Recent Development

CADDIO LAKE: ECOSYSTEM UNDER SIEGE

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I. INTRODUCTION

Caddo Lake falls on the Texas-Louisiana border and is plagued with the worst noxious weed currently known, Giant Salvinia. While federal laws exist to assist in funding invasive species control, Texas Parks and Wildlife Department (“TPWD”) has not bothered to apply for this aid due to the competition structure of the law and the limited funding existing legislation would provide.1 Eradication of invasive aquatic species is not a viable option; therefore, Texas spends significant amounts of money on biological control methods, herbicide treatments, physical removal efforts, and more recently, a public awareness campaign.2 Regardless of Caddo Lake’s cross-border location, funding for control methods has not been increased. In fact, Louisiana has only been able to assist on rare occurrences due to its control efforts for lakes fully encompassed by its own boundaries.

II. CADDIO LAKE AND GIANT SALVINIA: A BRIEF BACKGROUND

While Texas might be a land overflowing with oil rigs and state pride, one item it lacks is a surplus of natural lakes. In fact, lying on the eastern border of Texas and flowing into Louisiana, is the only natural lake known to Texas, Caddo Lake.3 The lake encompasses approximately 26,000 acres of “rare...wetlands

1. See infra Section III.
2. See infra Section V.
environment” and is recognized as a bottomland hardwood swamp.\(^4\) According to the Environmental Protection Agency (“EPA”), bottomland hardwoods are vital to their watersheds due to the wetland’s regulation of flooding.\(^5\) The EPA has identified that, of the thirty million acres of bottomland forests which previously covered the southeastern United States, only forty percent currently remains.\(^6\)

Salvinia Molesta is the formal name for the invasive aquatic species that is a “rapidly proliferating...aquatic fern” that can double in size in a week to ten days, and, in three months, can expand to cover forty square miles.\(^7\) In 2003, Giant Salvinia covered ninety percent of Lake Wilson in Hawaii, which could lead one to assume that there is no limit to Giant Salvinia’s expansion within any given body of water.\(^8\) Giant Salvinia forms a thick mat over the surface of the water and cuts off a majority of any sun penetration, which means that the dissolved oxygen levels “fall too low to support fish or other aquatic life.”\(^9\) In addition, the plant replaces native species, which disrupts the established feeding cycle in the area and disturbs the waterfowl.\(^10\)

Hailing from Brazil, Giant Salvinia has been encroaching northward, seeking “slow moving or quiet freshwaters.”\(^11\) According to Howard Elder, Aquatic Habitat Biologist for the TPWD, by the year 2000 “Giant Salvinia had been confirmed in [three Texas lakes and] as of 2010...[has] been reported in seventeen public reservoirs in Texas.”\(^12\) Furthermore, Giant

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5. EPA, Bottomland, supra note 4.
6. Id.
11. E-mail from Howard Elder, Aquatic Habitat Biologist, Texas Parks and Wildlife Department, to Allison Kluber Waldman (Mar. 31, 2010)(on file with author).
Salvinia has been reported in twelve states in “over 150 locations,” all located in the southern regions of America.13

III. GIANT SALVINIA REGULATION

A. Federal

Invasive species threaten the United States ecosystem functions as well as the economy.14 It is predicted that invasive species cost the United States as much as $120 billion a year with approximately $145 million being “invested...in the control of invasive...aquatic and wetland plants.”15 In 1974, Congress recognized a need to control invasive species when it passed the Federal Noxious Weed Act and again when the Plant Protection Act (“PPA”) was passed in 2000.16 The PPA defines noxious weeds as “any plant...that can... injure or cause damage to...interests of...navigation, the natural resources of the United States...or the environment.”17 The PPA prohibits the “movement in interstate commerce of any...noxious weed,” which includes a “release into the environment,” and grants the USDA the authority to publish a Federal Noxious Weed List on which Giant Salvinia is listed.18

In 2004, the PPA was amended by the Noxious Weed Control and Eradication Act (“NWCEA”) to “provide financial...assistance to control or eradicate noxious weeds.”19 Weed management entities can attempt to receive a grant from the Secretary of Agriculture who shall consider the severity of the invasive species, whether the entity will be able to match funds, and “other factors that the Secretary determines to be relevant.”20 Additionally, the PPA stipulates that projects shall be selected on a competitive basis and the Secretary shall further consider

15. INVASIVE PLANTS AND FOREST ECOSYSTEMS, supra note 14, at 412 (referencing D. Pimentel et al., Update on the Environmental and Economic Costs Associated with Alien-Invasive Species in the United States, 52 ECOLOGICAL ECON. 273, 273–88 (2005)).
17. 7 U.S.C. § 7702(10).
whether the project will resolve the problem and the “extent to which the program will improve the overall capacity of the United States to address noxious weed control and management...provide a comprehensive approach to the control or eradication of noxious weeds...[and] reduce the total population of noxious weeds.”

Furthermore, the Act provides that the Secretary shall consider the level to which the project “promotes cooperation and participation between States that have common interests in controlling and eradicating noxious weeds.”

The United States Department of Agriculture (“USDA”), which is in charge of funding grants under the NWCEA, allotted $341 million to pest and disease management programs for the year 2010. According to Dr. Earl Chilton, II, Aquatic Habitat Enhancement Program Director with TPWD, an application has not been filed nor funds sought under NWCEA because the program is based on cost share concepts where the federal government only matches fifty percent of the costs. Additionally, projects shall be selected on a competitive basis and TPWD has chosen to abstain from competing with “significant terrestrial pests” such as boll weevils.

B. Texas and Louisiana

The Texas Administrative Code considers any member of the salvinia family to be a “harmful or potentially harmful exotic plant.” Furthermore, the code provides that “it is an offense for any person to release into the water of this state...any species...defined as a harmful or potentially harmful...aquatic plant.” The Texas Parks and Wildlife Code also prohibits the placement of an “exotic harmful or potentially harmful...aquatic plant[]” “into water of this state.” The code regards “nonindigenous aquatic plant[s]...not normally found in aquatic

22. Id. § 7783(f).
24. E-mail from Dr. Earl Chilton, II, Aquatic Habitat Enhancement Program Director, Texas Parks and Wildlife Department, to Allison Kluber Waldman (Apr. 12, 2010)(on file with author); 7 U.S.C. §7783(c)(2).
25. 7 U.S.C. §7783(f); USDA, BUDGET, supra note 23; E-mail from Dr. Earl Chilton, II, supra note 24.
27. 31 TEX. ADMIN. CODE § 57.112(b) (2009).
or riparian areas of this state” to be an exotic aquatic plant. Violators of the Texas Parks and Wildlife Code typically face a misdemeanor charge unless they have previous violations and then they may face a felony charge. However, commentators note, that because boaters are ignorant of the law and imposing $500 fines might be severe, Texas game wardens regularly fail to distribute citations to violators even though violations are easily found.

Louisiana’s Department of Wildlife and Fisheries (“LDWF”) is charged with regulation of noxious aquatic weeds and prohibits persons from “import[ing] or caus[ing] to be transported... without first obtaining a written permit.” This statute has been criticized for lacking regulation of the sale of noxious aquatic plants once in the state. In addition, locating the “list of prohibited invasive, noxious aquatic plants” referenced in the statute is challenging. However, the 2007 Commercial Fishing Regulations published by the LDWF refers to the language in the statute above and then lists twenty-four noxious aquatic plants with salvinia being one.

IV. CADDO LAKE & GIANT SALVINIA: INFESTATION AND RESPONSE

On the Louisiana side of Caddo Lake is Jeems Bayou, where Giant Salvinia was first discovered in approximately June of 2006. The initial sightings reported 150 acres of the invasive species, but more than 600 acres were discovered. Immediately upon news of the plant sightings, individuals from several Texas organizations rushed to Louisiana to meet with residents who

29. § 66.007(e)(2).
33. ALYSSA R. KRAVITZ ET AL., CTR FOR BIENVIRONMENTAL RESEARCH AT TULANE AND XAVIER UNIVS, STATE MANAGEMENT PLAN FOR AQUATIC INVASIVE SPECIES IN LOUISIANA 78 (2005).
34. LA. REV. STAT. ANN. § 56:328.
35. LA. REV. STAT. ANN. § 56:328(B).
live in and around Jeems Bayou. These Texas stakeholders proposed a “containment barricade,” but the barrier failed to be erected due to the lack of community response.

In the summer of 2006, herbicide was sprayed over the affected area and residents believed the herbicide kept the Giant Salvinia at a manageable level. Nevertheless, Texas residents' worst fear became a reality in 2007 when flooding washed the Giant Salvinia over the state border. Under the leadership of a Texas County judge, a council was formed to provide fundraising and management oversight to tackle the Giant Salvinia issue. The group was able to raise $65,000 from local groups, and volunteers donated over one thousand hours of work to construct the containment barrier and continue spraying herbicide.

The containment barrier has been described as an “unusual approach” to the Giant Salvinia issue. It is a two-mile long, bright orange, nylon fence crossing the middle of Caddo Lake, and the fence is positioned as if to mimic the state line. The goal of the barrier is to continue water flow while apprehending any Giant Salvinia crossing into Texas. The barrier requires “continuous inspection and maintenance” since it is subject to “breakage under pressure,” and because wind can carry Giant Salvinia through the boat openings.

On the other side of the Caddo Lake containment barrier lies Louisiana which has 730,000 acres of aquatic vegetation issues. Lake Bistineau, located south east of Caddo Lake, appears to be receiving a majority of LDWF’s attention. In 2007, Lake Bistineau was covered in 4,500 acres of Giant Salvinia which was a 4,000 acre increase in as little as eight months. Therefore, the

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38. Canson, Emergency, supra note 36.
39. Id.
40. Id.
41. Id.
42. Id.
43. Id.
45. Id.
46. Id.
potential opportunities for combined state efforts are rare since Louisiana’s attentions are focused on other bodies of water.51 This past winter brought extremely cold temperatures and snow to Texas and Louisiana.52 Recent surveys have inferred that the lower temperatures “resulted in an 80-90% reduction on the [G]iant [S]alvinia on Caddo Lake.”53 Regardless of Texas’ initial response efforts and cold winter, Giant Salvinia has not lost its ability to double in size and still threatens the ecosystem.

V. CONTROL METHODS

A. Biological Control: The Salvinia Weevil

Biological control methods are more effective when attempting to control large infested areas, when the costs of herbicide applications are great and potentially harmful to the environment, and when the targeted species exhibit traits causing herbicide treatments to be challenging.54 However, the initial costs to begin biological controls are high and, due to the complexity of colonizing the insects, the price escalates with the increasing size of an infested area.55 Furthermore, the goal of biological control methods is not eradication of the invasive species, but as its title suggests, mere control.56 The largest obstacle when attempting utilization of biological control methods is an existing Federal regulation. The PPA allows the movement of noxious weeds and biological control organisms only through possession of a permit.57 Therefore, before commencement of a biological control study, a permit must be obtained to collect the organisms. If environmental release is desired, the USDA, in considering the request, must adhere to the National Environmental Policy Act in conducting an Environmental Assessment.58 Additionally, the USDA must consider the Endangered Species Act (“ESA”) when permitting...

51. E-mail from Howard Elder, supra note 12.
53. E-mail from Howard Elder, supra note 12.
55. Id. at 229–30; BIOLOGICAL CONTROL OF INVASIVE PLANTS IN THE UNITED STATES 17 (Eric M. Coombs et al. eds., 2004) [hereinafter BIOLOGICAL CONTROL].
56. BIOLOGICAL CONTROL, supra note 55; E-mail from Howard Elder, supra note 12.
releases since a release will not be permitted if the biological control agents might jeopardize an endangered species unless the Endangered Species Committee exempts the project.\(^\text{59}\)

While Giant Salvinia is resilient to many control methods, there is one biological control species which finds it quite appetizing, the Salvinia Weevil.\(^\text{60}\) The weevil causes “immense damage to plants by tunneling through rhizomes and feeding on terminal buds.”\(^\text{61}\) The Salvinia Weevil larvae are found to be especially devastating to the ecosystem.\(^\text{62}\) However, the weevil merely reduces the growth rate of the plant and does not completely eradicate the Giant Salvinia.\(^\text{63}\) In 2001, Texas participated in a study in which Salvinia Weevils were released into a private pond.\(^\text{64}\) The study collected samples three years after the initial release and after observing the presence of weevils concluded additional surveys needed to be conducted.\(^\text{65}\)

However, biological control programs are time-consuming given that the goals of these programs involve “long term stabilization of pest density at a sub-economic level.”\(^\text{66}\)

The equatorial regions have experienced success with the use of the Salvinia Weevil due to year-round ideal weather conditions.\(^\text{67}\) Texas, being north of the equator, finds the weevil to be sensitive to winter months; however, the weevil has established itself in the state.\(^\text{68}\) The main effect that Texas winters have on the weevil is an observed decrease in reproduction “prevent[ing] the establishment of sufficient numbers of insects for effective control.”\(^\text{69}\) Moreover, there is a lack of predictability in the effective establishment of Salvinia Weevils based on studies showing established weevils within two years at one site, whereas another site took four years to establish.\(^\text{70}\) The lack of commercial providers of Salvinia Weevils hinders biological control efforts due to the number of affected bodies of water placing the weevils in high demand so that obtaining the proper amount of insects to establish colonies in

\(^\text{60}\) E-mail from Howard Elder, supra note 12; Everitt et al., supra note 7.
\(^\text{62}\) McFarland et al., supra note 47, at 21.
\(^\text{63}\) E-mail from Howard Elder, supra note 12.
\(^\text{64}\) Id.; Everitt et al., supra note 7.
\(^\text{65}\) Everitt et al., supra note 7.
\(^\text{66}\) George I. Oduor, Biological Pest Control for Alien Invasive Species, in INVASIVE SPECIES AND BIODIVERSITY MANAGEMENT 305, 317 (Odd Terje Sandlund et al. eds., 1999).
\(^\text{67}\) E-mail from Howard Elder, supra note 12.
\(^\text{68}\) Id.; Hadlock, supra note 44; BIOLOGICAL CONTROL, supra note 55.
\(^\text{69}\) E-mail from Howard Elder, supra note 12.
\(^\text{70}\) Id.
one location is extremely limited. Rearing mass quantities of this insect at a reasonable cost is challenging and difficult to accomplish.

**B. Herbicide Treatments**

Effective herbicide treatments can be utilized in order to control Giant Salvinia; however, treatments are not without their challenges. When aquatic plants exhibit the characteristics of being located in proximity to the water, small in size, and extremely dense, herbicide treatments are potentially less effective. Therefore, treating Giant Salvinia, which exhibit these characteristics, might prove an obstacle. Herbicide treatments are hindered with Giant Salvinia due to its “upper frond surfaces [being] covered with numerous trichomes or hairs” which assist in safeguarding the weed from treatments because it is challenging for the treatment to adhere to the surface. A study observed extremely effective control of Giant Salvinia when certain herbicides such as diquat and glyphosate were applied to the plant through either a submerged application or through a spray.

Effective herbicide treatments can exacerbate certain harmful effects of the targeted invasive species. For instance, Giant Salvinia depletes oxygen levels in the waters it covers, which adversely impacts aquatic life below, but when it is effectively killed by herbicide treatments, it further depletes oxygen levels during its decomposition. As with any treatment, the costs have a tendency to become overwhelming. TPWD estimates that their current herbicide program for Caddo Lake costs $64,000. The state of Louisiana budgeted $7.9 million dollars for herbicide treatments throughout the entire state for

71. Id.; USGS, NAS, supra note 13.
74. Id.; Daniel D. Thayer et al., Effect of Herbicides on Floating Aquatic Plants, 23 J. AQUAT. PLANT MGMT. 94 (1985).
75. See generally Nelson et al., supra note 73; Thayer et al., supra note 74, at 94–95.
76. MCFARLAND ET AL., supra note 47, at 15.
77. Nelson et al., supra note 73.
78. WEBER, supra note 7; BIOLOGICAL CONTROL, supra note 55, at 175.
the fiscal year of 2009-2010; however, Louisiana has 730,000 acres of aquatic vegetation issues and information regarding the allotted amount intended for Caddo Lake is difficult to determine.\textsuperscript{80}

Application of chemical herbicides is regulated by a requirement that the party using the herbicide confirms that the chemical intended for use is permitted under federal law.\textsuperscript{81} Application of herbicides to Caddo Lake and other bodies of water belonging to the United States does not require National Pollution Discharge Elimination System ("NPDES") Permits because the EPA published a final rule eliminating the requirement for a NPDES permit if an “application of the pesticide is made directly to waters of the United States to control pests...in the water...[or] when the application of the pesticide is made to control pests that are over...waters of the United States.”\textsuperscript{82} Eliminating the NPDES permit requirement relieves a burden to invasive species control through herbicide treatments.

\textit{C. Physical Removal}

In the summer of 2009, the Caddo Lake Institute obtained proper permits to collect Giant Salvinia and conducted an experiment involving a privately owned harvester.\textsuperscript{83} The project was capable of clearing one acre of infested waters for $350.70 minus the $270,000 it would initially take to obtain a mechanical harvesting unit.\textsuperscript{84} For years, the use of a harvester was not attempted in the waters of Caddo Lake due to the assumption that the machinery would fail when it encountered underwater tree stumps.\textsuperscript{85} It was determined that current harvesters could in fact maneuver through the waters without being hindered.\textsuperscript{86}

One concern in using mechanical harvesting as a control method is the effect it might have on other aquatic life such as fish. However, Giant Salvinia turns the water beneath it into a barren wasteland. Therefore, during the ten days the institute operated its harvester, minimal amounts of fish and plankton

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\item \textsuperscript{80} STATE OF LA., STATE BUDGET FISCAL YEAR 2009-2010 155 (2009); La. Tech. Univ., \textit{supra} note 48.
\item \textsuperscript{81} \textit{See generally} Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. § 136 et seq. (2010).
\item \textsuperscript{82} 40 C.F.R. § 122.3(h) (2008).
\item \textsuperscript{83} JACK CANSON, CADDIO LAKE INST., MECHANICAL REMOVAL OF AQUATIC VEGETATION AT CADDIO LAKE 5 (2009) [hereinafter CANSON, MECHANICAL].
\item \textsuperscript{84} \textit{Id.} at 22.
\item \textsuperscript{85} \textit{Id.} at 18.
\item \textsuperscript{86} \textit{Id.}
\end{itemize}
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were observed being taken from the lake. The assumption was that the area beneath the Giant Salvinia had long been deserted and the biological life relocated to parts of the lake yet to be covered. Another downfall involving mechanical harvesting is that the machinery cannot reach all areas of Caddo Lake, so the Giant Salvinia that is intermingled with the bald cypress trees will be ignored due to the complexity of corralling the plant. Mechanical harvesting will therefore not be a solution by itself and this method would need to be used in combination with other control methods.

VI. PREVENTION THROUGH PUBLIC AWARENESS

Prevention should be viewed as “the first line of defense in the fight against invasive species” because “eradication of widespread invasive species may not be feasible.” One way to promote prevention is through public awareness so that invasive species can be identified early “and remove[d]...before...becom[ing] established.” TPWD recently launched a public awareness campaign through a partnership, the Texas Invasive Plant and Pest Council, this campaign encourages education regarding invasive species, training “citizen scientists” in spotting and reporting invasive species, and informing individuals of their abilities to unwittingly spread species.

The campaign has adopted targeted slogans such as “Hello Giant Salvinia, Goodbye Texas Lakes” and “Hello Invasive Species, Goodbye Fishing Hole.” The campaign is also airing commercials in areas surrounding affected bodies of water. One commercial features a “Giant Salvinia Monster” attaching itself to fishing lines and boat trailers, while a second has the monster

87. Id. at 19–20; Tompkins, Going Green, supra note 9.
88. CANSON, MECHANICAL, supra note 83.
89. Id. at 20.
91. E-mail from Howard Elder, supra note 12.
begging for its life at a TPWD meeting. The commercials take a comical stance that will hopefully appeal more to the viewers as compared to a typical public service announcement.

Public awareness regarding invasive species is vital. The spread of Giant Salvinia is thought to have been provoked by the transfer from boat trailers to new waters. If the public remains ignorant of its contributions to the invasive species issue, the problem will simply become amplified. Moreover, public awareness campaigns need to reach all citizens and not just the residents surrounding the infected lakes. Local residents have an incentive to keep their economy engaged and their waters clear. However, weekend boaters or out of state tourists lack long term association with the lake and will most likely exhibit self-enhancing bias traits in which they maintain a positive image of themselves and blame external causes for failures.

VII. Multi-Jurisdictional Ecosystems

Texas and Louisiana place different weights on particular policies. Unfortunately “pollution does not respect borders [and] residents on either side generally share the health impacts of the pollution resulting from uneven standards.” States have a history of appearing more lax on polluters when a majority of negative externalities concern neighboring states. However, in the situation involving Caddo Lake and Giant Salvinia, Louisiana, while not as active as Texas, is not choosing to be lenient on transporters of Giant Salvinia. Instead, it appears to be a judgment on Louisiana’s behalf to focus its resources elsewhere which imposes a negative externality on Texas.

When Caddo Lake was first infested with Giant Salvinia, Louisiana residents failed to take action and when the salvinia crossed into Texas, a negative externality problem arose. An externality is “the imposition of costs or benefits on another as a

95. TIPPC, Take Action, supra note 93.
96. Id.
result of one’s use of his [or her] property.” An externality becomes negative when a property owner realizes benefits from the use of the land; however, the owner fails to internalize the negative consequences of such use. Louisiana realized benefits from Caddo Lake by continuing use of it without regard for the Giant Salvinia; however, Louisiana failed to internalize the negative consequence of freely using the lake when Giant Salvinia crossed into Texas’ territory.

By Texas providing Giant Salvinia control, Louisiana will never have the incentive to internalize Giant Salvinia costs and regulations at Caddo Lake. A few ways to correct externalities include “bargaining, taxing negative externalities...or establishing regulatory controls.” Regulatory controls are already in place regarding Giant Salvinia as discussed in Section IV, and unfortunately, the controls fail to address transboundary pollution issues between states regarding Giant Salvinia. Texas is in no position to impose a tax on Louisiana for its negative externality. Moreover, Louisiana is not blasé as to its Giant Salvinia issue. Louisiana simply has more acres infested that do not sit on state borders in which it chooses to focus. Therefore, bargaining with Louisiana in order to achieve greater financial assistance would most likely prove difficult. Louisiana would hold the upper hand in the negotiations for the simple fact that if Texas refuses to maintain control and prevention methods, Texas will be harmed due to the loss of its only natural lake.

Arguably, Louisiana policy makers are addressing financial contributions to infected bodies of water under the Pareto criterion. This means if policy A is preferred to policy B, then the collective choice rule will select A. In other words, Lake Bistineau is Louisiana’s policy A while Caddo Lake is only policy B. Therefore, investments will be made to control Giant Salvinia in Lake Bistineau before Caddo Lake. Texas’ willingness to prevent the complete loss of Caddo Lake escalates Lake Bistineau to the policy A position.

The question then is whether Louisiana has a duty to assist in the control and prevention of Giant Salvinia at Caddo Lake. There appears to be no legal duty for a state to assist in controlling an invasive species once it crosses state borders.

101. Id. at 421.
102. Id. at 426.
104. Id.
Perhaps Louisiana has a moral duty imposed on them instead. However, the practical reality is if Louisiana refuses to or lacks the ability to control and Texas is willing, Louisiana lacks incentive to fulfill its moral duty.

VIII. CONCLUSION

The spread of invasive species such as Giant Salvinia is a terrifying reality which negatively impacts the United States ecosystems and economy. While regulations may be in place to assist states in control efforts, the law is a popularity contest among invasive species and states find themselves struggling with nationally unknown species.\textsuperscript{105} Control methods are costly and lack the ability to completely eradicate Giant Salvinia from a body of water.\textsuperscript{106} Unfortunately for Caddo Lake, there is no solution to Giant Salvinia, but Texas is not willing to be defeated easily. For the sake of virgin waters, perhaps the awareness campaign will prove fruitful and boaters will realize their negligence is hurting the water that provides their enjoyment. In the meantime, based on simple economic theory, Texas should not expect additional support from Louisiana in control efforts.

\textsuperscript{105} See supra Section III.
\textsuperscript{106} See supra Section V.