MECHANICAL REMOVAL OF AQUATIC VEGETATION AT CADDO LAKE

Review of a 10-Day Trial & Evaluation
Conducted May 29 – June 08, 2009

Report issued December 31, 2009
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The Caddo Lake Institute

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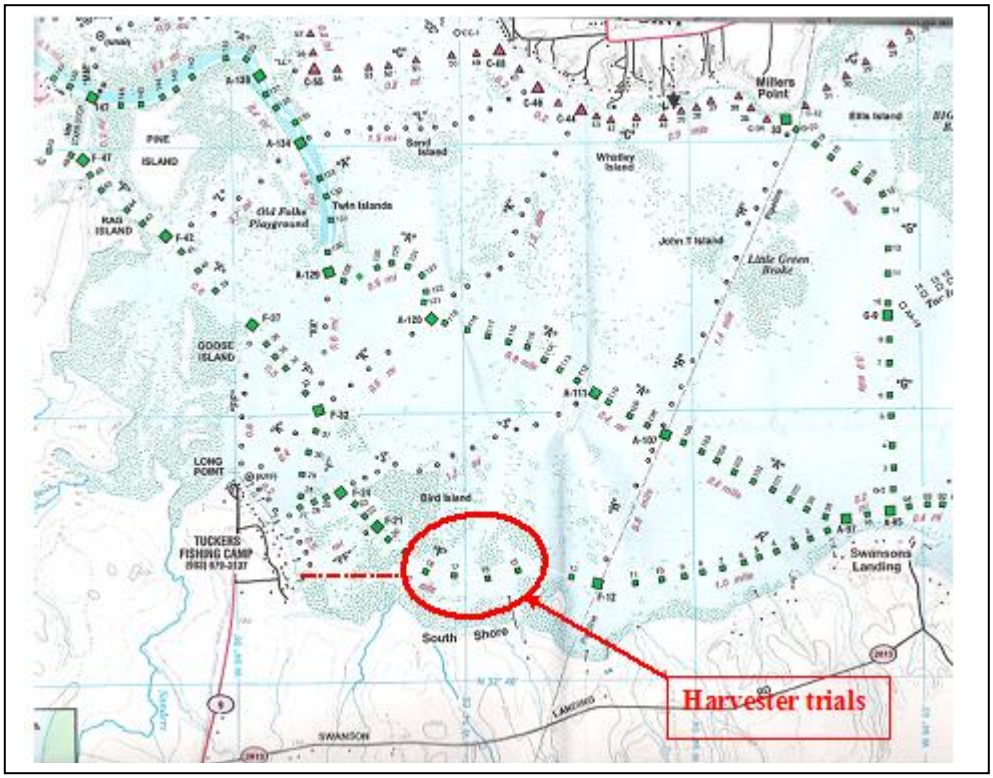


Background:

A 10-day demonstration and trial of mechanical harvesting equipment at Caddo Lake was conducted May 29 through June 08, 2009. The project was managed by the Caddo Lake Institute and supported by grants from the National Fish and Wildlife Foundation and the City of Marshall.

On-water operations were conducted in the vicinity of Bird Island along the south Shore of Caddo Lake. Shoreline removal operations were based at Tucker's Camp, near Long Point. Harvester contract services were provided by Mr. John Sanders.

Purpose of Project:

The purpose of the project was:

(1) to test and evaluate whether mechanical harvesters can effectively operate in Caddo Lake's shallow, stumpy waters;
(2) to determine the rate at which aquatic vegetation can be removed from Caddo Lake by harvesting machinery;
(3) to record useful observations that might be helpful in evaluating possible future mechanical removal trials or operations.

Limitations of Project:

These trials were limited in scope by the equipment available within the range of project funding.

NOTE: Mechanical removal of aquatic vegetation involves three distinct activities or dimensions:

(1) removal of AV from the water;
(2) movement of AV from the area where it has been captured to a shoreline site where it can be offloaded;
(3) disposition of the removed AV by transporting it overland to an area for composting, incineration, or other action.

REMOVAL OF AV FROM WATER: This project was able to thoroughly test and evaluate the first of these activities – whether mechanical harvesters can remove AV from Caddo Lake, and at what rate.

MOVEMENT OF AV OVER WATER: The project was unable to test or evaluate the second dimension – movement of removed AV from the harvester to the land. Budgetary constraints prohibited the acquisition of transport barges for this project; therefore, each time the harvester was fully loaded it was necessary for it to return to the Shoreline Offloading site to discharge removed AV.

DISPOSITION OF REMOVED AV: Some data and observations were acquired regarding the third dimension, transporting and disposing of AV that has been mechanically removed from the lake.

Above: Composite photo shows harvester unloading onto shore conveyor into dump truck as Harrison County Judge Richard Anderson observes..

Equipment & personnel:

1. UMI Harvester Model H6-4000B, storage capacity 400 cf/4,000 lbs, with operator.
2. 2 axle Harvester Transport Trailer T-6 w/8 HP winch.
3. Shore conveyor w/20 HP hydraulic power pack, model 6-500, with operator.
4. Dump truck (5-6 yds capacity) with operator.

Permitting:

The area was surveyed with Texas Parks & Wildlife Fisheries Biologist Tim Bister on 4/23/09 & 5/20/09. An Aquatic Vegetation Treatment Proposal was submitted 5/20/09 and a permit was obtained from TPW to remove giant salvinia and water hyacinth in a 60 acre area in the vicinity of Bird Island.

> NOTE: *Approximately midway through the trials, the Project Director was informed by TPW aquatic vegetation biologist Howard Elder that an additional permit is also required for the transportation of the removed IAV from the offloading site to the disposal site. It was determined that the Treatment Proposal submitted specified that the material would be transported for disposal, and that the disposal site had been inspected and approved by TPW, and the project was therefore in compliance. The Project Director was advised that in any future mechanical removal operations at Caddo Lake separate Treatment Proposals should be submitted for both on-water removal and for on-land transportation to a disposal site.*

Basic Operations:

Dates and periods of operation for this project were:

5/28/09
Practice & training for operators

5/29/09 – 6/06/09
Harvester operated 10 hours per day

6-07-09 – 6/08/09
Harvester operated 5 hours per day

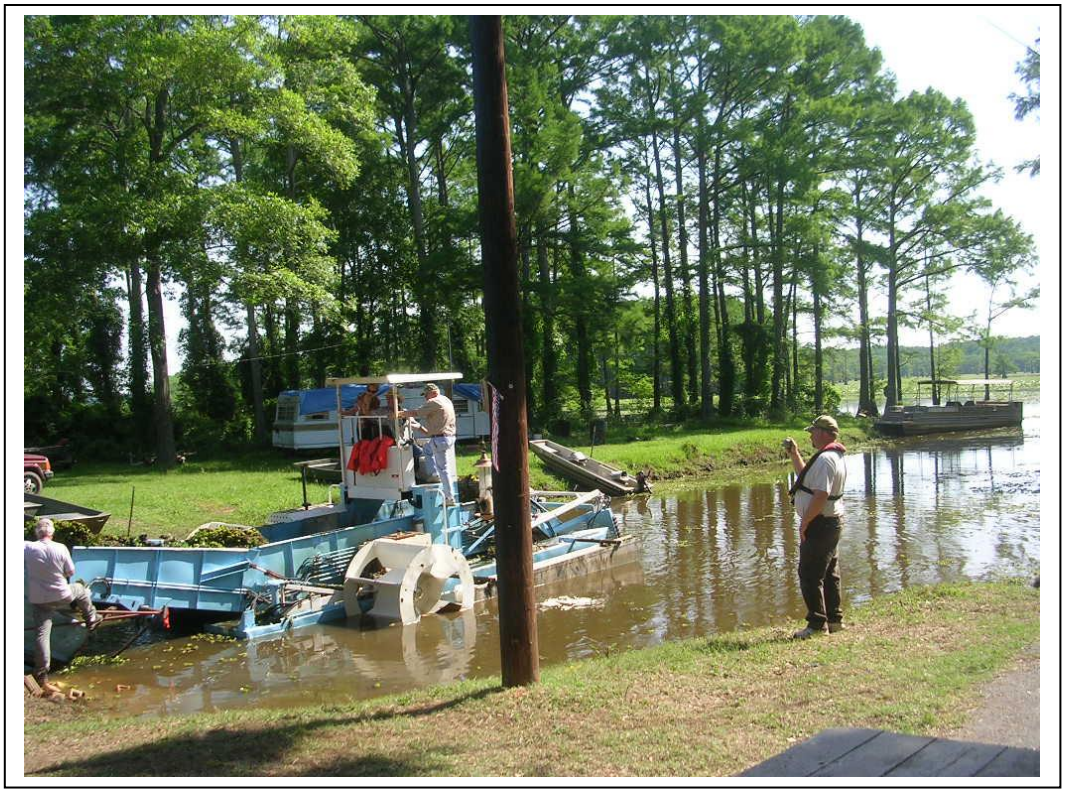
Operations observed totaled 100 hours.

NOTE: *During these operations, the project was visited by numerous people interested in mechanical harvesting, ranging from agency personnel and elected officials to shoreline property owners at Caddo Lake and nearby water bodies who have been adversely affected by IAV. More than 50 visitors were allowed to board the harvester and accompany the operators during the course of the project, or were transported on an accompanying vessel to observe operations at close range.*

Harvester owner/operator John Sanders demonstrates controls to Dr. Jack and Mary Jane Sanders, long time Caddo Lake advocates and residents.

General Information:

Operations were based at Tucker's Camp, off Texas FM 9 near the south shore of Caddo Lake. Tucker's provided exclusive use of a boat ramp for the shore conveyor, a channel for harvester and support vessels, and a paved drive for dump truck operations.



ABOVE: Louisiana Department of Wildlife & Fisheries biologist Jeff Sibley photographs harvester as it approaches shore conveyor in boat channel at Tucker's Camp.

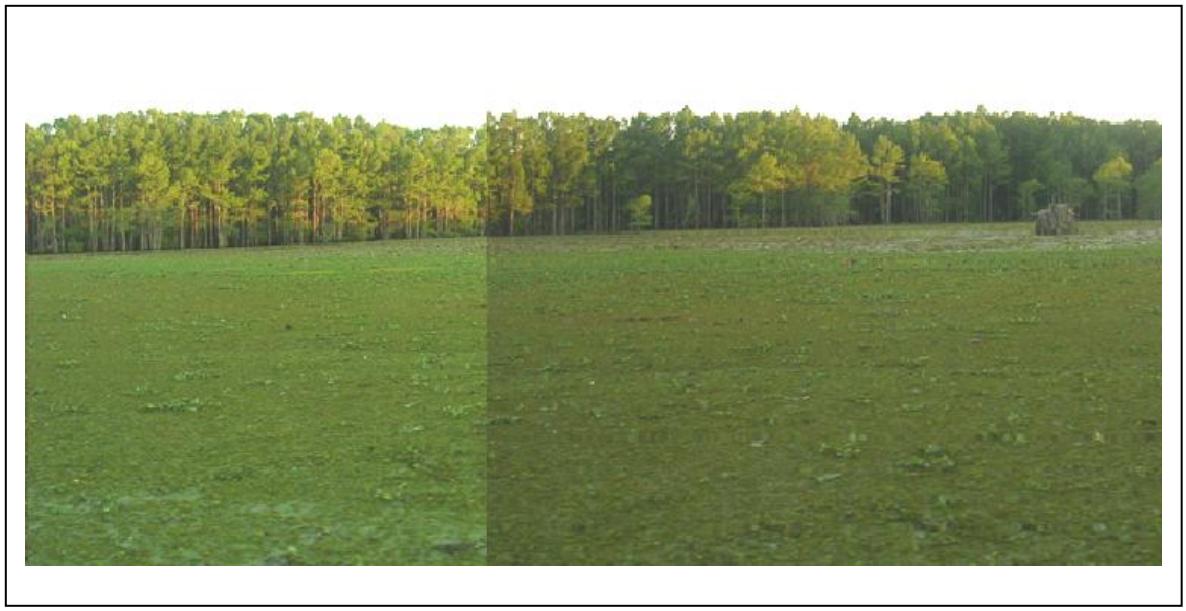
RIGHT: Mrs. Barbara Tucker, owner of Tucker's Camp, with friends as Harvester Trials prepare to get underway.

Area where trials occurred.

ABOVE: Composite photo showing NE corner of project area immediately before harvester trials began. This location is approximately 600 yards due east of the entrance to Tucker's Camp and until recent years was known to local anglers as one of the best bream fishing spots on Caddo Lake.

ABOVE: Moving east from Tuckers, this view on Boat Road FF looks toward Marker BR F21, before trials. Area in photo above is immediately to the left.

ABOVE: Looking northwesterly at trial area. BELOW: Continuation of photo above.



As can be seen in these photographs, the trial area was densely populated with mixed floating IAV. Prior to these heavy infestations, this area was frequented on an almost daily basis by anglers. Because of its close proximity to Tucker's Camp, a large number of these anglers were people who rented Jon boats without motors and paddled into the area. During Spring & Summer 2009, IAV virtually eliminated access to good fishing areas for people who do not have boats and outboard motors, and severely impacted Tucker's Camp and other marinas that provided boat rentals.

Sampling the vegetation in the trial area.

ABOVE & BELOW: Crews randomly removed 1 cubic meter samples of floating vegetation in the trial area for evaluation on shore.

ABOVE: Volunteer Texas Master Naturalists helped to assess samples. On average, floating aquatic vegetation removed in the trial area was determined to be approximately 62% giant salvinia and 38% water hyacinth. BELOW: TMN volunteers also helped record times and took photographs.

Harvesting.

ABOVE: The Harvester begins operations, removing vegetation on a 6 ft wide steel conveyor framed with vertical and horizontal cutting heads. Water depth at this location during this run was approximately 2.5 feet.

ABOVE: Rear view as harvester completes a run. BELOW: Close up giant salvinia and some spatterdock roots.

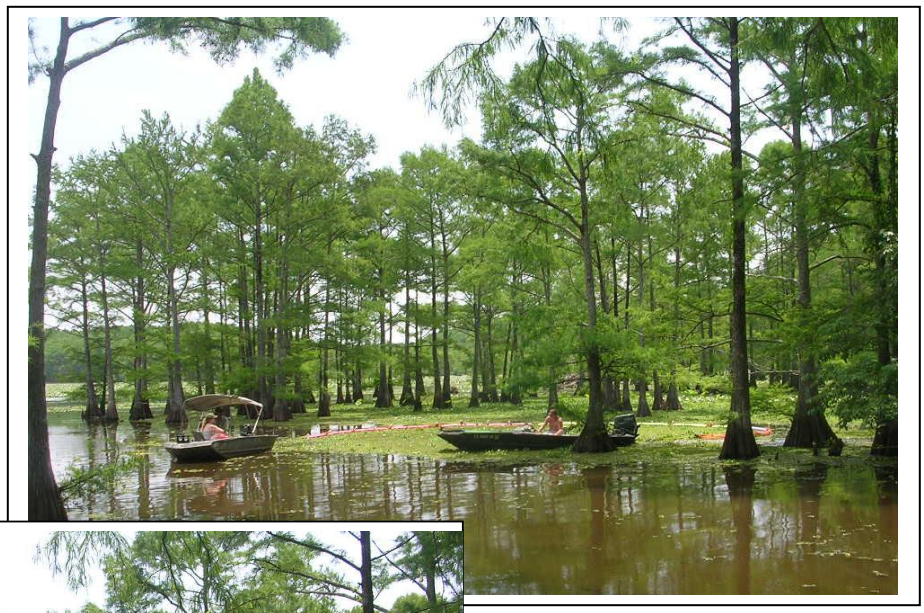
LEFT: Unloading from harvester to conveyor into dump truck. Fully loaded, the Model H6-4000B holds approx. 4,000 lbs/400 cubic feet of material.

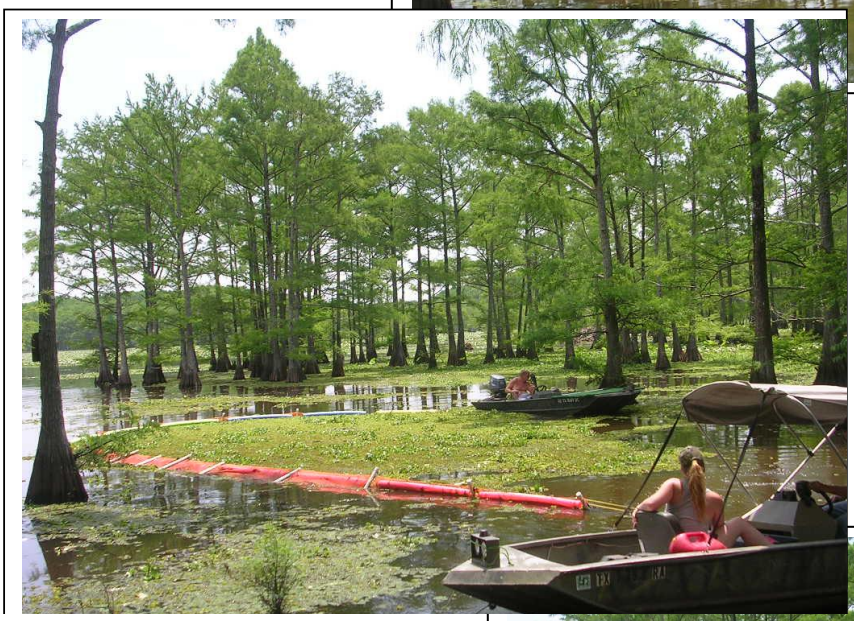
BELOW: Harrison County Judge Richard Anderson observes conveyor operation.

ABOVE: Removed vegetation was trucked to a field approximately 2 miles south of the project area and dumped into rows. BELOW: Periodically, vegetation piles were spread using a backhoe, at the request of the landowner who wanted the material for soil improvement.

Ancillary activities tested & observed.

ABOVE & BELOW: As boat roads and other passageways were opened by the harvester, low-cost booms were devised and deployed to help contain IAV in the operating area and to determine if other benefits might be provided by coordinated on-water support activities.





Among other operations, booms were used to capture IAV in tree-congested areas and drag vegetation into the path of the harvester.

Conclusions, Observations & Recommendations.

1. Test and evaluate whether mechanical harvesters can effectively operate in Caddo Lake's shallow, stumpy waters.

A. It was determined that mechanical harvesters can effectively operate at Caddo Lake.

- The harvester operated over 100 hours without losing any time to mechanical difficulties arising from underwater obstructions.
- Harvester operated in depths as shallow as 1.5 feet.
- Harvester encountered numerous stumps, cypress knees, submerged posts, and even iron re-bar. In every case, the equipment performed as it is designed to do – disengaging sickle blades and conveyor mechanism so that the operator could easily adjust directions and proceed without significant delay.
- When the equipment was removed from the water and examined, only one sickle blade was damaged by submerged objects, and that was believed to have occurred when the operator was using it to dredge silt in front of his own property after the trials were concluded.
- The harvester easily removed floating vegetation, rooted vegetation, and in some cases silt and sludge.
- The harvester was able to approach a wide variety of shallow shoreline environments and configurations, demonstrating it can offload in a variety of site types other than the paved boat ramp at Tucker's Camp where trial operations were based.

B. As noted elsewhere in this document, these trials were conducted without the benefit of having transport barges that are normally used to convey material the harvester has removed from the water to a shoreline offloading site. Consequently, most of the time the harvester was operating was spent returning to the offloading site to discharge removed vegetation, or returning to the removal area from the offloading site.

Therefore, the question of "effectiveness" answered by these trials is concerned solely with removal of vegetation from the water. That is, the principal objective was to determine whether mechanical harvesting machinery would or would not break down in the shallow, stumpy environment of Caddo Lake.

This was deemed to be a worthwhile undertaking because prior to these trials, it was commonly asserted by many parties involved in Caddo Lake IAV control that mechanical harvesters cannot operate at Caddo Lake. It is probable that this belief arose from unfavorable attempts to deploy mechanical harvesting equipment at Caddo Lake many years earlier, before improvements in hydraulic controls and other mechanical aspects of the equipment produced a generation of harvesters that are designed to compensate for underwater obstructions.

2. Determine the rate at which aquatic vegetation can be removed from Caddo Lake by harvesting machinery.

A. It was determined that the model harvester used in these trials (UMI Harvester Model H6-4000B, storage capacity 400 cf/4,000 lbs) could load to full capacity at an average time of under 6 minutes. (5.48)

B. It was determined that the model harvester used in these trials could offload from full capacity to the shoreline conveyor in an average time of approximately 4 minutes (4.17)

C. Depending on type of transport barges used with this model harvester, the following deductions can be made:

- Potential removal rate is 4,000 cf/40,000 lbs (wet) vegetation removed per hour, if harvester is deployed in concert with transport barges that can dock and undock during continuous operation. (10 full loads per hour)
- Potential removal rate is 2,400 cf/24,000 lbs (wet) vegetation removed per hour, if harvester must stop operations to offload to a transport barge. (average time for loading/offloading = 10 minutes = 6 full loads per hour)
- Based on estimated 82,000 lbs giant salvinia per acre (100% coverage), it can be expected that this model harvester would require a minimum of 2.1 hours operation per acre cleared.

3. Record useful observations that might be helpful in evaluating possible future mechanical removal trials or operations.

A. Harvester model & capacity.

- The harvester used in these trials was bought used and refurbished by the owner/operator. Based on his experience in these trials, he believes a larger harvester with a 12 foot cutter with storage capacity of 1,200 cf/12,000 lbs would greatly improve efficiencies.
- The owner/operator also states that a systematic mechanical removal program at Caddo Lake would require several mechanical harvesters of varying sizes to respond to different situations and environments as well as multiple transport barges and shore conveyors with related trucking equipment.

B. Effect on marine animal life.

- Because one of the disadvantages of mechanical removal often found listed in discussions of the subject is that harvesters may have a negative impact on fish and other marine animal populations, considerable care was taken to scrutinize material as it was being removed and when it was being offloaded. Only rarely were fish,

turtles or snakes observed in the vegetation removed from the water during these trials. It is thought that this is the case because the trials were conducted in an area where giant salvinia had been the dominant plant species for an extended period, causing most marine animals to depart prior to the trials.

- Careful inspection was also done of the 1 cf samples that were removed periodically by net from the surface of the project area and very few specimens of small fish, crustaceans or even insects were observed.
- Based on the two observations above, it is believed that where giant salvinia is the dominant vegetation in an area any effects of mechanical removal on animal life will be minimal and inconsequential.

C. Effect on habitat.

- The most immediate and perhaps profound observable benefit to mechanical removal is that the improvement on habitat is immediate. Even operating under the handicap of having to return to the shore conveyor to offload each time the harvester reached capacity, substantial areas were cleared of vegetation each day.
- As awareness of the mechanical removal project spread, many low-income anglers who in the past have rented non-powered boats from Tucker's Camp began to return to the area and were again able to reach good fishing areas within easy paddling distance.
- Although some turbidity was noticeable in the wake of the harvester, it appeared to quickly settle and within minutes of the harvester passing along an area there was no readily noticeable change in water quality.

D. Use of booms to protect open areas.

- The project determined that a variety of booms could be produced easily and inexpensively using Styrofoam tubing and PVC.
- Booms were easily deployed by a lone operator in a small boat for the purpose of preventing an area that is being cleared by the harvester from being reinvaded by wind and current-borne IAV.
- Booms or other containment structures are probably necessary to protect an area that has been cleared of IAV in areas of Caddo Lake where mechanical removal is used to improve human access and recreation.

E. Use of booms to capture IAV and drag to harvester.

- Capturing and dragging floating aquatic vegetation requires two boats working together. The project determined that small boats deploying a floating boom can penetrate areas such as cypress brakes that are inaccessible to larger equipment such as a harvester, corral vegetation, and pull it into an open area where a harvester can remove it from the water. This process is labor intensive and floating booms alone cannot effectively remove small clusters of giant salvinia and water hyacinth clinging to tree trunks, cypress knees, and stumps.

- Small boats deploying booms can be effective at corralling floating vegetation and pulling it into the pathway of a mechanical harvester in other situations, however, and this technique could be explored and improved.

- Using booms to drag IAV from one area to another has its limits. In areas where hydrilla is present, it was observed that floating vegetation such as giant salvinia and water hyacinth quickly became entangled in hydrilla and other rooted plants. Movement of IAV under these circumstances is difficult at best and it does not seem likely that it can be effectively done.

F. Strategic avoidance of some vegetation.

- It was observed that in areas where dense populations of water lilies, spatterdock, and some other rooted vegetation exist, it is sometimes desirable for the harvester to avoid removing those plants, allowing them to remain as natural barriers to prevent floating IAV such as water hyacinth and giant salvinia from returning to an area that is being cleared.

ABOVE: "Natural" barrier of lily pads left in place helps protect area that has been cleared from wind & current borne IAV.

Cost Analysis

Following is an analysis of capital cost to create a mechanical removal unit capable of operating effectively at Caddo Lake or comparable water bodies in the area.

1. Obtain serviceable used harvester, trailer & shore conveyor.	50,000
2. 2 Transport barges @ $50K ea.	100,000
3. Dump truck (used)	25,000
4. Tractor w/disk for disposal	25,000
5. Front end loader for spreading	25,000
6. Miscellaneous (20 %)	45,000
Total capital required to create one Mechanical Harvesting Unit:	270,000

Operating expenses: (based on 10 hour day)

Labor (per day):

1 Harvester operator @ 15 p/hr	150	
2 Transport barge operators @ 15 p/hr	300	
1 Truck driver @ 15 p/hr	150	
1 Supervisor @ 25 p/hr	250	
Payroll taxes, ins, etc (15%)	120	
Labor per day:	970	970

Other:

Fuel (diesel, oil, hydraulic fluids)	200	
Repairs/maintenance	200	
Interest on 250,000 cap invst @7%	100	
FIT on 150,000 profit @37%	200	
Other per day:	700	700
Total operating expenses:		1,670

Cost per hour of operation: $167
Cost per acre cleared (2.1 hrs estimated): $350.70

Analysis of viability of a mechanical harvesting contractor based at Caddo Lake.

Based on discussions with a number of mechanical harvesting contractors, the following elements are essential to create a Caddo Lake based mechanical contracting service provider operating a single unit as described above.

- Minimum of 1500 hours per year guaranteed work @ $200 per hour.

Cost for 1500 hours of mechanical removal is $300,000.

Estimated amount of vegetation that would be removed in 1500 hours would be 3,600,000 cf/36,000,000 lbs.

Based on estimated 82,000 lbs per acre 100% covered by giant salvinia, it is estimated that 1500 hours would result in clearing approximately 439 acres with the model harvester used in trials.

ABOVE: Area before harvesting. BELOW: Same area midway through trials.

Additional photos & links to videos.

ABOVE: U.S. Rep. Louie Gohmert interviewed after observing trials. BELOW: Marshall Mayor William E. "Buddy" Power and City Commissioner Jack Hester observe operations.