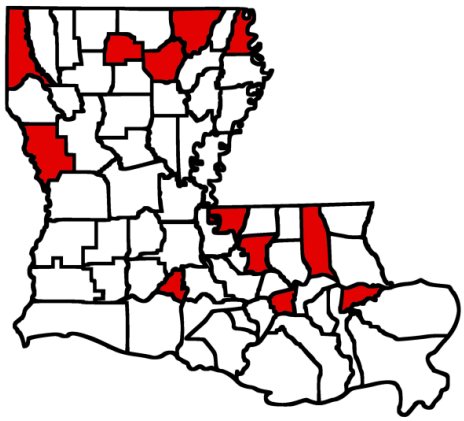
Bayhead Swamp, Hardwood Slope Forest, Salt Dome Hardwood Forest, Small Stream Forest, and Southern Mesophytic Hardwood Forest.

**Research Needs & Management Actions:**

- Conduct field surveys involving collection of voucher specimens to better determine distribution and abundance in Louisiana.
- Conduct research to determine the ecological impact of this fern on native species in Louisiana.

**18. Chinese Parasol Tree (*Firmiana simplex*):** This species is extremely fast growing, and in Louisiana has demonstrated the ability to aggressively invade mesic forests. Chinese Parasol Tree is self-fertile and produces large amounts of seed (Servis 2013). These characteristics, coupled with a fast growth rate, make it a serious threat. Chinese Parasol Tree is still sold in nurseries and planted in gardens and urban areas, increasing the likelihood of continued introductions. As with many exotic plants, this species has the potential to alter the composition of natural communities, degrading habitat quality.

**Distribution:** Widely scattered. Well established colonies exist in the Tunica Hills in West Feliciana parish.



Distribution from Thomas and Allen (1998)

**Communities/Species Impacted:**

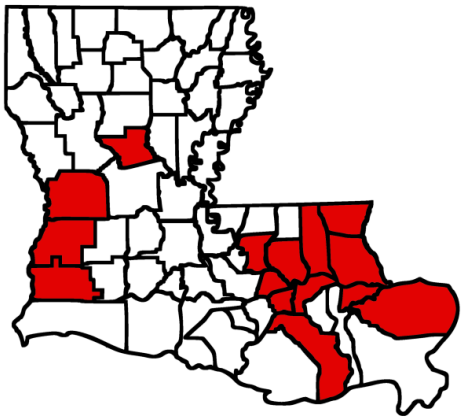
Hardwood Slope Forest, Mixed Hardwood-Loblolly Pine Forest, and Southern Mesophytic Hardwood Forest.

**Research Needs & Management Actions:**

- Produce and distribute educational materials to raise awareness of this lesser-known invasive.
- Pursue regulations prohibiting the commercial sale of this species.
- Conduct research into control methods and document habitat change following implementation of control.

**19. Cogon Grass (*Imperata cylindrica,* including *I. brasiliensis*):** Cogon Grass has been in the southeastern U.S. for about 100 years. It has been introduced several times, both accidentally in packaging material and intentionally as a potential forage grass. This species is a coarse, robust grass with extensive rhizomes forming dense colonies. The foliage is not palatable to grazing animals and fire is beneficial to this plant. These attributes make Cogon Grass a formidable weed. Cogon Grass ranges from one foot to several feet in height. The midrib of the leaf blade is noticeably off-centered and the leaf blade margins have a scratchy texture. Cogon Grass flowers in the spring, producing a white silky contracted panicle that is exerted above the foliage.

**Distribution:** Mainly Florida Parishes and between Baton Rouge and New Orleans, but with several reports west of the Mississippi River.



Distribution from Kartesz 2014

**Communities/Species Impacted:**

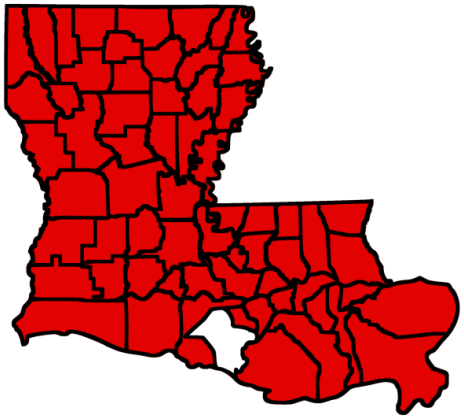
Eastern and Western Longleaf Pine Flatwoods Savannas, Eastern and Western Upland Longleaf Pine Woodlands, and Sandbars (particularly in the Florida Parishes). Many SGCN, including Gopher Tortoise and turtles nesting on Sandbars may be negatively impacted due to reductions in forage plants and suitable nesting sites, respectively, by heavy infestations of Cogon Grass.

**Research Needs & Management Actions:**

- Encourage diligent cleaning of highway mowing equipment after use.
- Conduct field surveys for timely detection of new occurrences, especially those outside the known range of Cogon Grass.
- Intensive control of existing occurrences.
- Target landowners and the public for education and outreach.
- Support additional research on the control of Cogon Grass, and research documenting habitat recovery where control efforts have been implemented.

**20. Chinese Privet (*Ligustrum sinense*):** Chinese Privet is one of the most problematic weeds in the southern U.S. Since its introduction in 1852, it has become naturalized throughout the southeast. Once introduced to an area, Chinese Privet can quickly out-compete native shrubs and trees, reduce ground layer species cover, and alter community structure. Chinese Privet prefers mesic soils, but will also grow on drier sites, and tolerates both heavy shade and direct sunlight. These characteristics allow Chinese Privet to invade a range of habitat types. Chinese Privet creates large seedbanks in infested areas (USDA, NRCS 2013) and also spreads through root suckers, making this species difficult to eradicate from an area.

**Distribution:** Statewide**.**



Distribution from Thomas and Allen (1998)

**Communities/Species Impacted:**

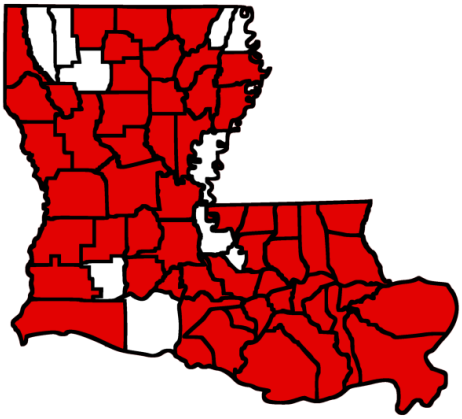
Bottomland Hardwood Forest, Coastal Prairie, Eastern and Western Upland Longleaf Pine Woodland, Hardwood Slope Forest, Mixed Hardwood-Loblolly Pine Forest, Small Stream Forest, and Southern Mesophytic Hardwood Forest.

**Research Needs & Management Actions:**

- Promote control measures such as mechanical removal, prescribed burning, and herbicide application, where appropriate.
- Synthesize and publish information pertaining to chemical control of Chinese Privet for use by land managers and owners.
- Provide education regarding the threats posed by this species and discourage its use as an ornamental.

**21. Japanese Climbing Fern (*Lygodium japonicum*):** Japanese Climbing Fern is a true fern that climbs by twining fronds. The frond (leaf) is the climbing structure, while the stem (rhizome) is present in the ground. The fronds of Japanese Climbing Fern are light green and, especially when fertile, appear "feathery". Reproduction is by spores and rhizomes. Japanese Climbing Fern is a very frequent, almost ubiquitous invasive, that climbs on trees and over understory shrubs and herbs, preventing sunlight from reaching native species. Additionally, the climbing fronds are ladder fuels, enabling fire to reach the forest canopy. While this species can invade relatively undisturbed forests, Japanese Climbing Fern is usually much more abundant in disturbed forest, along forest edges in utility corridors, and along roadsides.

**Distribution:** Essentially statewide.



Distribution from Thomas and Allen (1993)

**Communities/Species Impacted:**

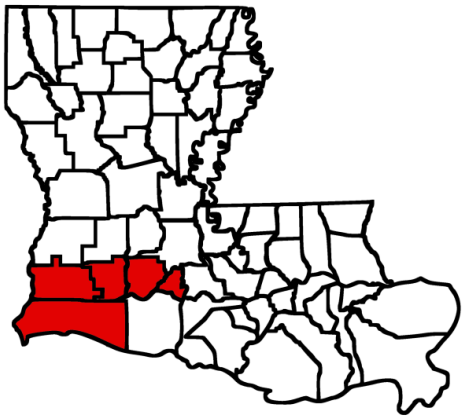
Bottomland Hardwood Forest, Hardwood Slope Forest, Mixed Hardwood-Loblolly Pine Forest, Salt Dome Hardwood Forest, Small Stream Forest, Southern Mesophytic Forest, Spruce Pine-Hardwood Flatwoods, Eastern and Western Upland Longleaf Pine Woodlands.

**Research Needs & Management Actions:**

- Synthesize and publish information pertaining to chemical and other methods and combinations of treatments to control Japanese Climbing Fern, for use by land managers and owners.

**22. Holmwood Grass (*Paspalum modestum*; synonym = *P. hydrophilum*):** Holmwood Grass is native to South America (Allen and Hall 2003). This species occupies a relatively small range in Louisiana, but is a significant threat where it does occur. Holmwood Grass may have been introduced in contaminated rice seed and is particularly well-established in the rice country of southwestern Louisiana. Holmwood Grass is problematic in Coastal Prairie remnants, where it can form dense stands in wet depressions.

**Distribution:** Restricted to the southwest corner of the state, corresponding to Louisiana's main rice-growing region.



Distribution from Allen et al. (2004)

**Communities/Species Impacted:**

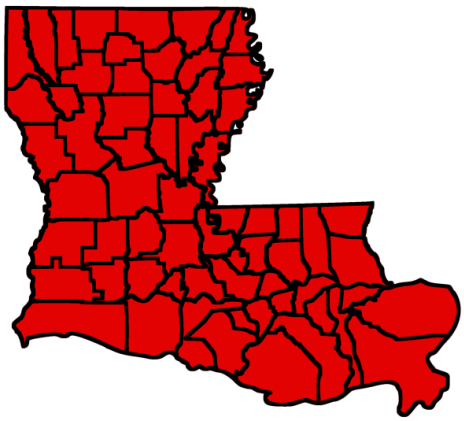
Coastal Prairie and Western Longleaf Pine Flatwoods Savanna.

**Research Needs & Management Actions:**

- Determine the effects of prescribed fire on this species.
- Identify herbicides and application times that are effective in controlling Holmwood Grass, while minimizing damage to desirable natives.

**23. Vasey Grass (*Paspalum urvillei*):** Vasey Grass is native to South America and is a frequent invader of disturbed areas in Louisiana. Vasey Grass thrives in open, moist to wet disturbed areas and is commonly seen on roadsides and in neglected agricultural fields where it can be problematic for land managers (Allen et. al. 2004). On grazed lands it is avoided by livestock due to its unpalatability, allowing it to freely proliferate on rangeland and pasture. Vasey Grass requires soil disturbance to gain a foothold, and will not often invade undisturbed high quality grasslands, with the possible exception of wetter prairies. However, as many remaining native grasslands are regularly disturbed, this species poses a threat to habitats that are valuable though slightly degraded.

**Distribution:** Statewide.



Distribution from Thomas and Allen (1993)

**Communities/Species Impacted:**

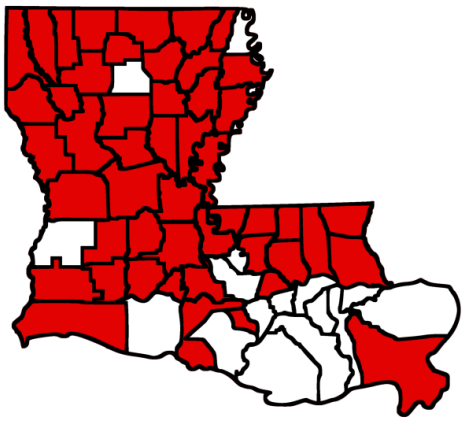
Calcareous Prairie, Coastal Prairie, Eastern and Western Longleaf Pine Flatwoods Savanna. Vasey Grass can also be found in disturbed areas throughout the state.

**Research Needs & Management Actions:**

- Conduct research to determine the effects of resting land from grazing combined with prescribed fire on the abundance and persistence of Vasey Grass.

**24. Trifoliate Orange (*Poncirus trifoliata*):** Trifoliate Orange is native to China, and was introduced as an ornamental and hedge plant. This species, a member of the citrus family, is also used as stock to graft commercial citrus, which may afford an additional opportunity for escape. Trifoliate Orange occurs in mesic forests where it can form extensive thickets, outcompeting native species. A notable trait of this shrub is the presence of large thorns.

**Distribution:** Nearly statewide.



Distribution from Thomas and Allen (1998)

**Communities/SGCN Impacted:**

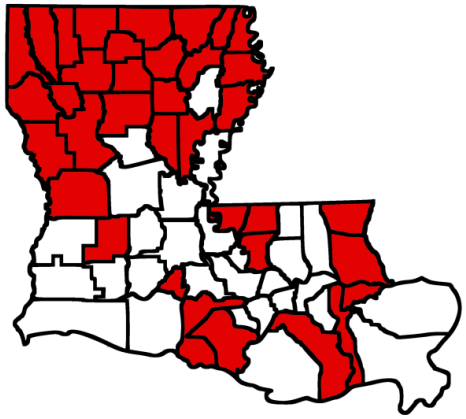
Bottomland Hardwood Forest, Hardwood Flatwoods, Hardwood Slope Forest, and Southern Mesophytic Forest.

**Research Needs & Management Actions:**

- Support chemical control of this species.
- Conduct research to document habitat recovery following control of Trifoliate Orange, especially where dense thickets were eliminated.

**25. Kudzu (*Pueraria montana*):** Kudzu is a fast growing deciduous legume that spreads by twining, blanketing large expanses if left uncontrolled. These monospecific expanses may suppress all other vegetation, leading to decreased structural and species diversity. Kudzu thrives in open disturbed areas and is typically seen on forest edges, abandoned fields, and roadsides (Munger 2002). Kudzu is susceptible to Asian Soybean Rust (Benedict 2009) and Tobacco Ringspot Virus (Khankhum et al. 2013) making it a potential conduit for the infection of valuable economic crops or native legumes important to wildlife. In a study by Hickman et al. (2012), Kudzu was discovered to reduce air quality by increasing nitrogen cycling in soils, causing soils to increase emissions of nitric oxide.

**Distribution:** Widely distributed throughout the state.



Distribution from Thomas and Allen (1998)

**Communities/Species Impacted:**

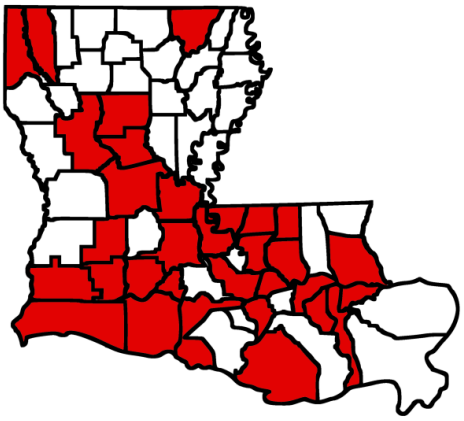
Southern Mesophytic Hardwood Forest, Bottomland Hardwood Forest, and Batture. This species requires disturbance, such as a canopy gap, to gain a foothold. In Louisiana, it typically dominates disturbed waste areas such as roadsides or eroded slopes.

**Research Needs &Management Actions:**

- Support control of this species using a variety of techniques (e.g., herbicide application, mechanical control, prescribed burning, and grazing) as appropriate for the affected habitat.
- Document habitat responses following control efforts.

**26. McCartney Rose (*Rosa bracteata*):** McCartney Rose is a densely prickly evergreen shrub that grows in clumps, and produces arching and climbing stems or canes. If left uncontrolled, this plant can reach up to 11.5 feet in height (Global Invasive Species Database 2005). McCartney Rose was introduced in the U.S. as an ornamental. Now a problematic weed, it has become nearly impossible to eradicate from the landscape (Enloe et al. 2013). McCartney Rose thrives in open sun in frequently disturbed areas and is drought and fire tolerant. This species is often very conspicuous on excessively grazed rangelands and pastures and persists when cultivated and then abandoned. McCartney Rose forms dense thickets that suppress native, desirable vegetation. Wildlife and cattle readily consume the rose hips (fruits) and subsequently spread seeds. McCartney Rose also spreads vegetatively through canes rooting at the nodes (Enloe et.al. 2013).

**Distribution:** Widely distributed.



Distribution from Thomas and Allen (1998)

**Communities/Species Impacted:**

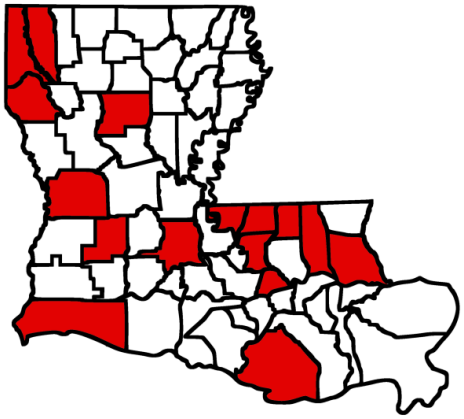
Coastal Prairie, Eastern and Western Longleaf Pine Flatwoods Savanna, and Eastern and Western Upland Longleaf Pine Woodland. McCartney Rose requires disturbance for establishment and does not readily invade high quality habitat.

**Research Needs & Management Actions:**

- Conduct research to determine the combined effects of herbicide application and prescribed fire on McCartney Rose.
- Encourage grazing schemes that limit invasion by McCartney Rose and other weeds, and that sustainably utilize native grass forage.

**27. Cherokee Rose (*Rosa laevigata*):** Cherokee Rose is native to China, and like many non-native plants, was brought to the U.S. as an ornamental. Cherokee Rose is a prickly evergreen sprawling shrub or high climbing vine. Cherokee Rose can be found in sunny disturbed areas along edges of forests, savannas, rangelands, pastures, along streams, and in utility rights-of-way. Since it thrives on edges, it is reasonable to expect Cherokee Rose to colonize canopy gaps in forests and possibly hinder forest regeneration.

**Distribution:** Widely scattered. Well established and frequent in West Feliciana Parish in the Tunica Hills.



Distribution from Thomas and Allen (1998)

**Communities/Species Impacted:**

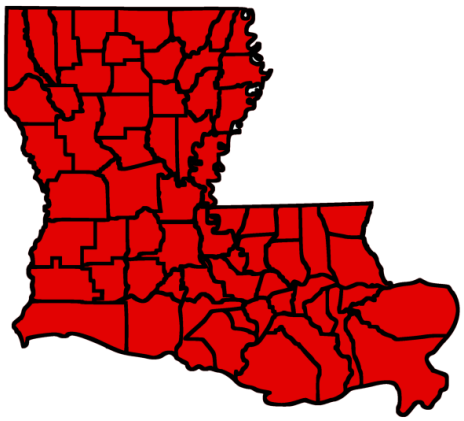
Southern Mesophytic Forest, Small Stream Forest, Eastern and Western Longleaf Pine Flatwoods Savannas.

**Research Needs & Management Actions:**

- Conduct research on control of this species and document habitat response following control of large infestations.

**28. Chinese Tallow Tree (*Triadica sebifera*)**: Chinese Tallow (a.k.a. Chicken Tree or Popcorn Tree) is one of our most serious invasive species of mesic and wet forests and grasslands. Native to East Asia, it has been present in the southeastern U.S. since the late 1700s, when it was introduced as an ornamental. The persistent seeds account for the common name Popcorn Tree. Chinese Tallow Tree is an invader of disturbed areas but can also appear in undisturbed forests. This species utilizes disturbed areas such as utility corridors to penetrate forest interiors. In the historical range of Coastal Prairie, it is a major weed of old fields, pastures, and rangeland. Neglected fields can be dominated by Chinese Tallow Tree. Shallow wetlands such as Flatwoods Ponds, especially in the absence of frequent prescribed fire, can also become tallow thickets.

**Distribution:** Statewide



Distribution from Thomas and Allen (1996) and additional field observations.

**Communities/Species Impacted:**

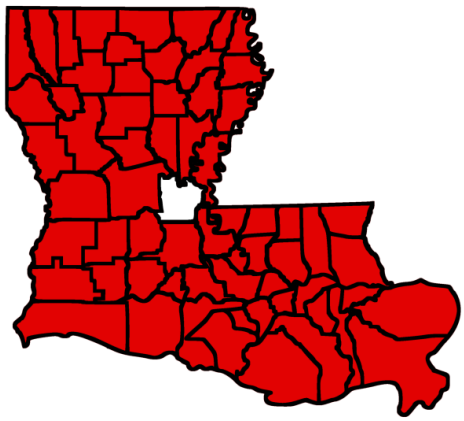
Bottomland Hardwood Forest, Coastal Prairie, Cypress-Tupelo-Blackgum Swamp, Ephemeral Pond, Live Oak Natural Levee Forest, Eastern and Western Longleaf Pine Flatwoods Savanna, and Small Stream Forest.

**Research Need & Management Actions:**

- Encourage use of prescribed fire in rangeland and pasture management to limit recruitment of Chinese Tallow Tree in these grasslands.

**29. Smut Grass (*Sporobolus indicus*):** Godfrey and Wooten (1979) report Smut Grass to be native to tropical Asia, although it may be native to tropical regions worldwide (Peterson et al. 2003). Smut Grass grows to nearly three feet tall and typically occupies disturbed or compacted soils. This species is often infected by *Curvularia ravenelii,* a black fungus which causes False Smut Disease (hence the common name Smut Grass). Smut Grass forms dense clumps, excluding native vegetation and decreasing diversity. The presence of Smut Grass on pasture and rangeland indicates excessive grazing, as this exposes bare soil, creating ideal conditions for Smut Grass seed germination. One individual can produce up to 45,000 seeds per year that easily attach to animals and are carried by wind and water. Smut Grass seeds can survive in soil for more than 2 years (Davy et. al. 2012). Its prolific seed production, seed size, and lifespan contribute to its success as an invasive.

**Distribution:** Essentially statewide. Particularly common in excessively grazed pasture and rangelands.



Distribution from Allen et al. (2004)

**Communities/Species Impacted:**

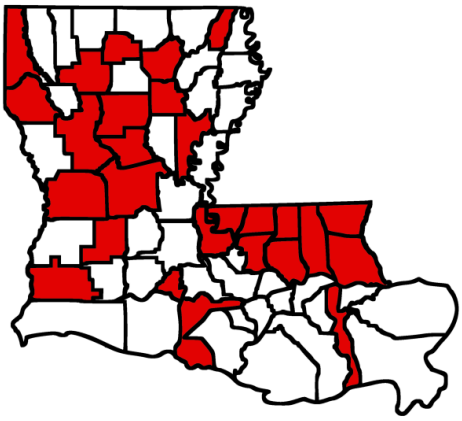
Coastal Prairie, Saline Prairie, and Calcareous Prairie. This species indicates disturbance, and does not readily invade high quality grasslands.

**Research Needs & Management Actions:**

- Work with landowners to establish grazing schemes that avoid overgrazing high quality native grasses, precluding the establishment of vigorous stands of Smut Grass.
- Conduct research examining the effects of resting grazing lands and employing prescribed fire on the abundance and persistence of Smut Grass.

**30. Tungoil Tree (*Vernicia fordii*):** Tungoil Tree is a small deciduous tree native to China that has been cultivated for tung oil, a component in lacquers, varnishes, polishes, and other products. Dense Tungoil Tree stands may represent abandoned plantations. A distinctive feature is the presence of two red glands located on the petiole (leaf stalk) at the junction with the leaf blade. All parts of the plant are toxic, especially the fruits and seeds.

**Distribution:** Widely distributed. Tungoil Tree occurs in mesic soils and is most prevalent in the Florida Parishes.



Distribution from Thomas and Allen (1996)

**Communities/Species Impacted:**

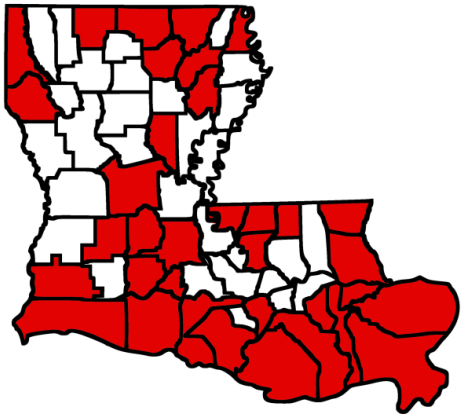
Eastern Upland Longleaf Pine Woodland, Mixed Hardwood-Loblolly Pine Forest, Shortleaf Pine-Oak-Hickory Woodland, Southern Mesophytic Hardwood Forest, and Small Stream Forest.

**Research Needs & Management Actions:**

- Support site-level control of Tungoil Tree and document habitat responses following control efforts.
- Educate the public regarding the negative impacts of using this species as an ornamental.

**31. Elephant Ear (*Colocasia esculenta*):** Elephant Ear, also called Wild Taro, is a Southeast Asian native that is cultivated in many areas for its edible (following cooking) corms. It is very frequent in southern Louisiana where it often forms dense stands along shorelines and in Cypress-Tupelo-Blackgum Swamps, displacing native vegetation. In some areas of southern Louisiana, this species has become so abundant that control is no longer practical.

**Distribution:** Scattered statewide, but most abundant in the southern half of the state.



Distribution from Thomas and Allen (1993)

**Communities/Species Impacted:**

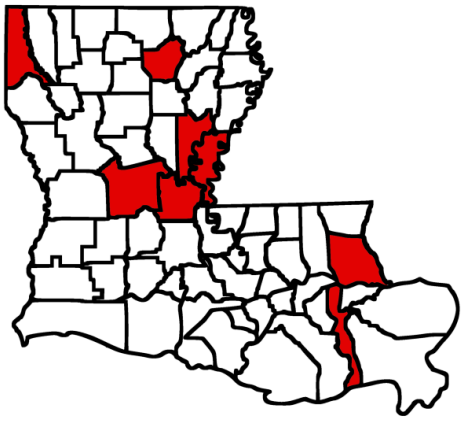
All freshwater wetland habitats, including Cypress-Tupelo-Blackgum Swamp. Shorelines of sluggish waterways throughout the state.

**Research Needs & Management Actions:**

- Discourage use of this species as an ornamental.
- Control local infestations with a combination of digging corms from soil and application of glyphosate plus surfactant (MacDonald et al. 2008).
- Conduct research to determine habitat responses following implementation of control efforts.

**32. Brazilian Waterweed (*Egeria densa*):** This species is also known as Common Waterweed or Brazilian Elodea and prefers slow-moving waters of sluggish streams, ponds, and lakes. Establishment in natural ecosystems is likely due to dumping from aquaria. However, this species has also been intentionally introduced, as it was once thought to aid in the control of mosquito larvae due to its oxygenating properties. Brazilian Waterweed has the ability to spread vegetatively, which can happen via currents, boats, and trailers. This plant forms dense mats near the surface of the water, smothering native vegetation and degrading water quality and fish habitat. Although some states have placed restrictions on the sale and transport of this plant, it remains one of the most widely distributed and utilized aquarium oxygenator plants.

**Distribution:** Found in scattered areas around the state.



Distribution from field observations by LDWF Fisheries Staff.

**Communities/Species Impacted:**

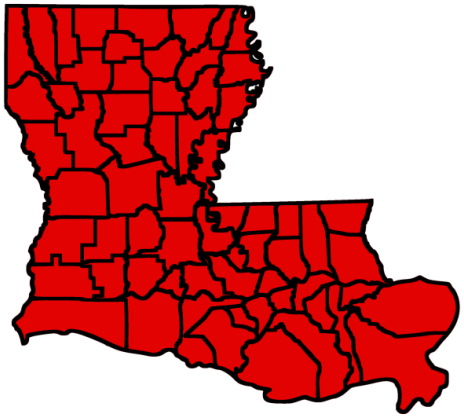
Cypress-Tupelo-Blackgum Swamp, other lentic water bodies, and slow-moving waterways throughout the state.

**Research Needs & Management Actions:**

- Control with herbicides that are known to be effective against Brazilian Waterweed.
- Support research into temperature and salinity tolerance of this species.
- Conduct research to determine more cost effective methods of control, including alternative herbicides and the use of additional biological controls.

**33. Water Hyacinth (*Eichhornia crassipes*)**: Native to South America, Water Hyacinth was first introduced into the U.S. as an ornamental plant at the World's Industrial and Cotton Centennial Exposition in New Orleans in 1884-1885. Because of its attractive purple flowers, Water Hyacinth quickly became popular among gardeners and landscapers. Water Hyacinth frequently clogs bayous and canals, impedes boat traffic, slows water currents, and blocks sunlight to native submersed aquatic vegetation (SAV) which degrades water quality and harms wildlife. Decomposition of Water Hyacinth lowers dissolved oxygen levels, thus negatively affecting aquatic wildlife.

**Distribution:** Statewide.



Distribution from field observations by LDWF Fisheries Staff.

**Communities/Species Impacted:**

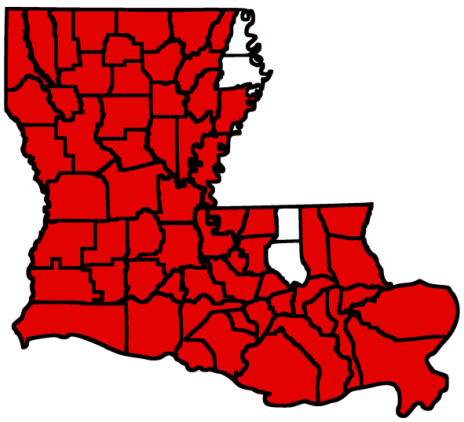
Native fauna and all native freshwater communities are negatively impacted. Additionally, those species that require a substantial open water habitat component are negatively impacted by the dense mats formed by this species.

**Research Needs & Management Actions:**

- Water Hyacinth infestations can be controlled with herbicides, as well as drawdowns. Water Hyacinth Weevils (*Neochetina eichhorniae* and *Neochetina bruchi*) are established throughout the state and do reduce the reproductive capacity and growth rate of this plant.
- Fund research to investigate Water Hyacinth as a potential component of biofuels.
- Conduct research on new herbicides to determine the efficacy and cost effectiveness versus current options.
- Conduct research into the long term effectiveness of biological control agents, and promote the use of such control when appropriate.
- Continue efforts to educate the public regarding the threats this species poses.

**34. Hydrilla (*Hydrilla verticillata*):** A native of Asia, Hydrilla is a rooted aquatic weed found in a variety of aquatic habitats, including both shallow and deep areas. In shallower areas, Hydrilla can form extremely dense mats. Hydrilla can adversely affect water quality by shading out native vegetation and lowering dissolved oxygen concentrations, which may lead to fish kills. Hydrilla was likely introduced via dumping from aquaria or intentional planting. This species spreads easily between water bodies via boats and trailers.

**Distribution:** Essentially statewide.



Distribution from field observations by LDWF Fisheries Staff.

**Communities/Species Impacted:**

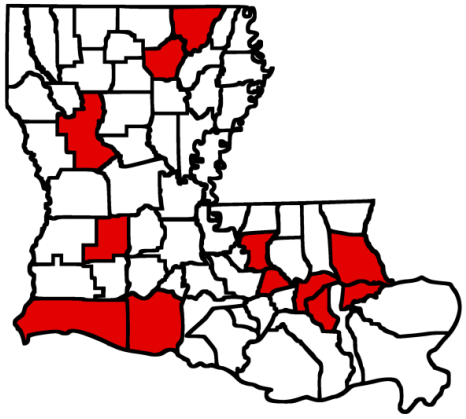
All freshwater habitats, particularly those with slow-moving water, such as Oxbows and Cypress-Tupelo-Blackgum Swamps. Hydrilla can exclude native aquatic plants, and lead to low levels of dissolved oxygen, causing negative impacts to native invertebrates and fishes.

**Research Needs & Management Actions:**

- Control using herbicides, drawdowns, and other known effective methods.
- Conduct research to identify new herbicides which would be more cost effective than current options.
- Conduct research into the long term effectiveness of biological controls.
- Continue efforts to educate the public about the threats this species poses.

**35. Yellow Flag Iris (*Iris pseudacorus*):** Yellow Flag Iris is an exotic invasive mainly found in wetland habitats, typically growing on edges of lakes, ponds, streams, or in swamps. Drought tolerance and its ability to withstand extended periods of anoxia make it a fierce competitor against native plants. Some possible negative effects of a Yellow Flag Iris infestation include reduced waterfowl habitat (Stone 2009) and displacement of native irises occurring in the same habitats. Yellow Flag Iris spreads mainly via rhizomes which allow it to quickly form large stands. Introduction to new areas may occur if rhizome fragments or seed are carried downstream or by a storm event (Ramey and Peichel 2001).

**Distribution:** Infrequent and scattered.



Distribution from Thomas and Allen (1993)

**Communities/Species Impacted:**

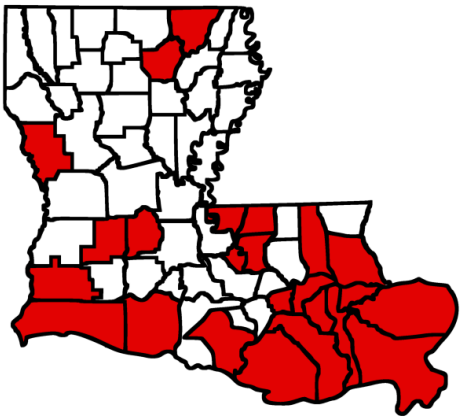
Cypress-Tupelo-Blackgum Swamp and Freshwater Marsh.

**Research Needs & Management Actions:**

- Increase awareness of the potential negative effects of this species when used as an ornamental, and promote the use of native irises as an alternative.

**36. Torpedo Grass (*Panicum repens*):** Torpedo Grass superficially resembles a much larger version of Bermuda Grass (*Cynodon dactlyon*). Torpedo Grass is invasive due to its rapid growth by torpedo-like rhizomes. This species can form dense stands in a variety of habitats, from sandy Gulf beaches to river, lake, and pond shorelines. In the latter settings, Torpedo Grass can dominate and actually grow out into the water. Torpedo Grass can rapidly invade and dominate disturbed sandy soils, including dredge spoil islands.

**Distribution:** Primarily the southern part of Louisiana, with scattered records elsewhere.



Distribution from Allen et al. (2004) and specimens housed at LSU Herbarium.

**Communities/Species Impacted:**

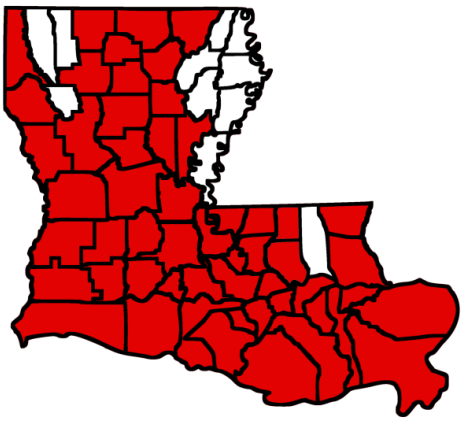
Barrier Island, Coastal Dune Grassland, Lakes, Ponds, Louisiana Beach, Vegetated Pioneer Emerging Delta, and Sandbars.

**Research Needs & Management Actions:**

- Conduct research to determine alternative herbicides that may be effective in controlling this species with minimal impact to non-target species.

**37. Common Salvinia (*Salvinia minima*):** A floating fern, Common Salvinia is also known as Water Spangles or Water Fern. Common Salvinia forms dense mats that exclude native plants, and have negative impacts on wildlife. This Central and South American native has been cultivated in the U.S. since the 1880s for water gardens, where it was likely accidentally introduced into the wild. This species is often spread via boats and trailers. Common Salvinia was first documented near Bayou Teche in 1980, and has since become a statewide problem.

**Distribution:** Essentially statewide.



Distribution from field observations by LDWF Fisheries Staff.

**Communities/Species Impacted:**

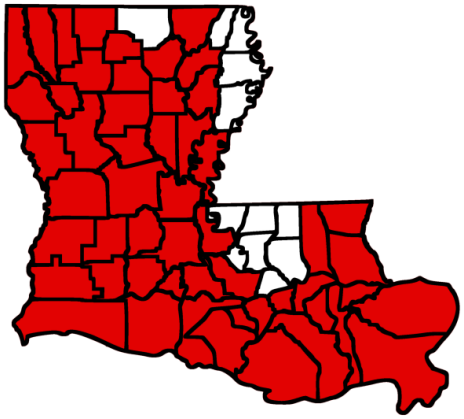
All aquatic systems, including Lakes and Ponds, Cypress-Tupelo-Blackgum Swamps, and Freshwater Marsh.

**Research Needs & Management Actions:**

- Continue efforts in conjunction with LSU Agricultural Center, U.S. Army Corps of Engineers Research and Development Center, and other partners to establish the Florida Salvinia Weevil (*Cyrtobagous salviniae*) as a form of biological control.
- Common Salvinia can be controlled with foliar applications of herbicide and surfactant mixtures. Water level fluctuation has also proven to be an effective and cost efficient control method for this species.
- Conduct research to identify more cost-effective methods of control, including alternative herbicides and additional biological control agents.

**38. Giant Salvinia (*Salvinia molesta*):** Giant Salvinia was likely brought to the U.S. as an aquarium plant, and subsequently introduced into the wild via dumping or intentional release. Giant Salvinia is spread via vegetative growth, by wind and currents, and by inadvertent transport by boats and trailer. This is a free-floating species that can double in biomass every three to five days under ideal conditions. Giant Salvinia can quickly take over canals, lakes, and bayous, displacing native vegetation. This species does particularly well in slow-moving water, such as that found in many Louisiana bayous, Cypress-Tupelo-Blackgum Swamps, and marshes. Giant Salvinia was first documented in Louisiana at Toledo Bend Reservoir around 1998, and has since expanded throughout the state.

**Distribution:** Essentially statewide.



Distribution from field observations by LDWF Fisheries Staff.

**Communities/Species Impacted:**

All aquatic systems, including Cypress-Tupelo-Blackgum Swamp, Lakes and Ponds, and Freshwater Marsh.

**Research Needs & Management Actions:**

- Continue efforts in conjunction with LSU Agricultural Center, U.S. Army Corps of Engineers Research and Development Center, and other partners to establish the Florida Salvinia Weevil (*Cyrtobagous salviniae*) as a form of biological control.
- Continue research to develop a cold tolerant weevil biotype that may be able to survive in north Louisiana.
- Giant Salvinia is controlled with foliar applications of a mixture of herbicide and surfactants. Water level fluctuations have also proven to be an effective and cost efficient control method for this species.
- Conduct research to identify more cost-effective and sustainable control methods.