VETIVER GRASS - AN EXOTIC, BUT...

Deliberately spreading an exotic plant around the world sends chills down the spines of many people, especially those charged with controlling exotic weeds. Many exotic weed problems come readily to mind - hydilla, water hyacinth, water milfoil, melaleuca, Australian pine, giant salvinia, torpedo grass, and others, depending on which part of the world you live in. In Florida alone, millions of dollars are allocated each year for the control of introduced exotic species. So why is the World Bank and the U.S. National Research Council (NRC) touting the use of an exotic species of grass, native to India, that grows two to three meters high with roots up to three meters deep?

Vetiver grass (Vetiveria zizanioides) is a coarse perennial "stiff-stem" grass found in the tropics of the Old World. It is in the same family as maize, sorghum, sugarcane and lemongrass. Named in 1771 by Linnaeus, zizanioides means "by the riverside", reflecting that it is commonly found along waterways in India. It is described as both a xerophyte and a hydrophyte (World Bank, 1990), or semiaquatic (Cook, 1990). Another species native to Africa, V. nigritana, is aquatic.

Vetiver tolerates an exceptionally wide pH range, and grows in any type of soil regardless of fertility. Its long, fibrous roots form a dense underground curtain. The grass is disease resistant, fire resistant, salt tolerant, and contains a strong aromatic oil that makes it unpalatable to rodents. It can withstand trampling and grazing by large animals because the plant crown remains below the surface of the soil. It also can withstand drought. The NRC states that "Vetiver is at home on the interface between land and water. It is one of the few terrestrial plants able to take wet conditions, even total immersion. For this reason alone, it might become outstandingly useful." (1993)

In an aquatic situation, might it become an outstanding nuisance?

ADVANTAGES

The features that make vetiver grass sound potentially formidable also make it sound like a rather remarkable plant for erosion control and water retention. Agricultural agents in developing countries recommend vetiver grass as a contour hedge for farming on sloping land. When planted as a tight hedge along the contour of the land, vetiver significantly slows water run-off from fields which allows time for water to soak into the soil before continuing along the normal watershed. The run-off also is filtered by the grass so that soil and organic debris collect at the hedge. This process causes a large, earthen terrace gradually to build up in front of the hedge, further stabilizing the sloping land and providing more land for farming. The extensive roots of vetiver grass are fibrous and grow straight down as opposed to spreading outward, which would interfere with crop growth. The deep roots anchor the plant firmly in the ground and stabilize soil even on steep slopes with large amounts of water run-off.

Vetiver grass also appears to be effective for stabilizing gullies when planted as a barrier across them. When used as a border grass, its dense growth is reported to prevent the rhizomes of weedy grasses from invading crops. In Ethiopia, the local grass, common African wild celery, is known as the "green Vetiver". (1993)

[See Vetiver on Page 8]
Here are three more APRLS-produced videotape programs for your viewing pleasure...

Aquatic Pest Control Applicator Training, Part I and Part II

Part I, 28 min., IFAS Catalog No. VT-1068;
Part II, 30 min., IFAS Catalog No. VT-1069.

These programs teach the basic knowledge necessary to become "certified" as a restricted use pesticide applicator in aquatic pest control (category 6) in Florida. Topics include a brief history of aquatic plant management, laws, herbicide technology, biological control, mechanical control and environmental effects. The programs were adapted from the Aquatic Pest Control Applicator Training Manual (IFAS Publ. SM-3), edited by Dr. Ken Langeland.

NHRA Gainesville Raceway Wastewater Treatment System

15 min., IFAS Catalog No. VT-455

In this program, Dr. Jerome Shireman (UF Department of Fisheries and Aquatic Sciences) explains the design and functioning of an innovative sewage treatment system, which processes the waste of 100,000 spectators at the annual Gatornationals auto racing event. This "batch" system uses aquatic plants as part of the treatment process, features on-site water disposal, produces fish and pine trees as salable end-products, and occupies only five acres of land.

Hormone Induced Spawning Of Grass Carp

25 min., IFAS Catalog No. VT-038

Grass carp are an effective biological control of submerged aquatic weeds, as well as a food-fish in many countries. Written by Mr Roger Rottman (UF Department of Fisheries and Aquatic Sciences), this video covers brood fish, mixing hormones, injecting fish, taking the spawn, inducing triploidy (by pressure), incubating eggs, stocking the fry, and raising them to salable fingerlings.

Programs may be borrowed from the Information Office (904/392-1799). Or they may be purchased from IFAS Publications, IFAS Building 664, Gainesville, FL 32611-0001 (904/392-1764). Each videotape costs US$15.00 (plus 90 tax for Florida residents), payable to the University of Florida. Checks or purchase orders are accepted. Specify VHS or European PAL format.
AT THE CENTER

GRASS CARP SYMPOSIUM

During a symposium to be held March 7-9, 1994, researchers and managers from across the U.S. will assess the environmental impacts of using grass carp in large lakes and reservoirs in the southern United States. The meeting will convene at the University of Florida Reitz Union.

It is co-sponsored by the Center for Aquatic Plants, the Florida Department of Environmental Protection, the Florida Game and Fresh Water Fish Commission, the U.S. Army Corps of Engineers - WES, the Tennessee Valley Authority, and B.A.S.S., Inc. For information, contact Bobbi Goodwin at 904-382-9613.

NUPHAR STUDY BEGINS

Dr. Ken Langeland, together with recent weed science graduate Mr. Brian Smith, will be conducting studies on spatterdock (Nuphar luteum) seed germination and ecological factors affecting seedling survival. Dr. Michael Kane of the Environmental Horticulture Department also will be working on the project to develop micropropagation techniques for Nuphar.

Spatterdock and other native plant populations have significantly declined in Lake Griffin, Florida. The researchers hope to apply their findings to restoration efforts in the lake during a pending drawdown. The restoration work will be coordinated with the Florida Game and Fresh Water Fish Commission.

AQUATIC PLANT HERBARIUM

'Til now at the University of Florida, most aquatic plant identification services and all aquatic plant archiving have been done by the university's herbarium. The Center for Aquatic Plants has long needed its own herbarium.

Now, room has been constructed and herbarium cabinets have been purchased for the start of an aquatic plant collection to be housed at the Center. Dr. Ken Langeland intends to make use of the many samples that Florida Lakewatch volunteers and others frequently bring to him for plant identification. With the help of the Herbarium, Langeland will preserve and catalog the specimens into a herbarium collection which will be open to the public.

Although the collection will concentrate on Florida species, Langeland wants to include specimens of exotic species with weed potential for Florida such as Lagarosiphon, Nechamandra, and others. He hopes to acquire these specimens through exchange with other herbaria.

HAVE DISC, WILL TRAVEL

The use of "interactive videodiscs" in training and education has increased in recent years. Inexpensive off-the-shelf videodisc players and TV sets are all that are required to take advantage of this technology, which provides random access video and instructional segments, guided by the user on-screen menus. Many of you have used them in the form of "information kiosks" in shopping centers, airports and museums. Many of your children use them in school to learn about everything from biology to art.

Recently, a prototype interactive videodisc on the identification and control of submerged aquatic plants was demonstrated at the annual meeting of the U.S. Army Corps Aquatic Plant Control Research Program (APCRP) in Baltimore. The videodisc is under development by the University of Florida Center for Aquatic Plants and the APCR. The goal is to develop better training materials for Corps water managers throughout the country.

Above, disc developer Vic Ramey demonstrates the prototype to Greg Jubinsky, of Florida’s Department of Environmental Protection. Ramey holds a copy of the prototype in the form of a rewritable optical disc.

CENTER FOR AQUATIC PLANTS
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Dr. William Haller, Interim Director
Hydrocotyle ranunculoides in the Canning River

by R. Ruiz-Avila, V. Klemm and N. Siemon. Environmental Investigations and Assessments Division, Swan River Trust, Perth, Western Australia

The Swan-Canning River is a major river system flowing through Perth, the capital of Western Australia. In the early 1980s the aquatic weed *Hydrocotyle ranunculoides* was observed in a creek and within five years it had spread into the Canning River Regional Park. *Hydrocotyle ranunculoides*, a common aquarium plant, was readily available throughout Western Australia. In the Canning River it probably originated from the release of garden and aquaria wastes into drains. The weed remained fairly static in the river system until early 1991, when the distribution suddenly became more extensive. It is now a major problem which must be controlled in the short-term and eradicated in the long-term.

In the Canning River *Hydrocotyle ranunculoides* is a floating, stoloniferous plant with a creeping stem. Profuse filiform roots grow down from the stem into the water and the leaves emerge above. The plant anchors to the bank and grows vegetatively, forming large dense mats up to several hundred meters long and one meter deep. When broken off from a mat, a small piece of stem can grow into a new mat, making any eradication attempts difficult.

By September 1992, the estimated volume within the Canning River Regional Park had increased to 420 tonnes along approximately six kilometers of the river. The infestation of *Hydrocotyle* in the Regional Park is a serious problem as the mats affect the ecological and recreational values of the River. There was widespread concern that *Hydrocotyle* may be transported to irrigation channels and other naturally occurring fresh water bodies in the State. This could result not only in environmental degradation but also economic loss including reduced access to water for crop irrigation.

In 1992 *Hydrocotyle ranunculoides* was "declared" by the Agriculture Protection Board, requiring control and eradication of the plant. In association with other state government agencies, local government and community representatives, the Swan River Trust has designed a two part control and eradication strategy. Both strategies are based on the concept of integrated control using a combination of mechanical, chemical, biological and ecological control techniques where appropriate. This approach reduces the potential environmental impacts of any one control technique.

**Short-term control program**

The aim of the short-term control strategy was to remove the majority of *Hydrocotyle* from the Canning River Regional Park and its associated drains during the summer of 1992/1993. This strategy relied largely on physical techniques (removal) with selective use of chemicals. Biological and ecological control techniques were either unsuitable or unavailable for use in the short-term but will be used where possible in the long-term.

The program operated by removing the weed from a section of the river and then moving the operations downstream for the next stage. Physical removal involved the cutting of floating mats of *Hydrocotyle* with sickles and scythes from small boats. The mats were pushed by small boats to the weed harvester which then floated them to the bank where they were removed by backhoe. Approximately 2,000 tonnes were removed using these methods. The weed was then used for composting.

[See *Hydrocotyle* on page 5]
After most of the weed had been removed, chemical control techniques were used along the banks to prevent new mats growing out. The rhizomes of Hydrocotyle can grow to 15 cm below the soil on the bank and a translocative herbicide is required for these to be destroyed. Glyphosate was selected on the basis of glass-house experiments and its low toxicity to mammals, fish and microbes and its low to medium toxicity to birds and other aquatic life. Preliminary assessments of the chemical control program have indicated that treatment was successful.

**Long-term eradication program**

The aim in the long-term is to eradicate this weed from the river system, thereby preventing its spread throughout the state. A combination of techniques will be used in the long-term strategy. These include biological, ecological, physical and chemical methods.

At this stage a biological control for Hydrocotyle is not available and may take up to ten years to develop. It is unlikely that a suitable biological control agent will be developed and approved for release in the near future. Ecological techniques which may be used include the reduction of nutrient loads to the river and removal of nutrient rich sediments. The reduction of nutrients to the Canning River would reduce the opportunities for invasion of other aquatic weed species.

Chemical control will be used on an on-going basis to prevent regrowth of any small fragments. The use of physical removal by boats and backhoes will be necessary if mats generate.

A surveillance program has been initiated to ensure early detection and control of any outbreaks. On-going monitoring of aquatic invertebrates and pesticide levels is being undertaken as part of both the short and long-term programs to assess the environmental impacts.

Based on strategies used to control other aquatic weed species in Australia, eradication may be an optimistic goal. In three to five years plant numbers will probably be reduced to levels that allow regular but low levels of control activity. If this is the case, control and management, rather than eradication, will be the most feasible option.


**MEETINGS**


The conference theme is "Lake Ecology and Management". It is co-sponsored by the Florida Lake Management Society (FLMS) and the Lakes Education/Action Drive (LEAD). For information, contact G. Medley, City of Lakeland Lakes Program, 407 Fairway Avenue, Lakeland, FL 33801, 813-499-8272.

**21st ANNUAL CONFERENCE ON WETLANDS RESTORATION AND CREATION.** May 19-20, 1994, Sheraton Grand Hotel, Tampa, Florida.

This annual conference provides a forum for nationwide exchange of results of scientific research in the restoration, creation and management of freshwater and coastal wetland systems. For information, contact F.J. Webb, Hillsborough Community College, Plant City Campus, 1206 N. Park Road, Plant City, FL 33566, 813-757-2104.

**EWRS 9TH INTERNATIONAL SYMPOSIUM ON AQUATIC WEEDS.** September 12-16, 1994, Trinity College, Dublin, IRELAND.

The European Weed Research Society organizes this aquatic weed symposium every four years. As have the previous eight, the upcoming symposium relates to the biology, ecology, spread and control of aquatic weeds in temperate and tropical climates.

Of particular concern this time are the effects aquatic weeds have on the functioning of aquatic ecosystems, natural biological community processes and man's use of water. Scientists, engineers, managers, conservationists and environmentalists all will find a forum where they can meet in comfortable surroundings and exchange ideas.

For more information, contact Dr. Joe Caffrey, Central Fisheries Board, Mobhí Road, Glasnevin, Dublin 9, IRELAND.
The thirty years collection of the *Journal of Aquatic Plant Management*, the official journal of the Aquatic Plant Management Society, is now for sale.


Order from:
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Washington, DC 20013-2695

Make checks and purchase orders payable to A.P.M.S. Inc.

Note: Volumes 3 and 4 are in short supply and photocopies will be supplied if necessary. Volumes 1-7 and 9-20 in 1 issue/yr; Volumes 8 and 21-30 in 2 issues/yr. This offer includes the separate 1985 "Milfoil Proceedings". Allow 4 to 6 weeks for delivery.


The AIPRS database includes more than 1,000 articles about the use of aquatic plants for food, medicine, construction, weaving, etc. A sampling from the database using the term "ethno" ("used by or related to a people or race") retrieves about 25 citations.
Biofertilizer technology for dry season rice

Millions of tons of topsoil and nutrients are displaced by erosion every year. Much of it runs off into ponds, lakes and rivers. Billions of dollars in commercial fertilizer are needed by farmers to replace the lost nutrients. If only farmers could reclaim the nutrients from the water and replace them on their crops.

The small floating ferns of the genus, Azolla, scavenge nutrients from polluted waters and, in symbiosis with the bacteria, Anabaena, "fix" nitrogen. Because it is so rich in nutrients, Azolla is used as "biofertilizer" by rice farmers in China, Vietnam, Thailand, India and elsewhere.

In India, a major problem is not having enough Azolla biomass growing near rice fields at the time biofertilizer is needed most, especially during dry season rice culture. Dry season rice culture in India usually begins around March.

Therefore, Indian researchers are looking for ways to keep large quantities of Azolla under cultivation during the cold months prior to March. Investigators are studying the effects of different tree canopies, in terms of how well trees protect Azolla from lethal cold temperatures, and how tree leaf leachates affect Azolla growth. (The fallen dead leaves of some trees kill Azolla while the leaves of other trees "remarkably increase" its biomass production and nitrogen content.)

Other investigators are studying the production of spores. The use of spores could have advantages over the use of grown plants: spores can easily over-winter, and can be easily transported, and would not require the use of additional water bodies for grow-out purposes. Spore collection, storage, packing and distribution could become village industries.

Above, Dr. D.P. Kushari and his colleagues at the University of Burdwan are working to overcome the problems of using Azolla as a biofertilizer for dry season rice in India. Contact them at the University of Burdwan, Department of Botany, Golapbag, Burdwan-713 104, West Bengal, INDIA.

[Weevil, From Page 1] stages of the weevil are associated with Eurasian watermilfoil. Adults lay their eggs on the meristems; larvae burrow into and feed on the meristem before moving down and into the stem. Pupation occurs inside the stem. Adults feed on the stems, leaves and leaflets of watermilfoil, and mate on the plant. They appear to concentrate feeding on the upper portions of the plant, removing significant amounts of photosynthetic tissue. Also, stem damage from both adults and larvae causes watermilfoil to lose its buoyancy and sink. The researchers suggest that the loss of buoyancy may be more significant in controlling the plant than the loss of leaves.

The weevils appear to prefer the exotic M. spicatum over the native milfoil M. sibiricum Komarov (= M. exalbescens Fernald). Creed and Sheldon suggest that the weevil may have either expanded its diet to include M. spicatum or undergone a host shift from the native plant to the exotic one.

References:


name for vetiver grass reportedly translates to "stops cough grass", a troublesome creeping grass weed in cultivated fields. Some Indian farmers even claim that its downwardly sharp, stiff leaves keep snakes away.

Other advantages of vetiver grass are that it is easy to propagate, inexpensive to plant, simple to maintain, and long lasting. In fact, agricultural agents report that one of the difficulties in promoting its use is that local people often mistrust such a simple solution to their massive erosion problems. They feel that something requiring heavy equipment, engineers, a lot of money and a lot of labor must be required.

**EROSION CONTROL**

The World Bank has been promoting the study and use of vetiver grass in developing countries with severe soil erosion problems. In many developing nations, torrential downpours, winds or flash floods can wash away tons of precious topsoil which end up in equally precious waterbodies. The National Research Council reports that erosion costs the earth 20 billion tons of soil a year worldwide. This equals the loss of between 5 million and 7 million hectares of arable land. In Vetiver Grass - A Thin Green Line Against Erosion, soil erosion is dubbed a "double disaster: a vital resource disappears from where it is desperately needed only to be dumped where it is equally unwanted."

**OVERSEAS**

Farmers near Mysore, India have been using vetiver hedges for perhaps 200 years and sugar companies in the West Indies and Fiji have used vetiver for more than 50 years to turn steep mountain slopes into profitable farmland. The grass is used to prevent erosion in tea and rubber plantations in Malaysian mountains where farmers cut flat areas, or benches, into the sides of mountains. Vetiver is found in more than 20 countries in Africa, a dozen Caribbean islands, throughout Asia (its native range), South America, the Pacific Islands, and elsewhere. In India, it has long been used around rice paddies, and along rivers, canals and ponds to strengthen banks.

More recently, vetiver has been used as a contour hedge on hill slopes to conserve water and soil on farms. Studies on this method of soil and water conservation have been carried out largely with funding from the World Bank. Vetiver is being studied by the International Rice Research Institute in the Philippines for erosion control and to reinforce bunds around paddies. Large projects are being carried out in China for soil and water conservation, to protect small dams from siltation and dam walls from rill erosion. Vetiver grass can be used as livestock bedding, compost, windbreaks, firebreaks, roof thatch, mulch, and basket and broom material. Its oil is used for perfumes and soaps. In several Indian villages, it is even credited with raising water levels in wells due to its ability to hold run-off so that water can soak into the ground.

**UNITED STATES**

Vetiver grass has existed in the United States for at least 150 years. A family in Louisiana has been farming it for three generations for its aromatic oil which is used to make sachets. It is found along the banks of bayous and on old plantations. Vetiver is currently being used in agricultural areas in northern Louisiana as a substitute for earthen terraces.

In 1990, vetiver was field tested in an attempt to correct severe erosion problems plaguing Fort Polk in Louisiana. Fort Polk is home to the Fifth Mechanized Infantry where soldiers are taught to drive tanks on steep (18-30%) slopes. Unfortunately, the fort also is home to the headwaters of three scenic streams that were rapidly filling with silt as tanks on training maneuvers scoured the land. After sediment-filled waters sluiced over check dams built by the Army, Mike Materne of the U.S. Soil Conservation Service (SCS) in Louisiana was called in.

Materne planted vetiver grass both in waterlogged soil below sediment basins and in dry sand above sediment basins to test its effectiveness in slowing water flow and filtering suspended materials. The grass was also planted on side slopes in highly eroded areas. The plants thrived and quickly grew together into hedges. Materne reports that the hedges captured 50 centimeters of soil in two
years and succeeded in reducing and cleansing the turbid run-off to acceptable levels. He calls the success "phenomenal".

In Florida, vetiver is being investigated by the SCS for use in biological filter strips for wastewater run-off from livestock production in confined pastures and for nutrient run-off from row crops and groves; as a cover crop to protect soil surface and reduce runoff; and for cropland gully stabilization.

When questioned about the plant’s weed potential, plant materials specialists at the SCS claim that vetiver grass in the U.S. does not produce viable seed. Matterne has made repeated attempts to germinate the seeds without success. It is reported that the plant can be easily killed by slicing off the crown which grows just below the soil surface. Vetiver also succumbs to glyphosate herbicide and is not very cold tolerant. (Incidentally, it is reported in Malaysia that Chinese grass carp readily eat the leaves of vetiver grass.)

The U.S. Army also is interested in vetiver grass. The Construction Engineering Research Lab (CERL) in Champaign, Illinois will be supervising research to establish the geographic range of vetiver grass. Plant material currently is being grown at army installations in the southeast. The plant also will be studied for its efficacy as a sediment filter around disturbed wetlands, for streambank stabilization, and for controlling erosion on slopes. Dr. Mohammad Sharif reports that vetiver will be studied to see if it can withstand vehicular traffic. Researchers plan to drive 60-70 ton tanks over the grass.

The NRC makes the sweeping statement that "Countries benefit by having cleaner rivers, unspoiled estuaries, and more water and less silt in their reservoirs." Certain caveats, however, arouse a certain amount of unease in those struggling with exotic weed problems: the NRC recommends that those looking for vetiver grass look in their own regions rather than importing seed because "... seed will likely lead to weedy plants, and that in turn could produce badly behaved vetivers that do not stay where they are put." They state that the purpose of their most recent book on the plant (see below) is "to assess vetiver’s promise and limitations and to identify any research that may be necessary before this grass can be deployed rationally, widely, and without undue environmental risk."

Here in the United States, using native species is a very popular tenet, almost dogma, with environmental purists, biologists, restoration researchers, some government agencies and others. However, when environmental problems overwhelm our native plant populations, perhaps the carefully controlled use of a non-native species should not be wholly discounted.

K.B.

(Vetiver Grass: A Thin Green Line Against Erosion is available from the National Academy of Sciences, 2101 Constitution Avenue N.W., Washington, DC 20418. The cost is $12.00 plus $4.00 shipping and handling.)
FROM THE DATABASE

Here is a sampling of the research articles, books and reports which have been entered into the aquatic plant database since March, 1993.

The database has almost 36,000 items. To receive free bibliographies on specific plants and/or subjects, contact APIRS at the address shown on the mail label on page 16.

To obtain articles, contact your nearest state or university library.

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BOOKS/REPORTS

LIFE CYCLES OF RICE FIELD WEEDS AND THEIR MANAGEMENT IN MALAYSIA edited by K. Itoh, Tropical Agriculture Research Center, Ministry of Agriculture, Oyashi, Japan. 1991. 92 pp. (In English) (Order from K. Itoh, Department of Lowland Farming, Tokoku National Agricultural Experiment Station, Ministry of Agriculture, Forestry and Fisheries, Oaragari, Akita, 014-01 JAPAN.)

According to the Introduction, "The most important information for weed management is the in-depth understanding of weeds' life cycle and the strategies adopted to control these species."

This colorful handbook includes 17 species of major weeds in rice fields, especially those in the family Poaceae. Each species is described and its habitat is defined. Effective control methods for each weed are described, including hand pulling and cutting, burning, rotation, as well as herbicides and biological controls.

What makes this book especially useful and distinctive is its use of many color photographs showing "characteristic parts" of each plant (flowers, seedlings, young plants, comparisons) as well as photographs of each "life cycle". Life cycles are depicted in circles of color photos of each stage of life: seed, emergence, seedling, small plant stages, tillering, growing as weeds, heading, flowering, seed development and dispersal.

A HANDBOOK FOR WEED CONTROL IN RICE by K. Ampong-Nyarko and S.K. De Datta, International Rice Research Institute, Manila. 1991. 113 pp. (Order from Division PR, Information Center, IRRI, P.O. Box 933, 1099 Manila, Philippines, US$17.50 (including shipping) for developed nations; US$8.25 for developing nations.)

In ten chapters, this book provides practical information on weed management in irrigated rice, rainfed lowland rice, upland rice and deepwater and floating rice. Chapters cover the effects of weeds, identifying 30 weeds and the principles of herbicide use. A special chapter is devoted to especially difficult-to-manage weeds such as Scirrus maritimus.

BIOLICAL CONTROL AND INTEGRATED MANAGEMENT OF PADDY AND AQUATIC WEEDS IN ASIA, Proceedings of International Symposium held in Tsukuba Science City, Japan, October 20-23, 1992. 442 pp. (Order from H. Shibayama, Chief of Paddy Weed Laboratory, National Agriculture Research Center, Kawanodai, Tsukuba, 305 JAPAN.)

This Proceedings includes 23 papers in six subject areas. They include country reports on integrated weed management, the status and prospects of biological controls, integrated control and allelopathy and "bioherbicides".

Included are interesting papers about aquatic plants that produce chemicals that can kill fish as well as plants (J. Harada, pp. 321-333), and about the search for pathogens to kill one of the worst paddy weeds, Eleocharis kurogawai (H. Tanaka et al., pp. 381-392).

The symposium was co-sponsored by the National Agriculture Research Center, Tsukuba, Japan, and the Food and Fertilizer Technology Center, Taipei, Taiwan.

THOMSON'S ENGLISH/SPANISH SPANISH/ENGLISH ILLUSTRATED AGRICULTURAL DICTIONARY by R.P. Rice, Jr., 1993. 160 pp. (Order from Thomson Publications, P.O. Box 9335, Fresno, CA 93791, (209)435-2165. US$27.95 plus handling.)

This dictionary is devoted exclusively to agricultural, botanical and horticultural terms and names for livestock, equipment, tools, weeds, diseases and insects. All are listed in Spanish and English; a few are illustrated.

PLANTES VASCULAIRES SUSCEPTIBLES D'ETRE DESIGNEES MENACEES OU VULNERABLES AU QUEBEC by G. Lavoi, 1992. 180 pp. (Order from Ministère de L'Environnement, Direction de la Conservation et du Patrimoine Écologique, Division de la Diversité Biologique, Quebec. EnvironIQ, ENV10479.)

This report identifies 274 vascular plants of Quebec that are designated either "threatened" or "vulnerable". Quebec law defines "threatened" as "any species whose disappearance is likely" and "vulnerable" as "any species whose survival is precarious". The report includes the criteria used in listing species.

Of the listed plants, at least 50 are wetland or aquatic.

POTENTIAL USE OF NATIVE AQUATIC PLANTS FOR LONG-TERM CONTROL OF PROBLEM AQUATIC PLANTS IN GUNTERSVILLE RESERVOIR, ALABAMA. REPORT 1, ESTABLISHING NATIVE PLANTS by R.D. Doyle and R.M. Smart, Environmental Laboratory, Vicksburg, Mississippi. Technical Report A-93-6, 1993. 65 pp. (Order from USAE Waterways Experiment Station, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199. Technical Report A-93-6.)

This report is about the attempt to prevent or delay the regrowth of the nuisance plants Myriophyllum spicatum,
Hydrilla verticillata and Lyngbya wollei in littoral zones of Guntersville Reservoir, Alabama, by establishing populations of native plants.

From these tests, the researchers drew two conclusions: 1) fenced exclosures to protect the newly-establishing native plants from turtles and other herbivores is an "absolute necessity"; and 2) three plant species had the morphological characteristics that enabled them to grow in floating mats of Lyngbya: Potamogeton nodosus, Nelumbo lutea and Pontederia cordata.


According to the editors, aquatic weeds are found throughout Africa, causing acute problems to human health and livelihoods and causing severe damage to the environment.

In many areas, "waterways are the only means of traveling to the market, hospital or school" and many hundreds of thousands rely on fishing for their livelihoods. Three floating weeds are mainly responsible for shutting down the waterways and fishing grounds, even causing entire communities to relocate to uninfested areas.

"But despite the increasing enormity of the waterweed problems, too often they remain unrecognised or forgotten."

This collection of 22 papers deal with aquatic weed problems of Zimbabwe, Botswana, Malawi, Uganda, Nigeria, Ghana, Benin and other African countries. The three plants most responsible for the misery are water hyacinth (Eichhornia crassipes), water fern (Salvinia molesta) and water lettuce (Pistia stratiotes).

This report includes a recommendations section which specifies action needed on local, regional and national levels.


MORE Aquatic Plant Drawings

Large format line drawings of an additional 14 plants are available from the APIRS office. They are provided free of charge, and may be used for educational or scientific purposes.

The latest drawings include:

- Bacopa caroliniana
- Bidens laevis
- Cyperus odoratus
- Hydrocotyle ranunculoides
- Hydrocotyle umbellata
- Ludwigia alternifolia
- Ludwigia repens
- Polygonum hydropiperoides
- Potamogeton illinoensis
- Potamogeton pusillus
- Ruellia brittoniana
- Sagittaria lancifolia
- Sagittaria stagnorum
- Zizania aquatic

Sagittaria stagnorum
AQUAPHYTE

This is the newsletter of the Center for Aquatic Plants and the Aquatic Plant Information Retrieval System (APIRS) of the University of Florida Institute of Food and Agricultural Sciences (IFAS). Support for the information system is provided by the Florida Department of Environmental Protection, the U.S. Army Corps of Engineers Waterways Experiment Station Aquatic Plant Control Research Program (APCRP), and IFAS.

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AQUAPHYTE is sent to 5,000 managers, researchers and agencies in 87 countries. Comments, announcements, news items and other information relevant to aquatic plant research are solicited.

Inclusion in AQUAPHYTE does not constitute endorsement, nor does exclusion represent criticism, of any item, organization, individual, or institution by the University of Florida.

Milfoil and Lake Titicaca, Bolivia

Among other research, Dr. Mark Brenner (Assistant-In Paleolimnology, Department of Fisheries and Aquatic Sciences, University of Florida) studies lake sediment cores in Central and South America in order to reconstruct paleoclimate and historic and prehistoric human impacts on lake watersheds. In doing so, Brenner also has observed extensive use of aquatic plants in the daily lives of local peoples.

Here in the Bolivian Altiplano on the high and dry shores of Lake Titicaca, water milfoil (Myriophyllum elatinoides) is harvested as food for livestock. The huge lake sits at an altitude of 12,500 feet (3,800 meters) and is the highest navigable lake in the world. Elodea and Potamogeton species also are used to feed domestic animals. Schoenoplectus tatora is grown and harvested to construct reed boats. Azolla grows abundantly in canals between raised agricultural fields and is used as fertilizer.