UNIVERSITY OF FLORIDA
INSTITUTE OF FOOD AND AGRICULTURAL SCIENCES
Center for Aquatic Weeds
AQUAPHYTE
International Plant Protection Center
AQUATIC WEED PROGRAM

VOLUME 4 NUMBER 2 GAINESVILLE, FLORIDA FALL 1984

WALT DISNEY WORLD: METHANE FROM WATER HYACINTH

Among the futuristic technological achievements at Walt Disney World (Orlando, Florida) one is not seen by the general public: an experimental system which integrates a water hyacinth wastewater treatment process with a methane production facility. In the system, some wastewater from the attraction's theme parks is cleansed by the action of water hyacinths, which are subsequently harvested and fed to a sophisticated anaerobic digestor for the production of usable methane. The project is sponsored by the Gas Research Institute (GRI) and according to them, "this research is expected to benefit the gas consumer and the public at large by providing local sources of pipeline-quality gas." Results here may lead to the construction of commercial full-scale water hyacinth utilization facilities in the late 1980s.

The first part of the system is the hyacinth secondary and tertiary wastewater treatment process. After some solids have settled out as sludge in the "primary clarifier", the water is diverted to concrete channels where the plants are cultured. Here, the plants remove unwanted nutrients and other pollutants, while complex organic wastes are broken down to simpler compounds by the bacteria which live on the water hyacinths. These simpler waste compounds are then utilized by the growing hyacinths. Under these conditions, the hyacinths grow luxuriantly.

continued on page 4

INTERNATIONAL SYMPOSIUM ON AQUATIC MACROPHYTES

Danish institutions for research in aquatic ecology have planned a symposium on aquatic macrophytes in Silkeborg, Denmark, 26-30 August, 1985. The symposium will focus on the physiology and ecology of submerged macrophytes. The three main topics for the symposium are: 1) Regulation of carbon metabolism through photosynthetic fixation and respiratory losses, 2) Regulation of field growth rates by internal and external variables, and 3) The effect of submerged macrophytes on ecosystem functioning in macrophyte dominated systems.

Four days will be used for scientific presentations and discussion and one day for excursion in Jutland, Denmark's lake district. Full hotel accomodations including all meals will range from about 2,400 D.kr. ($240.00) to 2,650 D.kr. ($265.00). The symposium registration fee is 500 D.kr. ($50.00).

For additional information, registration forms, hotel reservations, etc., contact the Secretary, **Dr. Morten Sondergaard, Botanical Institute, University of Aarhus, Nordlandsvej 68, 8240 Risskov, DENMARK.** Others on the organizing committe are **Dr. Kaj Sand-Jensen of the University of Copenhagen Freshwater Biological Laboratory, and Dr. Niels Thyssen of the National Agency of Environmental Protection Freshwater Laboratory.**

FLORIDA ENACTS WETLANDS PROTECTION LAWS

The 1984 Florida Legislature passed statutes which legally define and are expected to help conserve the State's remaining wetlands.The "Warren S. Henderson Wetlands Protection Act of 1984" (F.S.S. Chapter 403, part VIII) created a vegetative indicator index to use in defining wetlands and also empowered the Florida Department of Environmental Regulation to approve or deny mandatory permits for various operations in wetlands.Approval or denial is to be based on the expected impact of proposed operations on entire wetland ecosystems, including water quality and wildlife.The Act is the product of cooperative work of developers, farmers, ranchers, foresters and conservationists, and became law on October 1, 1984.The DER received $1.1 million and 18 new staff positions to implement the new law in its first year.

The Act defines the extent of wetlands according to vegetative dominance of wetland indicator plants.A list of more than 250 wetland indicator species is included with the Act.An area with a certain percentage cover (depending on plant stratum) of an indicator plant will be considered a wetland.Any dispute about vegetative dominance will be resolved by soil analysis of the area and the presence of hydric soils will indicate the area is a wetland.

Those with permits to operate in wetlands, according to the Act, will not violate water quality

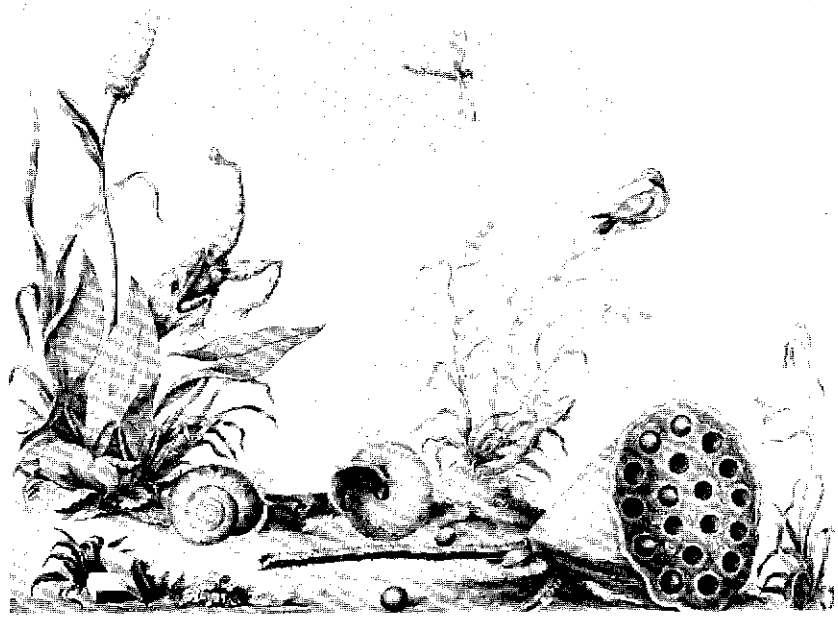
continued on page 2

RETIRING? MOVING? PLEASE DON'T THROW IT AWAY!

The Aquatic Weed Program will be happy to accept your reprints, books and reports. ANYTHING ABOUT ANYTHING about aquatic plants will be cataloged and entered into the Aquatic Plant Database and made available to your fellow researchers in 63 countries. Contact The Aquatic Weed Program, 2183 McCarty Hall, University of Florida, Gainesville, Florida 32611, USA. (904) 392-1799.

WETLANDS RESTORATION AND CREATION

The 12th Annual Conference on Wetlands Restoration and Creation will be held on May 16-17, 1985 in Tampa, Florida. This forum on research in the restoration, creation and management of freshwater, estuarine and marine wetland systems includes sections on marsh, mangrove and seagrass restoration; mitigation, permitting and regulatory policies; mine reclamation, and management techniques. For more information, contact Mr. Fred Webb, Hillsborough Community College, Plant City Campus, 1206 North Park Road, Plant City, Florida 33566, USA. (813) 754-1561.



William Bartram's illustration of plants and animals from Florida, showing *Pistia stratiotes,* the rosulate-leaved plant on the left side of the plate. *(See Story, page 6)*

NEW THREATS INVESTIGATED IN FLORIDA

by Deborah White, University of Florida Center for Aquatic Weeds

A stand of one of the world's worst weeds has established itself on the margins of Little Lake Bonnet in Highlands County, Florida. The spiny plant forms impenetrable thickets up to 12 feet tall and biologists are concerned that it may spread into other Florida wetland and aquatic habitats, becoming economic liabilities to public and private agencies. The plant, *Mimosa pigra var. pigra*, can take over aquatic and terrestrial sites, prevent access to water supplies by man and beast and in some countries has filled up water channels by as much as 40%. Based on the plant's world-wide reputation as a serious pest, *Mimosa pigra var. pigra* was included on the federal noxious weed list (7CF Part 360) published in June, 1984

The *Mimosa* infestation was described by the author during aquatic plant surveys during the summer of 1984. The surveys were conducted to identify infestations of recognized pest species that reportedly occur in Florida and to determine the distribution and size of aquatic plant populations of certain lakes. Pest species found were cultured for growth and salinity studies and for herbicide trials. Some of the species located and studied in Florida include *Mimosa, Cyperus papyrus, C. alternifolius, Leersia hexandra, Paspalum paspalodes* and *Ludwigia uruguayensis*. Introduction of these plants into Florida has been through natural dispersion (for examples, *Ludwigia uruguayensis* and *Paspalum paspalodes*) and as escapes from aquaria. Others are sold as ornamental plants. This research was supervised by Dr. William T. Haller and sponsored by the USDA/ARS Cooperative Agreement.

Because these species have become naturalized in Florida, it is important to assess their growth potential by monitoring their biological success, both reproductive and vegetative. Although these plants have been very successful and are considered weeds in other areas of the world, their success potential is unknown in Florida, where they may be limited by pathogens and other ecological conditions. Information obtained through our studies can be important not only for developing controls for Florida populations, but also may be significant to control strategies in other countries, especially if biological control agents are discovered.

Despite the recognition of *Mimosa pigra* as a serious pest, its biology is not fully known and its controls only now are being researched. The plant is so new to Florida that even aquatic specialists must learn to recognize it. (See drawing) Distinctive characteristics of this leguminous shrub are its "sensitive" bipannate leaves (folding upon touch), recurved prickles and spines on arching stems, an axillary globose inflorescence and flat brown legume composed of hairy seeds appearing as transverse sections. The seed morphology is ideal for efficient wind, water and animal dispersal. This mechanism, combined with *Mimosa*'s ability to rapidly colonize exposed, disturbed soils, insures the continued success of this species. Some research has shown glyphosate and fosamine to be effective controls; manual controls are ineffective. Recently, education programs, biological control research and integrated management schemes have begun. For more information about *Mimosa*, write to **MIMOSA BULLETIN, Center for Aquatic Weeds, 7922 N.W. 71st Street, Gainesville, Florida 32606, USA.**

Mimosa pigra in Florida

Another exotic plant found in Florida, *Cyperus papyrus* (Egyptian paper plant), has been an overwhelming pest of African lakeshores and rivers. Both this sedge and *Cyperus alternifolius* (umbrella sedge) are popular ornamentals in central and south Florida. Although they both have established along Florida waters, they have not formed the unmanageable floating mats that are their characteristic growth habit in tropical Africa. However, these plants do form large, dense clumps and, aided by their ability to produce runners, compete with native species for shoreline or any open area that is seasonally flooded. Continued monitoring of these populations will help determine what, if any, control measures should be applied.

Other species still are being studied but they are likely to be localized problems only and probably will not become a threat to Florida's environment. We will continue to collect information on the distribution of populations and the biology of these and other aquatic species introduced into Florida.

WETLANDS, *Continued from page 1*

standards, will not adversly affect conservation of fish and wildlife or their habitats, will not adversly affect navigation or water flow or cause erosion, will not adversly affect fishing or recreational values or marine productivity and will not adversly affect significant historical or archaeological resources.

In the case of "agricultural activities", the State's Water Management Districts have been directed to construct and operate "agricultural water management systems" which generally will be exempt from water quality standards. However, the "impact of agricultural water management systems on groundwater quality shall be regulated by water management districts."

The Act also states that 'it is the intent of the legislature' to utilize certain wetlands as natural means of stormwater managment and also as areas for tertiary domestic wastewater treatment. The DER is developing rules for these intents of the legislature.

The DER and Water Management Districts are directed by the Act to establish a central wetlands monitoring system to keep records relating to wetlands utilization, development, conservation and loss throughout Florida.

The Act also gives the DER additional authority to regulate the mining of peat in Florida and requires miners to restore mined areas.

Copies of the Wetlands Protection Act can be obtained from the Information Office, Department of Environmental Regulation, State of Florida, 2600 Blair Stone Road, Twin Towers Office Building, Tallahassee, Florida 32301, USA

ASOCIACION ARGENTINA DE LIMNOLOGIA

This is a newly formed (March, 1984) and comprehensive association of limnological specialists from throughout Argentina, numbering several hundred. The aims of the AAL are to promote scientific exchange and discussion about limnological research through meetings and symposia, publish a Periodical Bulletin, encourage and assist aquatic ecosystem managers, and to maintain a directory of Argentine limnologists.

All aspects of limnology are represented in its membership including ecology, biology, and taxonomy for all groups of plant and animal species of aquatic environments, and includes specialists in such areas as water quality and sedimentology. The elected Directive Committee includes President Juan A. Schnack, Vice-President Juan C. Paggi, Secretary Estela C. Lopretto and Treasurer Alberto Rodrigues Capitulo

The Asociacion has published a *Directory of Argentine Limnologists*, a listing of its members, their areas of scientific specialty, their institutional affiliations and their addresses.

Annual subscriptions are A $400 for Argentine members and US $10 for foreigners. Other information can be obtained by writing, **Asociacion Argentina de Limnologia, Av.Angel Gallardo 470, 1405 Buenos Aires, Argentina.**

Center for Aquatic Weeds
AQUAPHYTE
International Plant Protection Center

AQUAPHYTE is the newsletter of the Center for Aquatic Weeds and the IPPC Aquatic Weed Program of the University of Florida Institute of Food and Agricultural Sciences (IFAS). The International Plant Protection Center (IPPC) is a unit of Oregon State University and is funded by the United States Agency for International Development (AID). Support for the Aquatic Weed Program also is provided by the Florida Department of Natural Resources (DNR).

EDITOR: Victor Ramey

AQUAPHYTE's circulation is 4,000. It is distributed to aquatic biologists and agencies in 65 countries. Comments, announcements, news items and other information relevant to aquatic plant research are solicited.

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WILDLIFE AND WATER MANAGEMENT CAN BE COMPATIBLE

Water control systems in Europe have been dug and re-dug since at least Roman times to contain and channel flood waters, to irrigate agricultural areas and to float barges for commerce. These channels always seem to be straight, their sides paved, or barren. They may look good to engineers, who look for maximum this and minimum that. Conservationists, though, appreciate canal mathematics less than engineers, and notice more the elimination of wetland wildlife habitats which are being drained by these water carriers.

In Great Britain, water managers and wildlife conservationists recently have joined to find ways to "integrate nature conservation" into the design of water control systems. Alarmed by their country's rapid loss of wetlands and wildlife, the Nature Conservancy Council (the government body which promotes nature conservation) and others have decided that it is time to "shift from management that disregards wildlife and its needs, to management that achieves the same ends but takes the needs of wildlife into account."

At the 24th annual meeting of the **Aquatic Plant Management Society** (15-18 July 1984, Richmond, Virginia), delegates heard from their keynote speaker that water management channels do not necessarily have to be straight and unvegetated to be effective. According to Dr. T.O. (Dale) Robson, new channel designs can help restore wildlife habitats where wetlands have been drained, and vegetated banks can be more recreationally useful and more aesthetically pleasing. Robson says these new channels are efficient as flood control, irrigation and transportation systems, and cost little or no more to construct than older designs.(see diagrams) For more information, see *Nature Conservation and River Engineering* by C. Newbold, J. Purseglove and N. Holmes, 1983, published by Nature Conservancy Council, Attingham Park, Shrewsbury, SY4 4TW, U.K.

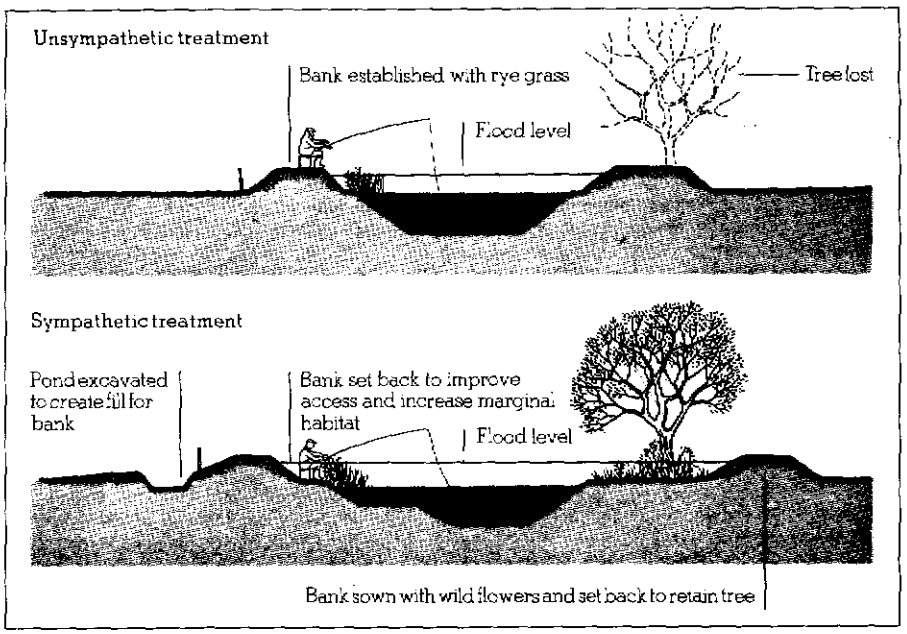
APMS Presidential Award

Dr. Robson is an expert in aquatic weed control, and for years has evaluated the use and efficacy of herbicides and other weed controls in water management systems. He recently retired from the Weed Research Organization in Oxford. (see *EWRS Research Group on Aquatic Weeds* elsewhere in this issue) In recognition of his contributions to the field of aquatic weed control, Robson was presented the APMS Presidential Award by A. Leon Bates. This was the first time this honor was conferred in the history of the APMS.

Other APMS News

Nearly 60 papers were presented at the recent APMS annual meeting in Richmond to an international audience. According to President Leon Bates and Dr. Max McCowen, program chairman, more people had submitted papers this year than in any previous year. Papers this year emphasized the latest discoveries about the biology and methods of control of the problem plants watermilfoil, water hyacinth and hydrilla. (Delegates also saw first hand that hydrilla has now spread to the Potomac River and even graces the Capitol's reflecting pool in Washington, D.C.) Grass carp also was discussed, and of particular interest was its complete control of hydrilla in Lake Conroe, Texas, as reported by R.D. Martyn, R.L. Noble and P.W. Bettoli. Other papers described the ecological effects of fluridone and endothall, the use of wetland plant communities as a means of wastewater treatment, the potential of some newly introduced plants also to become pests, *Eleocharis* as a source of allelopaths for controlling hydrilla and *Potamogeton pectinatus*, the effects of environmental factors on the activity of copper-based algicides, and growth requirements for certain algal species.

Dr. Max McCowen was sworn in as the new APMS president, and next year's program is being organized by Dr. Lars Anderson, president-elect. Secretary-Treasurer William N. Rushing again will handle the meeting's essential arrangements in Vancouver, British Columbia, and we all look forward to another excellent conference. For more information about the Aquatic Plant Management Society, contact Mr. Rushing at P.O. Box 16, Vicksburg, Mississippi 39180, USA.



MEXICAN AGENCY STUDIES AQUATIC WEEDS

by Dr. J. Gualberto Limon M., Centro de Estudios Limnologicos, Secretaria de Agricultura y Recursos Hidraulicos, Apdo. Postal 32, San Pedro Tlaquepaque, 45500 MEXICO

The main purpose of the Centro de Estudios Limnologicos (CEL) is to assess the state of Mexican lakes and to develop guidelines for their management, conservation and restoration. CEL is a federal research centre of Mexico under the Secretaria de Agricultura y Recursos Hidraulicos and is located between Guadalajara and Lake Chapala, the largest Mexican natural lake.

Since a frequent problem of our lakes is macrophyte infestation, a research office at CEL has been charged with investigating the control of aquatic weeds. Currently the most troublesome aquatic plants in Mexico include *Eichhornia crassipes, Potamogeton* spp., *Typha* spp. and *Hydrilla verticillata*. They are widely distributed, except *Hydrilla* which is found mostly in the northeast of Mexico. Another program of this office is to form a "Herbarium of Mexican Aquatic Plants". As of now, we have collected 683 specimens, comprising 163 species.

Part of CEL research has been the evaluation of the grass carp (*Ctenopharyngodon idella*) as a biological control agent for our most troublesome submerged macrophytes. Since grass carp is considered a valuable protein source in some countries, utilization of the fish as a biocontrol in Mexico could be doubly beneficial. In our first stage laboratory tests, food preferences of grass carp for local waterweeds were determined. These tests showed significant potential of grass carp for the control of *Potamogeton filiformis*. Subsequently, grass carp have been used successfully to control *P. filiformis* in irrigation canals.

Another area of our research is the biological control of water hyacinth. With the cooperation of the United States Department of Agriculture and University of Florida laboratory at Fort Lauderdale, Florida, the water hyacinth weevil (*Neochetina eichhorniae*) has been imported into Mexico. After having successfully completed specificity tests with our local plants of both economic and ecological importance, we are now in the final stages prior to its large scale release.

Because CEL is interested in expanding its research on water weeds, I made a two-week visit to Florida to obtain updated information on the control of aquatic plants. My technical visit included attending the short course on control of waterweeds at the University of Florida at Gainesville. I also discussed current topics of aquatic plant management with the staff of the Center for Aquatic Weeds at U.F., especially with Dr. William T. Haller who also kindly made the necessary contacts for the rest of my trip. Since CEL has focused its research interests on biological control of waterhyacinth, I also visited the laboratory at Fort Lauderdale. There I met Dr. Ted Center and discussed with him the latest developments in this area. My visit also covered operational aspects of aquatic plant management in Florida including programs in Polk County and on Lake Okeechobee.

METHANE/WATER HYACINTH,
Continued from page 1

After several days flow through the hyacinth channels, the water is clearer, waste compounds have been reduced, and the discharge stream meets water treatment standards.

To increase hyacinth growth rate and to remove polluting compounds from wastewater more effectively requires scheduled harvesting of the hyacinths, and scientists are studying which harvesting schedules best fit the seasonal growth patterns of the hyacinths.

The next part of the Disney World hyacinth system is the biogasification process in which harvested water hyacinths are anaerobically converted into pipeline quality methane gas. Encouraged by results of bench-scale tests, GRI built this scaled-up (1200-gallon) experimental unit which began operation in January 1984. Experiments with this test unit are expected to continue until 1987, when another scale-up will be built. This next scale-up may verify the economic suitability of the concept before design and construction of a full-scale commercial facility is attempted.

The pictured test unit is "designed to include the major physical, chemical, and biological operations and processes essential to the functioning of a full-scale biogasification plant." The unit has complete processing capabilities including water hyacinth and sludge preparation, feed blending, anaerobic digestion, gas treatment, and effluent handling. The effects of loading rates, particle size, hyacinth/sludge mixing, and pre-and post-treatment are being determined.

Water hyacinths are processed through a chopper and grinder to reduce particle size. Sludge from the primary clarifier is mixed with the water hyacinths and added to the digester as a feed blend. Bacteria in the reactor digest the feed, producing methane and carbon dioxide. The undigested residues are collected and processed for potential use as animal feed or fertilizer. The gas is then "cleaned up" (carbon dioxide, hydrogen sulfide and moisture are removed) for pipeline distribution.

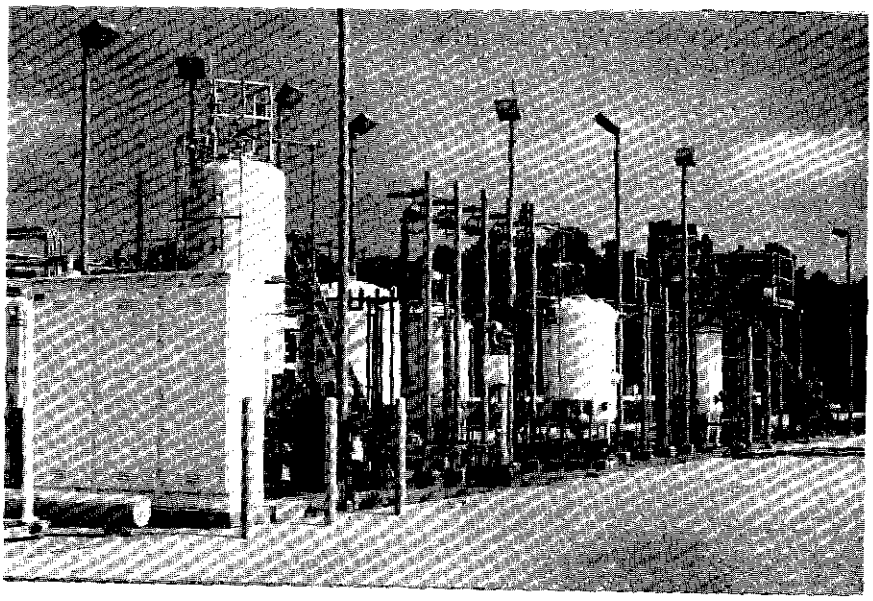
For more information on this waterhyacinth sewage treatment system, contact **Mr. Frederick M. Hueston, Manager, Water Hyacinth Project, Walt Disney World, P.O. Box 40, Lake Buena Vista, Florida 32830 USA, (305) 624-6448.**

For more information on the biogasification experimental test unit, contact Mr. Thomas D. Haynes, Manager, Biogasification Project, Gas Research Institute, 8600 West Bryn Mawr Avenue, Chicago, Illinois 60631 USA, (312) 399-8100.

D. Haskell/V. Ramey

The Aquatic Weed Program has about 40 articles and books on the biogasification of water hyacinths and about 50 on the use of water hyacinths in wastewater treatment systems.

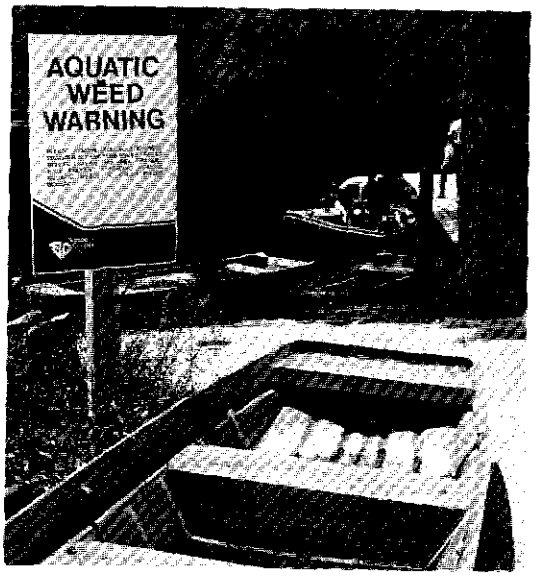
For more information contact:
Aquatic Weed Program
2183 McCarty Hall
University of Florida
Gainesville, FL 32611 USA
(904) 392-1799



SANTEE COOPER AQUATIC WEEDS

You think you have problems!

The huge (176,000 acres) Santee-Cooper in South Carolina was created in 1940 from Lakes Marion and Moultrie and the first aquatic weed battle began in 1943. Today, 30,000 acres of *Egeria densa* infest the system, and in 1982 *Hydrilla verticillata* appeared. (Other nuisance plants include *Ludwigia uruguayensis, Ceratophyllum demersum, Najas minor, Alternanthera philoxeroides* and *Myriophyllum heterophyllum.*



Santee-Cooper serves as a reservoir for hydroelectric production, but also supports $45 million tourism and commercial/recreational fishing industries. They are major stakes in the battle against aquatic weeds, and the cost of control there now approaches $.5 million a year.

Helicopters (above) help in the control efforts. According to John Inabinet, Supervisor of Santee-Cooper's water quality and weed control section, a single helicopter can treat with herbicides in one day what it would take a crew six weeks to treat (about 500 acres). Diquat is used for egeria control, Aquathol K is used against hydrilla.

Part of the control effort is spread prevention. At a boat ramp, fishermen check their live wells and propellors in response to this warning.

For more information, contact John Inabinet, Supervisor of Water Quality Management, Santee Cooper, #1 Riverwood Drive, Monck's Corner, South Carolina 29461, USA (803) 761-8000.