



UNIVERSITY OF FLORIDA  
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# Center for Aquatic Weeds

# AQUAPHYTE

## International Plant Protection Center



AQUATIC WEED PROGRAM

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### 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 cleaned by the action of water hyacinths, which are subsequently harvested and fed to a sophisticated anaerobic digester 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.

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### 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 accommodations 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 committee 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  
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### 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)

## *PISTIA STRATIOTES* (WATER LETTUCE) RECORDED FROM FLORIDA IN BARTRAMS' TRAVELS, 1765-74

by Dr. Ronald L. Stuckey and Dr. Donald H. Les, Department of Botany, College of Biological Sciences, The Ohio State University, Columbus, Ohio 43210, USA

*Pistia stratiotes* (water lettuce) is considered by most botanists to be non-indigenous or foreign to the flora of Florida, as well as elsewhere in the United States, apparently having originated in the Old World tropics. Little information exists, however, regarding when water lettuce made its first appearance in the United States. To determine whether a species is native or alien, it is essential to obtain some record of when it first invaded the area. We have not yet learned of this information for *Pistia stratiotes* in Florida, but our attention was recently drawn to accounts of the water lettuce in the *Travels* (1-6) of John and William Bartram, 1765-66 and 1773-74 that they made while in Florida.

During the Bartrams' first trip, while searching for the source of the St. John's River, 31 December 1765, they both saw, and John described for the first time in their *Travels*, "...prodigious quantities of the pistia, which grows in great plenty most of the way from hence to the head of the river and is continually driving down with the current, and great quantities lodged all along the extensive shores of this great river and its islands, where it is entangled... and... all matted together in such a manner as to stop up the mouth of a large creek, so that a boat can hardly be pushed through them, though in 4 foot water; these by storms are broke from their natural beds and float down the river in great patches, the roots striking deep, often touch the muddy bottom, and there anchor and fasten, and are ready to catch and entangle those that drive down upon them, and all together gather mud, by the daily accumulation of which they are formed into islands which are very numerous in this river, and are much enlarged by these plants fixing on their shores." (1) On 12 January 1766 at or near Lake Loughman, John recorded "...great patches of the pistia...all entangled together, covering many thousands of acres on St. John's and its branches, which heads in numerous rich swamps and marshes." (1) A similar phenomenon was noted by him on 19 January below Lake Beresford near Spalding's Upper Store.

As described in his *Travels* (2,3) of 1773-74, William Bartram, upon seeing the water lettuce in the St. John's River, wrote a much more detailed description than his father had earlier provided.

"It being a fine cool morning, and fair wind, I set sail early, and saw, this day [April, 1774], vast quantities of the *Pistia stratiotes*, a very singular aquatic plant. It associates in large communities, or floating islands, some of them a quarter of a mile in extent, and are impelled to and fro, as the wind and current may direct. They are first produced on, or close to the shore, in eddy water, where they gradually spread themselves into the river, forming most delightful green plains, several miles in length, and in some places a quarter of a mile in breadth. These plants are nourished and kept in their proper horizontal situation, by means of long fibrous roots, which descend from the nether center, downwards, towards the muddy bottom.

Each plant, when full grown, bears a general resemblance to a well grown plant of garden lettuce, though the leaves are more nervous, of a firmer contexture, and of a full green colour, inclining to yellow. It vegetates on the surface of the still stagnant water, and in its natural situation, is propagated from seed only. In great storms of wind and rain, when the river is suddenly raised, large masses of these floating plains are broken loose, and driven from the shores, into the wide water, where they have the appearance of islets, and float about, until broken to pieces by the winds and waves; or driven again to shore, on some distant coast of the river, where they again find footing and their, forming new colonies, spread and extend themselves again, until again broken up and dispersed as before." (3)

In Bartrams' *Travels*, *Pistia stratiotes* was recorded from the St. John's River system below Lake Beresford, at Lake Dexter, in Lake George, above Lake Harney, and on Salt Springs Run; also in the Suwannee River, according to the annotations in the published editions by Francis Harper. (1-3) At these places John and William Bartram both wrote of islets or floating fields of the bright green *Pistia*. William Bartram's drawings of the plants and animals seen on these journeys, never published by him, were retained in the John Fothergill Album at the British Museum (Natural History), London. Recently, the drawings were assembled with annotations prepared by Joseph Ewan and published by the American Philosophical Society. (6) Bartram's illustration of the water lettuce, shown with aquatic plants and animals that he encountered, is among them (Plate 59, described on page 85) and is reproduced here (Figures 1 and 2).

With reference to the initial question regarding when *Pistia stratiotes* first invaded Florida, the Bartrams' accounts are significant in that they date the species' occurrence in the state nearly a century earlier than data available from known herbarium specimens. The earliest specimens seen by the senior author are mostly from the St. John's River system and coastal localities. The following are noteworthy: (7) Abundant above Pilatka, St. John's River, Mar. 1872 (*J. Torrey s.n.*, NY); Tampa, Oct. 1877 (*A.P. Garber s.n.*, FLAS, PH, US); Lake Astachula, Sumter Co., Mar. 1879 (*J.D. Smith s.n.*, US); Hillsboro River above Tampa, Aug. 1880 (*A.H. Curtiss 2687*, FLAS, PH, US) [The year is given only on the specimen at US]; Tidal Creek near Jacksonville, 16 Feb. 1882 (*J.D. Smith 337*, US).

Because water lettuce is known to have been present in Florida as early as the middle of the eighteenth century, it could be considered native to the state. However, accounts of the biology of the species by Holm, et al. (8) report of the nearly complete failure of North American plants to set seed, in contrast to African individuals which produce several seeds per plant. These observations implicate the absence of appropriate pollinators for the species, and therefore suggest that the water lettuce has indeed invaded the region.

The town of St. Augustine, founded in 1565, could have provided an early avenue for the invasion of *Pistia stratiotes* into Florida. It is considered to be the oldest city in the United States and its trade connections to the outside world are well known. Exotic plants were imported into the region from the time of its earliest settlement, and easily could have escaped into the nearby St. John's River.



Fig. 2. William Bartram's illustration of *Pistia stratiotes*, the rosulate-leaved plant.

### Notes and references

Many versions of the lives and travels of John and William Bartram have been published. The following references have been used here:

1. Bartram, John. 1942. *Diary of a journey through the Carolinas, Georgia, and Florida from July 1, 1765, to April 10, 1766*. Annotated by Francis Harper. *Trans. Amer. Philos. Soc.* 33:i-iv, 1-120 + pls. I-XXII. Quotations, pp. 39, 42.
2. Bartram, William. 1943. *Travels in Georgia and Florida, 1773-74: A report to Dr. John Fothergill*. Annotated by Francis Harper. *Trans. Amer. Philos. Soc.* 33:121-242 + pls. I-XXVI.
3. -----, 1958. *The Travels of William Bartram: Naturalist's Edition, Edited with Commentary and an Annotated Index by Francis Harper*. Yale Univ. Press, New Haven. lxi, 727 pp. + 29 photographs and map. Quotation, pp. 57-58.
4. Berkeley, Edmund, and Dorothy Smith Berkeley. 1982. *The Life and Travels of John Bartram: From Lake Ontario to the River St. John*. Univ. Presses of Florida, Tallahassee. xvi, 376 pp.
5. Cruickshank, Helen Gere, ed. 1957. *John and William Bartram's America: Selections from the Writings of the Philadelphia Naturalists*. The Devin-Adair Co., New York. xxii, 418 pp.
6. Ewan, Joseph. 1968. *William Bartram Botanical and Zoological Drawings, 1756-1788*. *Amer. Philos. Soc.*, Philadelphia. x, 180 pp.
7. The specimens have been cited using the following standard herbarium abbreviations: FLAS, University of Florida, Gainesville; NY, New York Botanical Garden, Bronx; PH, Academy of Natural Sciences, Philadelphia; US, United States National Museum, Smithsonian Institution, Washington, DC.
8. Holm, LeRoy G., et al. 1977. *The World's Worst Weeds: Distribution & Biology*. Univ. Press of Hawaii, Honolulu. 609 pp.