

A Q U A P H Y T E



UNIVERSITY OF
FLORIDA

Institute of Food and Agricultural Sciences

CENTER FOR AQUATIC PLANTS

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Army Corps Research in Lewisville, Texas

Just north of Dallas on the shores of Lewisville Lake is the Lewisville Aquatic Ecosystem Research Facility (LAERF), 110 acres including 55 research ponds, state-of-the-art laboratories, and outdoor environmental education areas for local school children. LAERF is operated by the U.S. Army Corps of Engineers Waterways Experiment Station (WES) under the Aquatic Plant Control Research Program (APCRP).

The Lewisville facility is where the Corps' aquatics researchers take the intermediate steps between tank-scale testing in the laboratory and large-scale testing in lakes, reservoirs and waterways. LAERF "allows us to do research we couldn't accurately do otherwise," said Mr. Lewis Decell, program manager of APCRP.

The chief of LAERF is Dr. Michael Smart, a Corps research biologist: "Here we can control just about everything but the weather on a realistic scale. We can also do long-term studies that are nearly impossible in the lab. We don't know of any large-scale research facility with the capabilities or potential of Lewisville."



The next generation is learning to appreciate the values of aquatic ecosystems thanks to extension scientists like the University of Florida's Dr. Charles Cichra (Fisheries) and Dr. Kenneth Langeland (Aquatic Plants). Here, as part of the 4-H Ecology Field Day, Cichra shows third graders in Madison (Florida) the kinds of small animals that live among aquatic plants. The classes took place in a pond at the Ladell Brothers Outdoor Environmental Center on the campus of North Florida Junior College.

LAERF is suitable for many kinds of studies having to do with aquatic plants and aquatic ecosystems. Its 55 ponds average seven feet deep and are one-half to two acres in size. Each pond can be filled or drained according to the needs of the researchers, and ponds are automatically monitored for water temperature and other variables. Its laboratories have the best equipment for analyzing plants, sediments and water. The facility includes a full weather station as well.

More than a dozen APCRP researchers use the facility, and are supported by laboratory chemists and other workers. The researchers are also assisted by a couple of dozen graduate students from several area colleges and universities who spend long hours monitoring, planting, harvesting, grinding, taking data and analyzing the results of the various experiments.

About 20 experiments are conducted at a time by researchers of the several "technology groups" of APCRP: the biological control, chemical control, simulation and ecology groups. Here are some experiments that are now underway in the LAERF ponds:

[See LAERF on Page 15]

THE LIMITS OF AQUATIC SYSTEMS

Aquatic scientists often compare the values of different aquatic variables they collect to those reported by scientists from other parts of the world. This fundamental exercise contributes to the knowledge of the ecological limits these variables can have. In addition, these comparisons often reveal interesting aspects (or inconsistencies!) in the data. When newly measured values are close to the minimum or maximum reported values, they indicate measurements that may need to be reexamined for correctness or they may add insight into the ecological functioning of particular systems.

Hence, we believe there is a need for a comprehensive compilation of published ranges of physical, chemical and biological variables that have been measured in rivers, lakes, wetlands and oceans. We have begun to organize these types of data and intend to publish the compilation in an appropriate journal for the general use of aquatic scientists throughout the world.

In exchange for free copies of the finished work, we ask for your help with this task.

If you have measured or know of a value for an ecological variable that may represent a high or low limit and can cite the work so that the scientific community can use it, please send the documentation of this value (date and location of sample, method, value, and citation) to us.

The following are partial lists of the types of values that we believe should be compiled:

Physical Properties

altitude
latitude
area
depth
residence time
sedimentation rate
current
turbulence
density
temperature
optical properties
etc.

Chemical Properties

salinity
specific conductance
conservative ion concentrations
nutrient concentrations
oxygen concentrations
dissolved organic carbon
etc.

Biological Properties

primary producers
(macrophytes, algae)
bacteria
protozoa
zooplankton
fish
amphibians
aquatic reptiles
aquatic birds
other aquatic wildlife:
biomass
metabolism
(respiration,
photosynthesis)
immigration
reproduction
growth
recruitment
mortality
(natural,
harvested)
emigration
etc.

510 ($\mu\text{g/L}$) Chlorophyll *a*

18 (kg wet wt/m^2), *Hydrilla verticillata*

0.77 (mm TL/day), Largemouth bass

We believe that with your help a completion date of 1996 seems reasonable. And we will make sure that all contributors get free copies of the finished product.

Thank you very much for your help

1200 ($\mu\text{S/cm @ 25}^\circ\text{C}$), Specific Conductance

Carlos M. Duarte
Centro de Estudios Avanzados de Blanes
Cami de Sta. Barbara s/n
17300 Blanes, Girona
SPAIN
Fax: 34 72 337806
E-mail: DUARTE@CEAB.ES

Mark V. Hoyer
Department of Fisheries and Aquatic Sciences
University of Florida
7922 NW 71 ST
Gainesville, FL 32606
U.S.A.
Fax: 904 392-3462; E-mail: DANJR1@nervm.nerdc.ufl.edu

A T T H E C E N T E R



Phyllis Rester (directed by Ed Philips, Fisheries and Aquatic Sciences) completed her master's degree with the thesis, *Algal Growth Response to Sediment Resuspension in a Shallow Subtropical Lake, Lake Okeechobee*. (Ms. Rester has the added distinction of completing her degree at the non-traditional age of 72.)



Janice Miller (directed by William Haller, Agronomy) completed her master's degree with *Autecological Studies of Southern Wild Rice (*Zizania aquatica* var. *aquatica* L.) in Florida*.



Melanie Moon (directed by George Bowes, Botany) completed her master's degree with *The Effect of Temperature on the Distribution, Physiology and Competitive Ability of *Hydrilla verticillata* and *Egeria densa**.

Effect of 2,4-D...

In his master's thesis, *Effect of 2,4-D Amine on the Movement and Feeding Behavior of Largemouth Bass*, Marvin Boyer (directed by Charles Cichra, Fisheries and Aquatic Sciences) concluded that surface application of 2,4-D amine did not affect the home range, nesting, eating or other behaviors of largemouth bass.



Sherilyn Wood has stepped into the rather large footprints left by Philip Chiochio after a five-year run as "video-man" at the Center for Aquatic Plants. Phil helped produce 18 educational videotape programs as part of the Center's Information Office. He now moves on to the Department of Computer Animation at the Ringling School of Art and Design in Sarasota, Florida.

CENTER FOR AQUATIC PLANTS
Institute of Food and Agricultural Sciences
University of Florida
 7922 N.W. 71st Street
 Gainesville, Florida 32606
 (904) 392-9613

Dr. William Haller, Interim Director

Acorus calamus, a medicinal aquatic

by V.V. Sivarajan, Professor, Department of Botany, University of Calicut - 673 635, Kerala, INDIA.

Commonly known as "sweet flag", *Acorus calamus* is a small, gregarious, rhizomatous herb growing in ditches, margins of lakes, streams and in marshes. Superficially resembling *Iris* and *Gladiolus*, sweet flag can easily be recognized by its characteristic smell, the typical aroid inflorescence and the absence of prominently colored flowers. A native of India and North America, sweet flag is now widely distributed and cultivated in various parts of Europe and Asia.

That the strongly scented, bitter rhizomes of this plant have been widely used in medicine and for other purposes is clear from ancient Indian writings and in those of Dioscorides, Avicenna and others. In America, they were once eaten as candy and its powder was chewed in the belief that it would help break habitual tobacco smoking. It was so important a merchandise in ancient America that some tribes used it as a medium of exchange. The American Indian used it against a variety of ailments. The drug was listed in the US Pharmacopoea until the US Food and Drug Administration reported that the Asian variety was found to produce cancerous tumors in experimental animals and consequently declared its use as "unsafe".

Acorus has been an important article of trade between India and Arab countries for a long time, possibly resulting in its introduction to West Asia and thence to Europe. It was the Tartars who first introduced *Acorus* to Poland. History has it that the entire stock of European *Acorus* originated from the famous botanist, Clusius, who cultivated it in Vienna in 1574, from a rhizome he procured from Asia minor and subsequently distributed to Belgium, Germany and France. It was later introduced to England in 1596 by Gerard. However the Indian rhizome continued to enjoy an edge over American and European stock because of its stronger and more agreeable odor and continued to be imported into Europe, even after it became common there.

Dioscoride's *Herbal* is ample proof that this drug was well known to ancient Greeks who used it widely in their medicines. In fact, the generic name, *Acorus*, is derived from "acoron" used by Dioscorides for the plant. This in turn was derived from the Greek, "coreon" (pupil of the eye), as it was used by the Greeks in treating ophthalmic complaints.

Europeans used sweet flag not only for medicinal purposes, but also for sanctifying places of worship and sometimes even private houses of the affluent. The chopped rhizomes were strewn on the floors of churches at festival times to impart a pleasant (celestial!) odor. In fact, Cardinal Wolsey of England had to face a charge of extravagance on this count, because in those days, England was importing *Acorus* at considerable expense.

In India, *Acorus calamus* has been used in indigenous medicine since ancient times, as can be seen in classical literature. Garcia da Orta, in his *Os Colloquios* (1565) discussed this drug and its importance in great detail. Indians used it against a variety of ailments and for improving digestion, speech and intelligence. It was considered to be useful in warding off evil spirits and to cure hysteria, insanity, epilepsy and chronic rheumatic complaints. But we Indians have also been cautioned that overdosage can lead to irrepressible vomiting. The maximum dose is 35 grains at a time.

Apart from these, this drug has been considered to be a good repellent of snakes and insects. Snake catchers and charmers are reported to chew the rhizomes before their encounters. And keeping bits of the rhizome or its powder in woolen clothes in wardrobes saves the clothes from insect damage.

Acorus rhizomes have been an integral part of Grandma's medicine chest in most Indian homes for centuries. It has been used to cure infantile problems and stomach complaints. In Kerala, it has been a long-standing tradition to rub the rhizome and gold on the tongue of new-born children. The gold, it is believed, imparts fair complexion to the baby and improves its intellect. *Acorus*, in its turn, wards off all other problems of health, besides curing fungal infections of the tongue, enabling the baby to start speaking rather earlier and more legibly too. Are mothers and would-be-mothers listening?



MEETINGS

14th INTERNATIONAL SYMPOSIUM OF THE NORTH AMERICAN LAKE MANAGEMENT SOCIETY. October 31-November 5, 1994, Hyatt Orlando Hotel, Orlando, FLORIDA.

The NALMS mission is "to forge partnerships among citizens, scientists and professionals to foster the management and protection of lakes and reservoirs for today and tomorrow."

The theme of this year's conference is "Managing Water Resources in the 21st Century: Finding Workable Solutions." This year's symposium will include a special session on "Managing Aquatic Macrophytes."

Abstracts are due June 1; address them to Marty Kelly, SW Florida Water Mgmt District, 7601 Hwy 301 N, Tampa, FL 33637. For other NALMS information, call 904/462-2554.

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, Mobhi Road, Glasnevin, Dublin 9, IRELAND.

RESTORATION OF AQUATIC ECOSYSTEMS: DEVELOPING A NATIONAL AGENDA. June 20-23, 1994, Radisson Hotel, St. Paul, MINNESOTA.

This meeting is sponsored by the U.S. Environmental Protection Agency, and is hosted by the Association of State Wetland Managers, the Coalition to Restore Aquatic Ecosystems, and the Coalition to Restore Urban Waterways.

The goal of the meeting is to "help develop a national agenda or strategy for facilitating the restoration of wetlands, streams, and lakes on a watershed basis at all levels of government and by the private sector in the U.S. and other countries."

For more information, contact the Association of State Wetland Managers, P.O. Box 2463, Berne, NY 12023-9746, 518/872-1804.

ECOSYSTEM MANAGEMENT AND RESTORATION FOR THE 21st CENTURY. October 19-22, 1994, Palm Beach Gardens, FLORIDA.

This is the 21st Natural Areas Conference and will have sessions on control of exotics; fire management; hurricanes; marine, wetland and old growth ecosystems; environmental education and mitigation banking.

To submit abstracts or obtain more information, contact E.S. Menges, Archbold Biological Station, P.O. Box 2057, Lake Placid, FL 33416-4680, 813/465-2571.

SHALLOW LAKES '95, International Conference on Trophic Cascades in Shallow Freshwater and Brackish Lakes. August 21-26, 1995, Mikolajki, POLAND.

This meeting continues the work of the international conference on shallow lakes held in Silkeborg, Denmark in 1992. It will cover all aspects of shallow lake research such as lake succession, nutrient dynamics, trophic relations, stable states, and bio-restoration practices.

The conference will be conducted in English and will be hosted by the Mikolajki Hydrobiological Station of the Institute of Ecology. It will be chaired by Lech Kufel, Andrzej Prejs and Jan Igor Rybak.

For more information, contact Lech Kufel, Institute of Ecology, PAS, Hydrobiological Station, Lesna 13 11-730 Mikolajki, POLAND.

BOOKS/REPORTS

DYNAMIC AQUARIA, Building Living Ecosystems by W.H. Adey and K. Loveland, Smithsonian Institution, Washington, D.C. 1991. 643 pp. (Order from Academic Press, Inc., San Diego, CA 92101.)

This book contains information that enables scientists and hobbyists to build model aquatic ecosystems that closely approximate natural ecosystems.

It is divided into four broad sections of several chapters each. Part I discusses the physical environment, including shapes and construction materials for the aquaria, and the types of substrate to make up the floor of the system. Part II discusses the biochemical environment, including gas and nutrient exchange and animal waste management, and the use of "controlled communities of algae" to simulate larger volumes of open water. In Part III, the biological structure section, the role of diversity and the food web are discussed in terms of "aquarium science". In Part IV, the authors present case studies of microcosms, mesocosms and aquaria. And in Part V, they present "principles for establishing and operating living ecosystems."

PRIVATE LANDOWNER'S WETLANDS ASSISTANCE GUIDE: Voluntary Options for Wetlands Stewardship in Maryland, by U.S. Environmental Protection Agency, Wetlands Division. 1992. 39 pp.

(For information on the availability of this booklet, contact the Wetlands Protection Hotline, 800-832-7828.)

This guidebooklet was developed for Maryland workshops held in 1992, entitled "A Land Ethic for Wetlands Stewardship: Assisting Private Landowners to Conserve and Manage Wetlands." It was written for field staffs of federal, state and local agencies and organizations.

This guide lists public and private assistance programs which are available to provide financial and technical assistance to private homeowners and landowners who want to manage and retain the natural and cultural values of their property.

Programs provide technical assistance in wetlands creation and restoration; management of wildlife,

forestry and agriculture; education and outreach opportunities; and financial incentives including cash benefits, cost-sharing, tax incentives and conservation management agreements.

Because the guidebook was made for Maryland residents, Maryland state programs are featured. However, much of the remainder of the booklet will be useful to residents of other states, inasmuch as the federal programs which are described and the discussions about landowner planning and general options apply to all U.S. citizens.

CHESAPEAKE BAY SUBMERGED AQUATIC VEGETATION HABITAT REQUIREMENTS AND RESTORATION TARGETS: A TECHNICAL SYNTHESIS by R.A. Batiuk, R.J. Orth, K.A. Moore, et al., Chesapeake Bay Program, Annapolis, Maryland. 1992. 248 pp.

(For information, contact Richard A. Batiuk, U.S. Environmental Protection Agency, Chesapeake Bay Program Office, Annapolis, Maryland.)

One of the world's largest estuaries, Chesapeake Bay, suffers from a seriously reduced abundance of submersed aquatic plants. Historically, some twenty freshwater and marine species have provided food for waterfowl and habitat for shellfish and finfish, and have affected nutrient cycling, sediment stability and water turbidity. It is believed the decline is a result of the development of the bay's shoreline and surrounding watershed.

The objective of this "technical synthesis" is to present the water quality standards required to support continued survival, propagation and restoration of submersed plants in the bay. Using "nutrient and sediment reduction strategies", bay managers expect to restore submersed aquatic plants to hundreds of thousands of hectares of bay bottom.

The authors say this synthesis is the "first comprehensive effort to link habitat requirements for a living resource with water quality restoration targets for an estuarine system."

EDIBLE? INCREDIBLE! POND-LIFE, The Eating Guide To American Ponds, by M. Furlong and V. Pill, 1980, 95 pp.

(Order from Naturegraph Publishers, Inc., Box 1075, 3543 Indian Creek Rd., Happy Camp, CA 96039. US\$7.95 plus postage.)

This interesting little "cookery" book includes recipes for beverages, muffins, jellies, salads and main dishes, which are made from grasses and herbs, trees and shrubs, and animals of the ponds of North America. Among the aquatic plants called for are arrowheads, bur-reeds, cattails, lilies, pondweeds, reed grass, rushes, sedges, watercress and wild rice. Each plant is pictured and characterized; edible parts are briefly described. One plant recipe is for a sedge-nut energy bar, another for arrowhead/burreed salad.

PLANTES SAUVAGES DES LACS, RIVIERES ET TOURBIERES, Guide d'identification, by Groupe Fleurbec, Quebec, Canada, 1987. 400 pp.

(Order from Fleurbec, Saint-Henri-de-Levis, Quebec, G0R 3E0, CANADA. US\$20.00 plus shipping.)

This highly informative field guide to aquatic plants includes the most comprehensive treatments of any aquatic plant field guide in the APIRS library. If the reviewer could read French, he would buy a copy of this excellent book for personal use.

Several pages are devoted to each plant, and include sections about its Latin name, synonymy and etymology; its origin and world distribution; a map of its North American distribution; its detailed description; other plants that it might be confused with; its flowering period; its habitat; its toxicity; its medicinal use; its edibility; and its horticultural and agricultural interest. Each plant is also pictured in a full-page color photograph, and a supplemental photograph.

Fleurbec, the private non-profit group of researchers, writers and photographers, is well-known for its series of wildflower books, of which this is one.

RESTORATION OF AQUATIC ECOSYSTEMS, Science, Technology and Public Policy, by the U.S. National Research Council, Washington, DC, 1992. 552 pp.

(Order from Island Press, Box 7, Covelo, CA 95428. Hardcover, US\$39.95 plus S/H.)

The Committee of eminent scientists that wrote this report on restoration ecology believes that "whereas much about the functioning of ecological systems remains poorly understood, it is common to fail to use even available information when attempting to solve environmental problems."

Therefore, this report is an attempt to present the basics of what is known about aquatic restoration, and to expound the basic elements of a national restoration strategy.

It includes sections on the history and government control of ecosystem management; planning and evaluating aquatic ecosystem restoration; overviews of lakes, rivers and wetlands ecosystems and restoration, including needs and recommendations; national restoration goals, and several case studies of restorations of lakes, rivers and wetlands.

WETLAND PLANTING GUIDE FOR THE NORTHEASTERN UNITED STATES, Plants for Wetland Creation, Restoration and Enhancement, by G.A. Thunhorst, Environmental Concern, Inc. 1993. 179 pp.

(Order from Environmental Concern, Inc., P.O. Box P, 210 West Chew Avenue, St. Michaels, Maryland 21663. US\$19.95 plus S/H.)

Made for wetland designers, "this guide is an effort to consolidate the information available from many different sources on wetland species...It is hoped the guide will prevent the placement of species in areas where they cannot compete or survive."

The guide includes trees, shrubs, and herbaceous emergent, submersed, and floating vegetation. A single standardized page is devoted to each of about 150 plants, and includes a plant drawing, and basic characteristics about plant type, growth, planting spacing, habitat, wildlife benefits and required hydrology. The book includes a list of wetland plant suppliers.

This is the most thorough wetland/aquascaping plant guide known to APIRS.

WETLANDS, 2nd edition, by W.J. Mitsch and J.G. Gosselink. 1993. 722 pp.

(Order from Van Nostrand Reinhold, Mail Order Dept., P.O. Box 6904, Florence, KY 41022-9949, 1-800-544-0550. US\$59.95 plus S/H.)

This is a new edition of one of the definitive books on the subject of wetlands, authoritatively written by two recognized wetlands ecologists. The book is readable, suitable for many audiences, well-organized and illustrated with photographs, understandable graphics, and useful charts.

In this fine book are reviews about wetland history, types, terms, hydrology, biogeochemistry, biological adaptations and wetland ecosystem development. The authors also present overviews of coastal wetlands, including tidal saltwater and freshwater marshes, and mangrove wetlands; as well as overviews of inland wetlands, including freshwater marshes, northern peatlands, southern deepwater swamps and riparian wetlands.

The book concludes with an overview of the management of wetlands, including the valuation of wetlands, protection, creation and restoration and classification and inventory of wetlands.

ECOLOGICAL INTEGRITY AND THE MANAGEMENT OF ECOSYSTEMS, edited by S. Woodley, G. Francis and J. Kay. 1993. 220 pp.

(Order from St. Lucie Press, 100 E. Linton Blvd., Suite 403B, Delray Beach, FL 33483. US\$59.95 plus \$5.95 S/H.)

The first paragraph from the first chapter, "The Notion of Natural and Cultural Integrity," by H.A. Regier:

"The notion of ecosystem integrity is rooted in certain ecological concepts combined with certain sets of human values. The relevant normative goal of human-environmental relationships is to seek and maintain the integrity of a combined natural/cultural ecosystem which is an expression of both ecological understanding and an ethic that guides the search for proper relationships."

LAKE TITICACA, A Synthesis of Limnological Knowledge, edited by C. Dejoux and A. Iltis. 1992. 573 pp.

(For the U.S.A. and Canada, order from Kluwer Academic Publishers, 101 Philip Drive, Norwell, MA 02061. US\$239.00 plus S/H.)

Lake Titicaca is a huge and deep lake, the highest navigable lake in the world (at 12,500 feet). It is part of the border between Bolivia and Peru. This book is a compilation of more than a century of limnological work done on

the unusual lake, a lake that has long been known for its reported *lack* of biological diversity, as well as its alleged high degree of endemism (species known only from Lake Titicaca).

The book has sections on the lake's origins; geomorphology and sedimentation; paleohydrology; climatology and hydrology; physico-chemistry; phytoplankton; macrophytes; zooplankton; benthic fauna; fish fauna; associated animal communities; ethnology and socio-economy; hydrological potential, ichthyological potential and its contamination.

As for macrophytes, the lake has notably few species. A band of tall totoras (*Schoenoplectus tatora*) is obviously prominent, and the submersed plants *Elodea potamogeton* and *Myriophyllum elatinoides* are very abundant. Lake Titicaca also features *Lemna gibba*, *Ruppia maritima*, *Zannichellia palustris*, *Ranunculus trichophyllus*, *Hydrocotyle ranunculoides*, *Azolla filiculoides* and a species or two of *Potamogeton*. Only a dozen aquatic plant species have been recorded there.

HARMFUL NON-INDIGENOUS SPECIES IN THE UNITED STATES,

U.S. Congress, Office of Technology Assessment. 1993. 400 pp.

(Order from New Orders, Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954. US\$21.00; International customers, add 25%.)

The Foreword of this report states that "...federal and state policies designed to protect us from the worst [non-indigenous] species are not safeguarding our national interests in important areas"—there is no real national policy, the current system is piecemeal, statutes and regulations do not keep pace with new pests, better environmental education would help, and greater funding for faster response is needed.

This report to Congress is a very good (and relatively readable) overview of the problems caused by non-indigenous species ("NIS"), and a frank assessment of the failures of federal and state laws and regulators. The authors present options for improving regulations and make recommendations.

[See BOOKS on page 8]

[BOOKS, from page 7]

In its review of the worst NIS in the U.S., the authors found that 79 of 557 NIS had caused an estimated cumulative loss of about \$97 billion. The report attributes almost 96% of this loss to exotic insects, and less than 1% to aquatic weeds.

As an example of the kinds of regulatory problems that persist, the authors noted that purple loosestrife (*Lythrum salicaria*), Brazilian pepper (*Schinus terebinthifolius*) and Eurasian watermilfoil (*Myriophyllum spicatum*), are not listed on the current federal list of noxious weeds, and thus still may be legally imported.

EVERGLADES, The Ecosystem and Its Restoration, edited by S.M. Davis, J.C. Ogden and W.A. Park. 1994. 826 pp.

(Order from St. Lucie Press, 100 E. Linton Blvd., Suite 403B, Delray Beach, FL 33483, (407) 274-9906. USS\$97.50 plus \$7.95 S/H)

This is a collection of 31 review articles, including unpublished data, about various aspects of the Everglades, from the driving forces that formed them, to the vegetation and faunal components and processes that characterize them, to guidelines for restoring them to the way they were before being drained, ditched and diked, poked, plugged and plowed.

Among other chapters in this book, there are reviews about the history of Everglades water control and agriculture; the age and evolution of the 'glades in terms of sea level, climate, hydrology and fire patterns; vegetative composition, patterns and sensitivity to nutrients; and the population dynamics of fish, alligators, wading birds and white-tailed deer.

The most interesting chapter has to do with the Natural System Model, a computer simulation (being developed by the South Florida Water Management District) of how water might flow in a natural Everglades, having no canals, structures, pumps, etc. Accompanying colored plates show that surface water flow would be more extensive and prolonged in the Everglades were it not for canals, roads and other man-made structures.

VERNAL POOL PLANTS, Their Habitat and Biology, edited by D.H. Ikeda and R.A. Schlising. Studies from the Herbarium, California State University, Chico. Number 8. 1990. 178 pp.

(Order from Studies from the Herbarium, Department of Biological Sciences, California State University, Chico, CA 95929-0515. \$11.00. Make checks to: The University Foundation.)

This is a collection of eight papers given at the 1989 symposium designed to emphasize biological and environmental information on the plants of vernal pools. "Vernal pools are characterized by "long-term or periodic inactivation during the growing season, desiccation during the summer and early fall, and a flora dominated by native annual species adapted to both aquatic and terrestrial habitats and the added stress of year-to-year climatic differences."

Papers in this collection discuss the floristics of volcanic vernal pools, the edaphic factor in plant community patterns, a model of the hydrology of vernal pools, the structure and function of photosynthetic tissues of vernal pool macrophytes, host-specific bees, plant life histories and vernal pool restoration and creation.

INVASIVE PLANTS OF NATURAL HABITATS IN CANADA, by D.J. White, E. Haber and C. Keddy. Canadian Wildlife Service. 1993. 121 pp.

(Order from Habitat Conservation Branch, Canadian Wildlife Service, Environment Canada, Ottawa, Ontario K1A 0H3, CANADA.)

Alarmed by the rapid spread of the exotic wetland plant, purple loosestrife (*Lythrum salicaria*), Environment Canada contracted this study. It documents the occurrence of invasive wetland and upland plant species of Canada. The study also presents a thorough review of the federal weed acts of Canada, and suggests modifications to them.

Of an estimated 700 alien plant species in Ontario, the "principal aquatic aliens" are few and include Eurasian watermilfoil (*Myriophyllum spicatum*), European frog-bit (*Hydrocharis morsus-ranae*), flowering rush (*Butomus umbellatus*), glossy buckthorn (*Rhamnus frangula*), purple loosestrife (*Lythrum salicaria*) and reed canary grass (*Phalaris arundinacea*). Some minor invasives include curly pondweed (*Potamogeton crispus*), floating heart

(*Nymphoides peltatum*), marsh cress (*Rorippa amphibia*), and yellow flag (*Iris pseudacorus*).

EARTHKIND - ROMANIA SEEKS CONTRIBUTIONS

Located in the center of Bucharest, a city of two million people including 100,000 students, is the newly established **Public Information and Documentation Environmental Center (PIDEC)** of EarthKind-Romania, a professional non-profit non-governmental organization founded last October as a branch of EarthKind International.

The main objectives of EarthKind are biodiversity and wetlands conservation, environmental education and management, and improving public awareness of environmental problems. The main goal of PIDEC is to provide access to information on the environment, both at a general level and at a higher scientific level.

Due to the destruction of the university library in December 1989 and the lack of large collections on environmental topics in Bucharest public libraries, there is a great need for periodicals and books on environmental sciences. Several thousand books and journals have been donated and some funds have been received from the Regional Environmental Center for Central and Eastern Europe, the EEC and from UNESCO for subscriptions.

However, additional support is requested in acquiring recent books and textbooks on ecology and environmental sciences and in subscribing to journals.

For further information, contact Dan Cogalniceanu, Coordinator, PIDEC, University of Bucharest, Faculty of Biology, Splaiul Independentei 91-95, 76 201 Bucharest, Romania. Telephone/Fax: 4013122310.