

A Q U A P H Y T E

A NEWSLETTER ABOUT AQUATIC, WETLAND AND INVASIVE PLANTS

Center for Aquatic and Invasive Plants

with support from
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It's Been Happening for Quite a While: Their Plants Invade Here, Our Plants Invade There

"One of the major problems in the fight against harmful aquatic plants in Africa, as in other parts of the world, is that infestations of particular species have often spread alarmingly before their danger is realized. This may be because the botanical identity of the plant is not known early enough, or alternatively, because it is not recognized that the plant constitutes a potential danger as a harmful plant." H. Wild, Scientific Council for Africa South of the Sahara, Project No. 14, 1961.

The problems of invasive non-native plants have been recognized and studied around the world for quite some time--the *Spartina* invasion of England and France in the late 1800s; the *Salvinia* invasion of Ceylon in the 1940s; the current *Lantana* invasion of South Africa. And for more than 100 years, an official war has been waged against water hyacinth (*Eichhornia crassipes*) in the U.S. (recently resulting in "maintenance control" of this plant in the U.S.). Now, by Presidential decree and federal laws, the water hyacinth war has been expanded to include hundreds of invasive non-native plants, aquatic and terrestrial, which are invading the wildlands and waters of America.

To gain perspective on invasive plant problems and their solutions, wouldn't it behoove us to learn of the experiences of others, past and present, successes and failures, aquatic and terrestrial, in the U.S. and elsewhere? That's why the **APIRS** plant literature database was created: to gather from myriad scientific sources the insights and answers gleaned by invasive plant researchers around the world. Invasive plant research published in several hundred journals and books is included in this database of more than 53,000 items.

While there are many fine new books being published about invasive non-native plants (listed at <http://plants.ifas.ufl.edu/books.html>), the information in these books generally is extracted from the research. The following publications represent a fraction of the thousands of research items in the **APIRS** collection that are specifically about plant invasions, ecology and biology. Although the **APIRS** collection originally was devoted to aquatic plants, we are now tracking the literature of all invasive plants as well, aquatic, wetland and terrestrial. The following titles merely suggest the variety of invasive plant problems and management projects around the world. You are welcome to query the online

database (<http://plants.ifas.ufl.edu>) or have us do it for you (kpb@gnv.ifas.ufl.edu), to obtain citation bibliographies on any invasive plants in the world.

- Aiken, S.G., P.R. Newroth, I. Wile.** 1979. The biology of Canadian weeds. 34. *Myriophyllum spicatum* L. Can. J. Plant. Sci. 59:201-215.
- Animal Plant Control Commission, South Australia.** 1994. Prohibited Aquarium and Pond Plants. Proclaimed Plant Notes, APCC-5/Aquatic/Ver2/July121994. (Australia's prohibited plant list includes some plants that are beneficial natives in the U.S., such as *Cabomba caroliniana*, *Hydrocotyle ranunculoides*, *Ceratophyllum demersum*, and *Sagittaria graminea*; some plants prohibited in the U.S. are beneficial natives in Australia, plants such as *Melaleuca quinquenervia*.)
- Ashton, P.J., D.S. Mitchell.** 1989. Aquatic Plants: Patterns and Modes of Invasion, Attributes of Invading Species and Assessment of Control Programmes. In: Biological Invasions: A Global Perspective, pp. 111-154. Drake, J.A. and H.A. Mooney (eds.), John Wiley & Sons, Ltd., Chichester. (A review of modes.)
- Baki, B.B.** 2000. Biological invasions of noxious weeds in a man-made reservoir. A case study of Timah Tasuh, Perlis, Malaysia. In: Abstracts, Third Internat'l. Weed Sci. Congress, A. Legere (ed.), Foz do Iguassu, Brazil, June 6-11; pp. 5-6. (*Leersia hexandra*, a bird food native in the U.S., is unwanted in Malaysia.)
- Baldwin, J.R., J.R. Lovvorn.** 1994. Expansion of seagrass habitat by the exotic *Zostera japonica*, and its use by dabbling ducks and brant in Boundary Bay, British Columbia. Mar. Ecol. Prog. Ser. 103(1-2):119-127.

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FREE! Photo-Murals for K-12 Teachers in the U.S.

These full-color photo-murals are 62 inches X 23 inches and are fully laminated. Plants shown are from around the country. To read the list of plants for each mural, go to: <http://plants.ifas.ufl.edu> Created especially for school teachers, the **APIRS** photo-murals are free-of-charge to teachers (K-12) in the U.S. **To obtain your free copies, please send a non-virtual request letter, on school letterhead, to APIRS Photo-Mural, Center for Aquatic and Invasive Plants, 7922 NW 71 ST, Gainesville, FL 32653.**

For non-teachers, the cost per mural is \$20 each plus S/H. The *Invasive Non-Native Plants* photo-mural (SP-293) is now available. The *Native Freshwater Plants* photo-mural (SP-292) will be available in June, 2001. To purchase, call IFAS Publications, 1-800-226-1764.

These photo-murals are the result of a collaborative effort by the University of Florida Center for Aquatic and Invasive Plants; the Bureau of Invasive Plant Management of the Florida Department of Environmental Protection; Sea Grant - Florida; and Cerexagri (formerly Elf-Atochem).

Invasive Non-Native Plants



Native Freshwater Plants



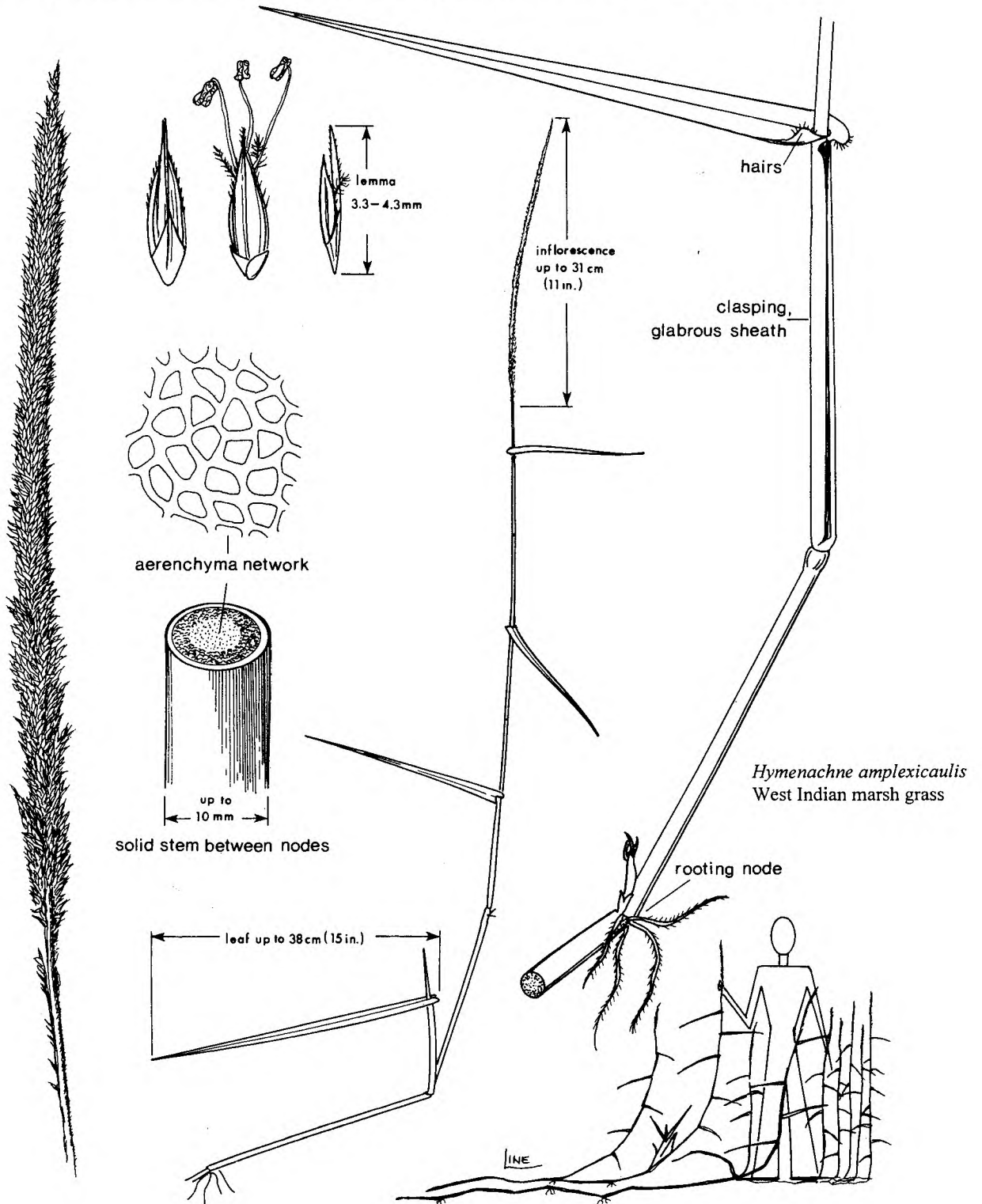
Continued from Page 1

- Barreto, R.W., H.C. Evans.** 1995. The mycobiota of the weed *Mikania micrantha* in southern Brazil with particular reference to fungal pathogens for biological control. *Mycol. Res.* 99(3):343-352.
- Bentivegna, D.J., O.A. Fernandez, M.A. Burgos, M.R. Sabbatini Cerzos.** 2000. Growth of *Potamogeton pectinatus* L. in the irrigation system of the Rio Colorado, Argentina. In: Abstracts, Third Internat'l. Weed Sci. Congress, A. Legere, (ed.), Foz do Iguassu, Brazil, pp. 219-220. (Native in North America, invasive in South America.)
- Blossey, B., J. Kamil.** 1996. What determines the increased competitive ability of invasive non-indigenous plants? In: Proceedings of the IX Internat'l. Symp. on Biological Control of Weeds, pp. 3-9. V.C. Moran and J.H. Hoffmann (eds.). 19-26 January 1996, Stellenbosch, South Africa. University of Cape Town. (*Lythrum salicaria* is also attacking South Africa.)
- Bossard, C.C., J.M. Randall, M.C. Hoshovsky, eds.** 2000. Invasive Plants of California's Wildlands. University of California Press, Berkeley. 360 pp. (Some invasive plants in California, such as *Spartina alterniflora* and *Spartina patens*, are desirable natives in the eastern U.S.)
- Chapman, V.J., J.M.A. Brown, C.F. Hill, J.L. Carr.** 1974. Biology of excessive weed growth in the hydro-electric lakes of the Waikato River, New Zealand. *Hydrobiologia* 44(4):349-363. (Invasive *Ceratophyllum demersum* shut down the Ohakuri power plant in 1965; however, it is a desirable native in the southeastern U.S.)
- Cody, W.J., K.L. MacInnes, J. Cayouette, S. Darbyshire.** 2000. Alien and invasive native vascular plants along the Norman Wells pipeline, District of Mackenzie, Northwest Territories. *Canadian Field Naturalist* 114(1):126-137.
- Crowder, A.A., J.P. Smol, R. Dalrymple, R. Gilbert, et al.** 1996. Rates of natural and anthropogenic change in shoreline habitats in the Kingston Basin, Lake Ontario. *Can. J. Fish. Aquat. Sci.* 53(Suppl.1):121-135.
- Dawson, F.H., D. Holland.** 1999. The distribution in bankside habitats of three alien invasive plants in the U.K. in relation to the development of control strategies. In: Developments in Hydrobiology, J. Caffrey, P.R.F. Barrett, et al., eds. Kluwer Academic Publishers, Dordrecht, The Netherlands, pp. 193-201.
- Del Fosse, E.S. (ed.)** 1980. Proceedings of the Fifth International Symposium on Biological Control of Weeds. 22-29 July 1980. Brisbane, Australia. (Biological control and management of *Salvinia molesta*, *Rumex crispus*, *Hypericum perforatum*, and *Senecio jacobaea*, among other invasive plants.)
- Deloach, C.J.** 1991. Past successes and current prospects in biological control of weeds in the United States and Canada. *Natural Areas J.* 11(3):129-142.
- Duncan, K.W.** 1997. A case study in *Tamarix ramosissima* control: Spring Lake, New Mexico. In: Plant Invasions: Studies from North America and Europe, J.H. Brock, M. Wade, P. Pysek and D. Green, (eds.), Backhuys Publ., Leiden, pp. 115-121.
- Elton, C.S.** 1958/2000. The Ecology of Invasions by Animals and Plants. University of Chicago Press. 181 pp. (One of the first seers in the field.)
- Ferreira, M.T., I.S. Moreira.** 1995. The invasive component of a river flora under the influence of Mediterranean agricultural systems. In: Plant Invasions - General Aspects and Special Problems, pp. 117-127. P. Pysek, K. Prach, M. Rejmanek and M. Wade (eds). SPB Academic Publishing, Amsterdam. (*Paspalum distichum*, a beneficial knotgrass native to the U.S., is unwanted in Portugal.)
- Gopal, B.** 1987. Water hyacinth. Aquatic Plant Studies 1. Elsevier Sci. Publ., Amsterdam. 471 pp. (A monograph.)
- Gritten, R.H.** 1995. *Rhododendron ponticum* and some other invasive plants in the Snowdonia National Park. In: Plant Invasions - General Aspects and Special Problems, pp. 213-219. P. Pysek, K. Prach, et al (eds). 1995. SPB Academic Publishing, Amsterdam. (*Rhododendron ponticum*, native to Spain and Portugal, is unwanted in North Wales.)
- Groves, R.H.** 1986. Plant invasions of Australia: An overview. In: Ecology of Biological Invasions, R.H. Groves and J.J. Burdon (eds.). Cambridge University Press, London, pp. 137-149. (*Sagittaria graminea*, *Cabomba caroliniana*, *Eichhornia crassipes*, *Hydrilla verticillata*, *Lantana camara*, *Myriophyllum aquaticum* and *M. spicatum* are unwanted in Australia.)
- Hamabata, E.** 1997. Distribution, stand structure and yearly biomass fluctuation of *Elodea nuttallii*, an alien species in Lake Biwa. *Jpn. J. Limnol.* 58(2):173-190. (A North American species in a Japanese lake.)
- Hatting, E.R.** 1961. Problem of *Salvinia auriculata* Aubl. and associated aquatic weeds on Kariba Lake. *Weed Research* 1(4):303-306. (*Salvinia* has been an invader for years.)
- Hedge, P., L.K. Kriwoken.** 2000. Evidence for effects of *Spartina anglica* invasion on benthic macrofauna in Little Swanport Estuary, Tasmania. *Austral Ecology* 25(2):150-159. (*Spartina anglica* has made it to the other side of the world.)
- Henderson, L.** 1999. The Southern African Plant Invaders Atlas (SAPIA) and its contribution to biological control. *African Entomol. Memoir* 1:159-163. (*Lantana camara*, *Melia azederach* and *Lonicera japonica* are blacklisted both in Florida and in South Africa.)
- Jenkins, P.T.** 2000. Global policy changes needed to stop biological invasions caused by international trade. In: Third Internat'l. Weed Sci. Congress, A. Legere, (ed.), Foz do Iguassu, Brazil, p. 214.
- Kartesz, J.T., C.A. Meacham.** 1999. Synthesis of the North American Flora. CD, North Carolina Botanical Garden.
- Kissmann, K.G.** 1987. O problema das plantas invasoras na cultura do arroz. *Atualidades Agricolas* 1(1):4-11. (*Polygonum hydropiperoides*, native in Florida, is unwanted in Portuguese rice fields.)
- Kornas, J.** 1996. Five centuries of exchange of synanthropic flora between the Old and the New World. *Wiadomosci Botaniczne* 40(1):11-19. (In Polish; English summary) (Humans and post-Columbian plant migrations.)
- Kozhova, O.M., L.A. Izhboldina.** 1992. Spread of *Elodea canadensis* in Lake Baikal. *Hydrobiologia* 239(1):43-52.

New Drawings!

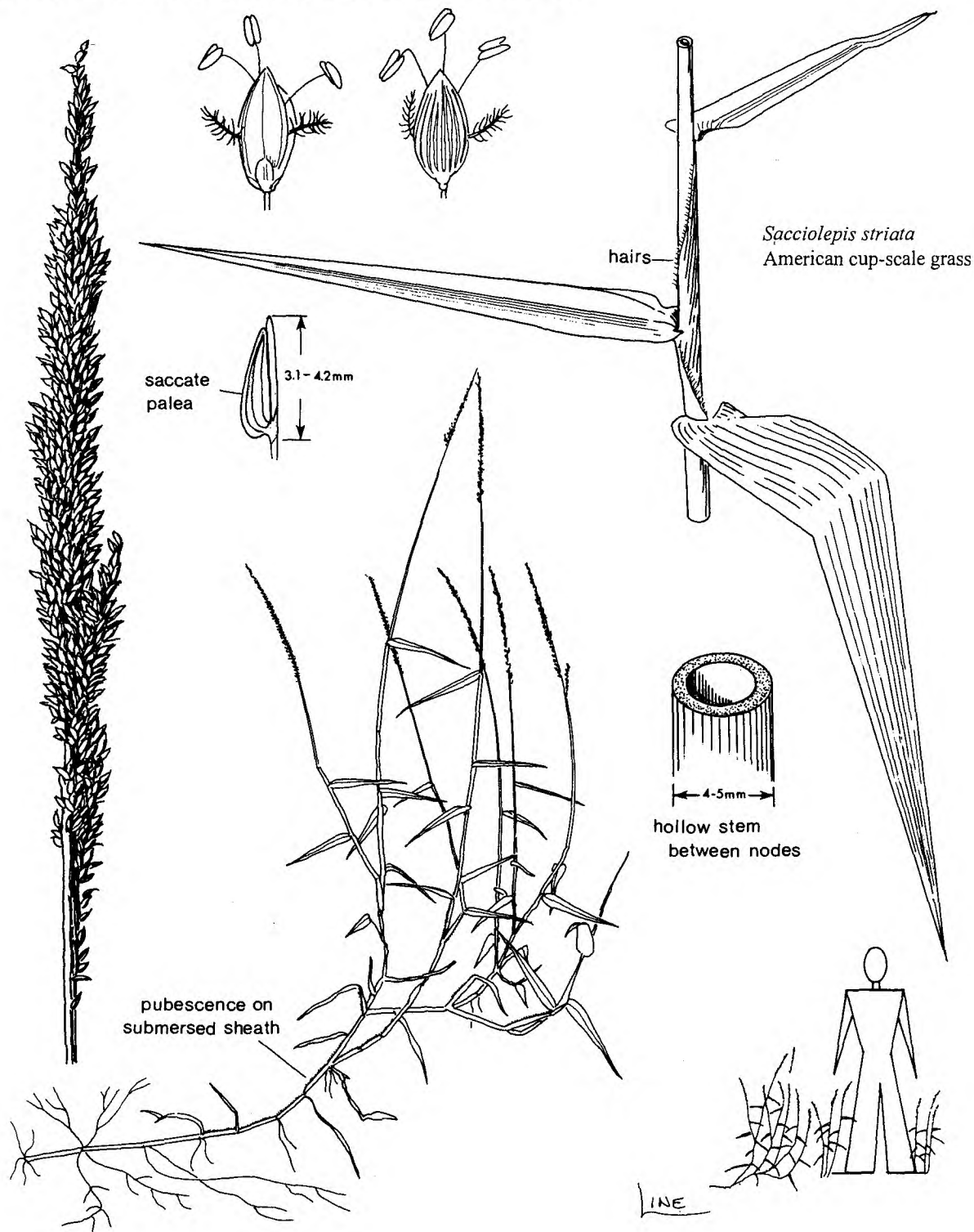
These are new drawings of two aquatic plants in Florida that eco-managers need to carefully distinguish:

***Hymenachne amplexicaulis* is an invasive non-native plant to be controlled in Florida.**



These line drawings are by Laura Line, Center for Aquatic and Invasive Plants, University of Florida. With proper attribution and in not-for-sale items only, please feel free to use these line drawings for manuals, brochures, reports, proposals, web sites

Sacciolepis striata is a native plant to be promoted in Florida.



Some charophytes from the Orlando area in Florida, USA

by Anders Langangen, Hallagerbakken 82 b 1256 Oslo, Norway

On vacation in eastern parts of USA last summer I had a few days in Orlando, where I got the opportunity to visit a few lakes in the area. In two of these lakes I found several interesting charophytes which I would like to report.

The North American charophytes have been studied for more than one hundred years (from Allen, 1880 to Mann, et al., 1999). Still, there is much to find out, both concerning which species occur and their ecology and distribution. There is no modern flora covering the group in North America and my determinations are based on common knowledge of the group, and especially three articles which together cover the different genera of charophytes (Robinson, 1906, Allen, 1954, and Wood, 1948). Later works by the eminent American charologist Richard D. Wood (Wood 1965, 1968) have a species concept which is different from that which is in common use today. In Wood (1965) the number of species is reduced from 395 to 81, but the "old" species are still partly found as forms or microspecies. The descriptions of these are useful. Excellent drawings of many species can be found in Wood and Imahori (1964).

Florida is a tropical part of USA. The soil is rich in lime, and in the Orlando area there are a great number of lakes of different sizes. One should therefore expect to find charophytes in many of these lakes. All such finds are of interest. Material for determination can be sent to me. Determined specimens will be kept in the Botanical Museum, University of Oslo (Herb. O). Specimens can be treated as angiosperms or conserved in 70% alcohol and later put in small plastic envelopes (without alcohol) and sent.

Visited sites:

1. Florida: Osceola County: Kissimmee: Lake Cecilie, June 29, 2000. A eutrophic medium lime-rich lake with a fine white sandy bottom. Charophytes were growing in dense, mixed stands in shallow parts of the lake. Water analyses (analysed in Norway): specific resistance 316 uS/cm, chloride 20 mg/L, and calcium 14 mg/L/
2. Florida: Orange County: Orlando: Lake Crescent (at the entrance to Disney MGM Studios), June 30, 2000. A mesotrophic lake which presumably is artificial. *Nitella* was growing in shallow parts competing with phanerogames and filamentous algae.
3. Orlando: Lake Lucerne, July 1, 2000. Eutrophic lake. No charophytes were found.
4. Orlando: Lake Copeland, July 1, 2000. A strongly polluted lake without charophytes. Lakes 3 and 4 are close to the Orlando Railway Station.

The charophytes found:

1. *Nitella transilis* T.F. Allen (Icon 308 in Wood & Imahori 1964)

Locality: USA: Florida: Orlando: Lake Crescent July 30, 2000.

Specimens monoecious to 10 cm high, green. Axes to 150 µm in diameter. Internodes 1-2x the length of branchlets, to 1 cm. Both sterile and fertile branchlets 6 in a whorl, 2 (3) furcate, to 0.4 cm long. Primary rays 0.5x of branchlet length, secondaries of 4-5, of which one is a central secondary ray or antheridium. Dactyls two celled, to 1.2 mm, of which end cell is 50 µm. Gametangia solitary, conjoined at (1)-2 node. Oogonium 450 µm long. Oronula 100 µm long and 100 µm wide. Convolutions 8. Oospore 200 µm long, 150 µm wide. Brown reticulated membrane. Fossae 34 µm. Antheridium 150 µm wide.

Comments: *Nitella transilis* is a species very close to *N. tenuissima* Kutzing and is separated from this by having much shorter internodes which gives the species a more compact look. The species has been accepted by Wood (1948, 1949, and 1952). In Wood and Muenscher (1956) it is regarded as a variety of *N. tenuissima*. Allen (1954) does not accept it as a species, only as part of the variability of *N. tenuissima*. In Wood (1965) it is *N. tenuissima* f. *transilis* (Allen) R.D. Wood.

Ecology: Lake Crescent is a mesotrophic lake and the charophytes were found on shallow places inside a belt of different water plants. Wood (1952) reported the species from three localities -- one oligotrophic lake on sand bottom and two mesotrophic ponds and sand-muck bottom. The species was associated with oligotrophic/mesotrophic species such as *Nitella flexilis* (L.) Agardh, *N. megacarpa* T.F. Allen, and *Chara braunii* Gmelin.

Distribution: North American species.

2. *Nitella leibergii* T.F. Allen (Icon 315 in Wood & Imahori 1964)

Locality: USA: Florida: Orlando: Lake Cecilie June 29, 2000.

Specimens monoecious to 9 cm high, green. Axes to 400 µm in diameter. Internodes 1-2x the length of branchlets to 1.5 cm long. Fertile branchlets 7 in a whorl, 1-2-(3)(very few) furcate, 0.6 cm long. Primaries 0.5x branchlet length, secondaries 7 (short 1/6 of primaries) again furcate into 1-2 tertiaries. Sterile branchlets 7 in a whorl, 1 and 2 (3) furcate to 1.1 cm. (Small heads with fertile whorls found on many shoots). Dactyls 4-5, uniformly 2-celled (end-cell 50 µm, penultimate 0.9 mm). Gametangia conjoined at second branchlet nodes. Without mucus. Oogonia 400 µm long, 300 µm wide with 7 convolutions. Coronula small. Oospore 250-300 µm long, 200-250 µm wide with 5-6 ridges. Membrane granulate. Dark brown to golden brown oospores. Fossae 50 µm. Antheridia unripe, and only found in the small undeveloped heads on some whorls.

Comments: This species is or is close to *Nitella gracilis* (Smith) Agardh. It differs from this by having strictly 2-celled dactyls. Other similar species are *N. intermedia* Nordstedt in Allen and *N. minuta* Allen.

Ecology: Lake Cecilie is a eutrophic lake and *Nitella* were growing here in dense stands.

Distribution: North American species.

3. *Chara sejuncta* A. Braun (Icons 99 and 100 in Wood & Imahori 1964)

(= *C. compacta* Robinson)

Locality: USA: Florida: Orlando: Lake Cecilie June 29, 2000.

Plants to 6 cm high, green. Axes 550 µm in diameter. Internodes to 1 mm. Cortex regularly triplostichous, isostichous. Spine-cells solitary to 250 µm long, commonly shorter, acute, at older internodes not visible. Stipulodes in two rows. Upper row to 750 µm long, lower row 250 µm. 10-11 branchlets in each whorl, to 1-2x the length of the internodes. Number of branchlet segments 11. Lowest branchlet segment ecorticate, others corticated. Anterior bract-cells two, bracteoles two, both as long as the oogonium, posterior bract-cells five?, short, to 150 µm long. Monoecious, sejoined. Oogonium 1000 µm long; including coronula, 600 µm wide. Antheridium 300 µm wide.

Comments: This is a species similar to the widespread *Chara zeylanica* Klein ex. Willd., but differs from this by having sejoined (at different branchlet nodes) gametangia.

Ecology: Little is known about this species. In eutrophic Lake Cecilie a few specimens were found together with *Nitella* and *Chara gymnopitys*. The species is also found in "lakes in the lowlands of the Mississippi Illinois, opposite St. Louis" (Robinson 1906).

Distribution: American species, see Allen (1894).

4. *Chara gymnopitys* A. Braun (Icons 125, 127, 129, and 130 in Wood & Imahori 1964)

(= *C. cardias* Allen ex. Robinson, *C. coronatiformis* Robinson)

Locality: USA: Florida: Orlando: Lake Cecilie June 29, 2000.

Plants 4-15 cm high. Axes to 500 µm in diameter. Internodes to 10 mm long. Root bulbils. Cortex diplostichous to subtriplostichous, isostichous to strongly tylacanthous on younger internodes. Spine-cells solitary from papillous to as long as stem diameter scattered and not dominating. On small specimens spine-cells are appressed to the stem both up and down. Stipulodes in one row (haplostephanous), acute, 900-1250 µm long, 100 µm wide, 24 stipulodes in 12 pairs. Number of branchlets in each whorl 9-12, to 10 mm, 0.5-2x the length of internodes. Number of segments 3-6, end-segment 1-celled, to 1 mm long. Branchlets total ecorticated. Bract-cells verticillate as long as or longer than the segments. Rich fertile, monoecious, conjoined at 1-3 segment. Oogonium 850 µm long, to 450 µm wide. Convolutions 10-13. Coronula 100 µm long, 150 µm wide. Oospore 550 µm long, 350 µm wide, black, 10-13 ridges. Fossae 50 µm. Antheridium 300 µm wide.

Comments: The original description of *Chara cardias* was based on material collected in Volusia County in Florida. A similar species, *C. flaccida* A. Braun is reported from Latin America (Horn of Rantzien 1950).

Ecology: According to Zaneveld (1940) *Chara gymnopitys* "is a prominent element in the rice-fields or paddies of the tropics and subtropics."

Distribution: Southeastern coast of USA (Tindall 1966). Asia (Zaneveld 1940).

References:

- Allen, G.O. 1954. An annotated key to the Nitellae of North America. Bull. Torrey Bot. Club 81: 35-60.
 Allen, T.F. 1880. The Characeae of America. Part I. New York.
 Allen, T.F. 1894. Note on *Chara sejuncta* A. Br. Bull. Torrey Bot. Club 21: 526.
 Horn of Rantzien, H. 1950. Charophyta reported from Latin America. Arkiv för Botanik 1: 355-411.
 Mann, H., Proctor, V.W., and Taylor, A.S. 1999. Towards a biogeography of North American charophytes. Aust. J. Bot. 47:445-458.
 Robinson, C.B. 1906. The Characeae of North America. Bull. New York Bot. Garden 4: 244-308.
 Tindall, D.R. 1966. The Systematics and Ecology of the Characeae (*Chara* and *Nitella*) of the Southwestern United States and Northern Mexico. Ph.D. Thesis University of Louisville, pp. 134-145/*Chara hydropitys* Reichenbach.
 Wood, R.D. 1948. A review of the genus *Nitella* (Characeae) of North America. Farlowia 3: 331-398.
 Wood, R.D. 1949. The Characeae of Woods Hole Region, Massachusetts. Biol. Bull. 96: 179-203.
 Wood, R.D. 1952. An analysis of ecological factors in the occurrence of Characeae of the Woods Hole Region, Massachusetts. Ecology 33: 104-109.
 Wood, R.D. 1964. Monograph of the Characeae. In: Wood, R.D. & Imahori, K., A revision of the Characeae. Vol. I. 904 pp. J. Cramer, Weinheim.
 Wood, R.D. 1967. Charophytes of North America. A Guide to the Species of Charophyta of North America, Central America, and the West Indies. 72 pp. University of Rhode Island, Kingston, USA.
 Wood, R.D. and Imahori, K. 1964. Iconograph of the Characeae. In: Wood, R.D. and Imahori, K., A Revision of the Characeae. Vol. II. J. Cramer, Weinheim.
 Wood, R.D. & Muenschler, W.C. 1956. The Characeae of the State of New York. Mem. 338, Cornell Univ. Agric. Exp. Sta.: 3-77.
 Zaneveld, J.S. 1940. The Charophyta of Malaysia and adjacent countries. Blumea 4: 1-223.

Books/Reports

THE ECOLOGY OF INVASIONS BY ANIMALS AND PLANTS, by C. S. Elton. 1958/2000. 181 pp.

(Order from University of Chicago Press, 5801 S. Ellis Ave, Chicago, IL 60637. \$13.00. WWW: <http://www.press.uchicago.edu>)

In 1958, when first published, this book was "the bible for practitioners of a burgeoning new science: invasion biology," according to Daniel Simberloff in his forward to this new reprint. Elton himself was interested in "faunal history...ecology...and conservation," and he was especially concerned with the "serious dislocations taking place in the world today [1957]," which were causing "ecological explosions."

Writing in layman's language, Elton describes the invasion and effects of organisms invading the U.S., such as the European starling, the chestnut blight, the muskrat, and plant invasions such as *Spartina townsendii* in England. Chapters dealing with invasions and changes in continents and islands are complemented by chapter essays about population balance, "new food chains," reasons for conservation, and biological variety.

IN SEARCH OF SWAMPLAND -- A Wetland Sourcebook and Field Guide, by R.W. Tiner. 1998. 264 pp.

(Order from IWEER, P.O. Box 288, Leverett, MA 01054-0288. USD \$26 plus S/H. WWW: <http://www.wetlanded.com>)

This primer serves as an introduction to wetlands, and provides the basic tools to identify wetlands, their plant and animal life, and their hydric soils. It is written in a nontechnical style, but may be used as a textbook for courses in wetlands or environmental science.

This illustrated book is divided into two parts. The Wetland Primer is an overview of wetland ecology, status and trends, and contains chapters on hydrology; soils; vegetation; wildlife; formation; functions; values; causes of wetland loss; and wetland protection. The Wetland Identification Guide is a field guide to 300 wetland plants, 200 wetland animals, and soils.

SEAGRASS ECOLOGY -- An Introduction, by M.A. Hemminga and C.M. Duarte. 2000. 298 pp.

(Order from Cambridge University Press, 40 W. 20 St, New York, NY 10011-4211. \$80.00 plus S/H.)

"This book provides an entry point for those wishing to learn about the ecology of this fascinating group of plants, and gives a broad overview of the present state of knowledge, including recent progress in research and current research foci, complemented by extensive literature references to guide the reader to more detailed studies. As such it will be valuable to students of marine biology, and will be an excellent source of information to managers of coastal areas that harbour seagrasses."

THE JAPANESE KNOTWEED MANUAL - The Management and Control of an Invasive Alien Weed, by L. Child and M. Wade. 2000. 123 pp.

(Order from Packard Publishing Ltd, Forum House, Stirling Road, Chichester, West Sussex, PO19 2EN, UNITED KINGDOM. BP £25.00 plus S/H.)

This is a full-blown management manual about a single invasive plant. Japanese knotweed (*Fallopia japonica*) is an invasive weed in Europe, the U.S., Canada, New Zealand and Australia, found along river and stream corridors, road verges, railway embankments and in gardens and on waste ground. Based on more than ten years of research into the life-cycle, biology, ecology and management of the plant, the chapters in this very complete manual deal with recognition; related species and hybrids; history, background, habitat and spread; autecology and habitats; dispersal and regeneration; and problems and legislation. A chapter on developing an effective management program includes advice on awareness, assessment, surveying, and formulating policy. Finally, a full review of control options includes experiences with chemical control, mechanical control, biological control, manual control and disposal. A complete bibliography ends the book, which is illustrated with color photographs, diagrams and case studies.

FLORA OF FLORIDA. Volume One: Pteridophytes and Gymnosperms, by R.P. Wunderlin and B.F. Hansen. 2000. 365 pp.

(Order from University Press of Florida. USD \$49.95 plus S/H. WWW: <http://www.upf.com>)

This is the first of an eight-volume series likely to become the standard reference for the more than 3,800 vascular plants of Florida. Wunderlin is a professor of biology at the University of South Florida; Hansen is curator of the USF herbarium.

For professionals and advanced amateurs, this volume includes keys, descriptions, line drawings, nomenclature, and distribution information for ferns and non-flowering seed plants such as pines, cedars and yews, growing in the wild in Florida.

The next volumes in the series are under way; all will be required by researchers, agencies, teachers, students and consultants who have anything to do with Florida plants.

NATURE OUT OF PLACE - Biological Invasions in the Global Age, by J. Van Driesche and R. Van Driesche. 2000. 352 pp.

(Order from Island Press USD \$29.95 plus S/H. WWW: <http://www.islandpress.org/contact.html>)

"Whether the world becomes a world of weeds will be decided in the next decade or two. There is not time to waste." So say the father/son authors of this book.

Part One presents the scope and history of the invasive species problem. Part Two examines the ecological consequences of and the human responses to invasions. Part Three describes what people can do about biological invasions.

THE RED DATA BOOK OF FLORA OF SERBIA. Volume One: Extinct and Critically Endangered Taxa, edited by V. Stevanovic. 1999. 556 pp.

(Order from Faculty of Biology, University of Belgrade, Takovska St. 43, 11000 Belgrade, YUGOSLAVIA. USD \$85 plus S/H. E-mail: jblaz@eunet.yu)

This clearly written, well produced and reliable book, the first part of an overview of threatened and endangered floral species of Serbia, contains detailed explanations, maps, drawings and photographs of 171 species already extinct or critically endangered in this region.

The book describes the plants' status locally and globally, their distribution and habitat. The book includes taxonomic and phytogeographical notes, causes of extinction or threats to which they are exposed, conservation methods, and suggested ways for reintroducing extirpated species.

THE BIOLOGY OF MANGROVES, by P.J. Hogarth. 2000.

(Order from Oxford University Press, 198 Madison Avenue, New York, NY 10016. \$34.95. WWW: <http://www.oup.com>)

This review of the scientific literature is all about mangrove trees: their distribution, environment, reproductive adaptations; the mangrove ecosystem, form, zonation; the mangrove community, terrestrial components, including associated plants and animals ("insects, spiders, vertebrates"); the mangrove community, marine components, including algae, root fauna, crustacea, molluscs and fish; measuring and modelling mangroves; comparisons and connections, biodiversity and biogeography; impacts and uses, mangroves and pollution, hurricanes, rehabilitation and climate change.

The book comes complete with an extensive bibliography, web site listing, recommended readings, and glossary.

WINTER GUIDE TO WOODY PLANTS OF WETLANDS AND THEIR BORDERS: NORTHEASTERN UNITED STATES, by R.W. Tiner. 2000. 91 pp.

(Order from IWEER, P.O. Box 288, Leverett, MA 01054-0288. USD \$16 plus S/H. WWW: <http://www.wetlanded.com>)

This is a winter identification guide to 100 species of trees, shrubs and woody vines of wetlands and their borders. Illustrations of winter woody twigs and buds, persistent leaves, and other parts used for winter ID make this a unique reference.

CHECKLIST OF THE WOODY CULTIVATED PLANTS OF FLORIDA, by D. Burch, D.B. Ward, and D.W. Hall. 1988. 80 pp.

(Order from IFAS Publications, 1-800/226-1764. Ask for SP-33. Checks and credit cards accepted. \$5.00 plus S/H.)

This book was published in January 1988 by the University of Florida, IFAS Florida Cooperative Extension Service. IFAS Publications still has over one thousand of these paperback books for sale for only \$5.00. This checklist could serve as an historical account of cultivated exotic plants in Florida at some point in time because every woody plant on the Florida Exotic Pest Plant Council's (<http://www.fleppc.org>) Category 1 list is listed as a cultivated plant in this book. The authors state, "By the industrious efforts of plant enthusiasts and importers, and the appropriate niches awaiting suitably selected species, the abundance of the world's flora is well sampled in Florida." (Remember, this was in 1988!)

PRAIRIE WETLAND ECOLOGY, edited by H.R. Murkin, A.G. van der Valk and W.R. Clark. 2000. 413 pp.

(Order from Iowa State University Press, POB 570, 2121 S. State Ave, Ames, Iowa 50010-0570. USD \$79.95 plus S/H. Phone: 800-862-6657; WWW: <http://www.isupress.edu>)

Ten experts explain what has been learned so far from MERP, the Marsh Ecology Research Program, a joint project of Ducks Unlimited Canada and the Delta Waterfowl and Wetlands Research Station. MERP, designed as a long-term replicated experiment, studied the ecology and nutrient budgets in prairie wetlands during wet-dry cycles especially as related to marsh management for wildlife. The water level manipulated experimental cells were created in the Delta Marsh of Lake Manitoba. Prairie wetland macrophytes and algae, and the uses of these wetlands by invertebrates, birds and muskrats are discussed in detail. A very good summary reports what was learned from their extensive efforts about prairie wetland management.

FIELD GUIDE TO NONTIDAL WETLAND IDENTIFICATION, by R.W. Tiner. 1988. 224 pp.

(Order from IWEER, P.O. Box 288, Leverett, MA 01054-0288. USD \$35 plus S/H. WWW: <http://www.wetlanded.com>)

This guide includes keys to identifying about 300 wetland plants common to freshwater wetlands from Florida to New England. Illustrations of over 270 species.

WETLAND ECOLOGY-PRINCIPLES AND CONSERVATION, by P.A. Keddy. 2000. 614 pp.

(Order from Cambridge University Press, 40 West 20 St, New York, NY 10011-4211. Hardback: USD \$140 plus S/H; Paperback: USD \$52.95 plus S/H)

For researchers, enviro-managers and senior undergraduates, the eminent author of this book tries "to provide some unity and coherence in the study of wetland ecology" by providing "a synthesis of the existing field of wetland ecology".

Besides including an excellent and readable overview of wetlands, this book contains chapters which summarize what is known about wetland zonation and succession, diversity, hydrology, fertility, disturbance, competition, herbivory, burial, restoration and conservation, management and research. Examples from all over the world are included.

WETLAND SYSTEMS FOR WATER POLLUTION CONTROL, Proceedings of the 7th International Conference, Volumes I, II and III, edited by K.R. Reddy and R.H. Kadlec. 2000. 1082 pp.

(Order from University of Florida, IFAS Publications, POB 110011, Gainesville, FL 32611-0011. USD \$100.00 + S/H. E-mail: pub@gnv.ifas.ufl.edu)

This 3-volume proceedings includes 187 papers and 63 abstracts. Volume I includes keynote papers and papers on phosphorus removal and transformations; nitrogen removal and transformations; and pathogen removal.

Continued next page -

Volume II includes papers on optimization and modelling; ecological considerations; and subsurface flow wetland systems.

Volume III includes papers on surface flow wetland systems; industrial waste waters; agricultural waste waters and stormwater.

INVASIVE PLANTS OF CALIFORNIA'S WILDLANDS, edited by C.C. Bossard, J.M. Randall and M.C. Hoshovsky. 2000. 360 pp.

(Order from University of California Press, Sales Department, 2000 Center Street #303, Berkeley, CA 94704, 609-883-1759. USD \$29.95 plus S/H.)

This is a well-produced, well-organized and practical book of accounts for 78 non-native plant species that are listed by the California Exotic Pest Plant Council as invasive plants. "These plants cause or have the potential to cause serious damage in the state's parks, preserves and other wildlands."

Not only have the authors read the literature, but they also know how to present the scientific information with a manager's point of view. So, included for each plant are practical and reliable answers to the questions: How do I recognize it? Where would I find it? Where did it come from and how does it spread? What problems does it cause? How does it grow and reproduce? and How can I get rid of it? Also included for each plant are synonymy and California distribution maps.

The book also contains information about strategies and methods appropriate for the control of plants in parks, preserves and other wildlands.

Continued from Page 3

Les, D.H., L.J. Mehrhoff. 1999. Introduction of nonindigenous aquatic vascular plants in southern New England: a historical perspective. *Biological Invasions* 1:281-300. (*Cabomba caroliniana* and *Limnobiium spongia*, natives to the southeastern U.S., are unwanted in the northeastern U.S.)

Monteiro, A., T. Vasconcelos, L. Catarino, eds. 1998. Proc. 10th EWRS

International Symposium on Aquatic Weeds. European Weed Research Society, September 1998, Lisbon. (Since 1967, the European Weed Research Society has met over invasive plants.)

Nohara, S., M. Hiroki. 1996. Effects of land use in the surrounding area on bamboo grass invasion into Akaiyachi Mire. In: Mires of Japan, T. Iwakuma, ed., National Inst. Environ. Studies, Tsukuba, pp. 95-98

Pieterse, A.H., K.J. Murphy. 1990. Aquatic Weeds: The Ecology and Management of Nuisance Aquatic Vegetation. Oxford University Press, New York. 593 pp. (Information about 372 aquatic species around the world.)

Prach, K., S. Husak. 1996. Invasion of alien plants. In: Floodplain Ecology and Management, pp. 93-98. Prach, H., J. Jenick, et al, (eds.). SPB Academic Publ., Amsterdam. (Among others, *Heracleum mantegazzianum* (giant hog weed) is a problem plant for river managers in Ireland, is prohibited in Washington state, and is invading Canada.)

Pysek, P. 1998. Alien and native species in Central European urban floras: a quantitative comparison. *J. Biogeog.* 25:155-163.

Roberts, D.E., A.G. Church, S.P. Cummins. 1999. Invasion of *Egeria* into the Hawkesbury-Nepean River, Australia. *J. Aquat. Plant Manage.* 37:31-34. (*Egeria* is displacing "native" *Vallisneria americana* in Australia.)

Ruiz-Avila, R.J., V.V. Klemm. 1996. Management of *Hydrocotyle ranunculoides* L.f., an aquatic invasive weed of urban waterways in Western Australia. *Hydrobiologia* 340:187-190. (*Hydrocotyle ranunculoides*, floating marsh pennywort, is native to the U.S. but is unwanted on Australian rivers.)

Sandlund, O.T., P.J. Schei, A. Viken, eds. 1999. Invasive Species and Biodiversity Management. Kluwer Academic Publishing, Boston. 431 pp.

Stone, C.P., C.W. Smith, et al., eds. 1992. Alien Plant Invasions in Native Ecosystems of Hawaii--Management and Research. University of Hawaii, Honolulu. (A continent and half an ocean apart, Florida and Hawaii share some of the same invasive plants: *Psidium guajava*, *P. cattleianum*, *Schinus terebinthifolius*, *Ficus microcarpa*, *Sacciolepis indica* and others.)

Thompson, K., J.G. Hodgson, T.C.G. Rich. 1995. Native and alien invasive plants: more of the same? *Ecography* 18:390-402. Copenhagen. (A list of many non-native plants in Europe.)

Tjitrosoedirdjo, S.S., E.T. Wahyu. 1994. Weed Information Sheets. Southeast Asia Weed Information Center, SEAMEO BIOTROP, Bogor, Indonesia. (*Eleusine indica*, Indian goosegrass, is an invasive plant in the crops of Indonesia, as well as the U.S. and eastern Canada.)

Tsuyuzaki, S., T. Tsujii. 1992. Size and shape of *Carex mayeriana* tussocks in an alpine wetland, northern Sichuan Province, China. *Can. J. Bot.* 70:2310-2312.

Usher, J.F. 1971. *Salvinia*--a rival for water hyacinth? *Cane Growers Quarterly Bull.* 34:137-138. (*Salvinia* in Australia since the 1960s.)

van Wilgen, B.W., F. van der Heyden, H.G. Zimmermann, D. Magadela, T. Willems. 2000. Big returns from small organisms: developing a strategy for the biological control of invasive alien plants in South Africa. *South African J. Science* 96(3):148-152. (The "Working for Water" program led to the establishment of over 200 alien plant control projects in South Africa against plants such as *Acacia longifolia*, *Lantana camara* and *Solanum mauritianum*.)

van der Wal, R., S. van Lieshout, D. Bos, R.H. Drent. 2000. Are spring staging brent geese evicted by vegetation succession? *Ecography* (23(1):60-69. (Migrating waterfowl may not be able to eat invading plants in The Netherlands.)

Velu, G., A. Rajagopal. 1996. Response of rice (*Oryza sativa*) to infestation of barnyard grass (*Echinochloa crus-galli*). *Indian J. Agric. Sci.* 66(6):360-362.

Wisheu, I.C., P.A. Keddy. 1994. The low competitive ability of Canada's Atlantic coastal plain shoreline flora: Implications for conservation. *Biological Conserv.* 68(3):247-252.

Wild, H. 1961. Harmful aquatic plants in Africa and Madagascar. CSA/CCTA Joint Publ. No. 73, Salisbury. 68 pp.

Zalba, S.M., M.I. Sonaglioni, C.A. Compagnoni, C.J. Belenguer. 2000. Using a habitat model to assess the risk of invasion by an exotic plant. *Biological Conserv.* 93(2):203-208. (*Atriplex nummularia* invasion in Argentina.)

MEETINGS

WATERSHED SCIENCE, POLICY, PLANNING AND MANAGEMENT--Can We Make It In Florida?

June 19-21, 2001. Tampa Busch Gardens, Tampa, FL.

This is part of the Natural Resources Forum Series hosted by the Center for Natural Resources of the University of Florida. The forum "explores the interconnections and processes driving watershed management," and "allows for dynamic interaction between public and private entities."

Contact: WWW: <http://gnv2.ifas.ufl.edu/%7Econferweb/nrf/>

ANNUAL MEETING, PLANT GROWTH REGULATION SOCIETY OF AMERICA.

July 1-5, 2001. Miami Beach, FL.

The meeting will include presentations on any area of plant growth regulation and natural products. The PGRSA was founded in 1973, and serves scientists from very diverse disciplines.

Contact: <http://www.griffin.peachnet.edu/pgrsa>

41st ANNUAL MEETING, THE AQUATIC PLANT MANAGEMENT SOCIETY.

July 15-18, 2001. Minneapolis, MN.

This meeting is attended by aquatic plant researchers and managers and includes papers on the biology, ecology and management of aquatic plants. Includes a student paper competition.

Contact: WWW: <http://www.apms.org/>

16th ANNUAL SYMPOSIUM, FLORIDA EXOTIC PEST PLANT COUNCIL.

September 12-14, 2001. St. Augustine, FL.

Find out the latest on Florida's exotic pest plants in this state's oldest city.

Contact: Kathy Burks, kathy.burks@dep.state.fl.us

11TH INTERNATIONAL CONFERENCE ON AQUATIC INVASIVE SPECIES.

October 1-4, 2001. Hilton Alexandria Mark Center, Alexandria, VA.

This conference deals with aquatic animal and aquatic plant invaders, and will feature talks on prevention, rapid response, and management; global and regional environmental impacts; habitat/ecosystem changes; monitoring and information exchange; education and outreach initiatives; ballast water and shipping; and control technologies.

Contact: Conference Administrator, 800-868-8776. E-mail: profedge@renc.igs.net

WWW: <http://www.aquatic-invasive-species-conference.org>

25TH ANNUAL MEETING, FLORIDA AQUATIC PLANT MANAGEMENT SOCIETY.

October 16-18, 2001. Daytona Beach, FL.

This meeting is primarily to share control strategies among members who include government agency personnel and private companies, with an emphasis on field personnel. Includes a resource and equipment demonstration and an applicator paper competition.

Contact: WWW: <http://www.homestead.com/fapms/program.html>

21ST ANNUAL SYMPOSIUM, NORTH AMERICAN LAKE MANAGEMENT SOCIETY.

November 7-9, 2001. Madison, WI.

2001: A Lake Odyssey. "If you're looking for good examples of projects that have traveled the path from science to policy, to implementation, then be in Madison the first week of November 2001." This NALMS meeting will be hosted by the Wisconsin Associations of Lakes.

Contact: <http://www.nalms.org/symposia/madison>

2ND INTERNAT'L. CONFERENCE, PLANTS AND ENVIRONMENTAL POLLUTION.

November 15-19, 2001. National Botanical Research Institute, Lucknow, India.

This conference is sponsored by the International Society of Environmental Botanists. Various conference themes include Climate Change and Agricultural Production; Environmental Pollution and Biodiversity; Environmental Biotechnology; Plant Response to Environmental Pollution; Environmental Impact Assessment; and Environmental Education, Legislation and Economic Impact.

Contact: WWW: <http://www.icpep.org> or E-mail: nbri@lwl.vsnl.net.in

FROM THE DATABASE

Here is a sampling of the research articles, books and reports which have been entered into the aquatic plant database since Winter 2000.

The database contains more than 53,000 citations. To receive free bibliographies on specific plants and/or subjects, contact APIRS using the information on the back page or use the database online at <http://plants.ifas.ufl.edu/>

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

Abe, K., Ozaki, Y., Mizuta, K.

Evaluation of useful plants for the treatment of polluted pond water with low N and P concentrations.

SOIL SCI. PLANT NUTRITION 45(2):409-417. 1999.

Ambrogio, D.M., Gallardo, M.T., Benson, R.F., Martin, D.F.

Use of a computer-interfaced system for determination of the inhibition of oxygen production by selected aquatic weeds in the presence of cattail (*Typha domingensis*) extract.

FLORIDA SCIENTIST 63(2):118-122. 2000.

Antuniassi, U.R., Velini, E.D., Martins, D.

Mechanical removal of aquatic weeds: operational and economic analysis.

IN: THIRD INTERNATIONAL WEED SCI. CONGRESS, ED. A. LEGERE, FOZ DO IGUAU, BRAZIL, JUNE 2000, P. 219 (ABSTRACT). 2000.

Araki, S.

Variation of sterility and fertility in *Utricularia australis* F. *australis* in Hokkaido, northern Japan.

ECOLOGICAL RESEARCH 15(2):193-201. 2000.

Azza, N.G.T., Kansime, F., Nalubega, M., Denny, P.

Differential permeability of papyrus and *Miscanthidium* root mats in Nakivubo Swamp, Uganda.

AQUATIC BOTANY 67:169-178. 2000.

Bagwell, C.E., Lovell, C.R.

Microdiversity of culturable diazotrophs from the rhizoplanes of the salt marsh grasses *Spartina alterniflora* and *Juncus roemerianus*.

MICROBIAL ECOLOGY 39(2):128-136. 2000.

Baki, B.B.

Biological invasions of noxious weeds in a man-made reservoir. A case study of Timah Tasuh, Perlis, Malaysia.

IN: THIRD INTERNATIONAL WEED SCI. CONGRESS, ED. A. LEGERE, FOZ DO IGUAU, BRAZIL, JUNE 2000, PP. 5-6 (ABSTRACT). 2000.

Balashov, L.S., Zub, L.N., Savitsky, A.L.

Types of Kiev waterbodies according to floristic composition of higher aquatic vegetation.

BIOL. INLAND WATERS 1:5-12. (IN RUSSIAN; ENGLISH SUMMARY). 2000.

Banziger, R.

Spatio-temporal distribution of size classes and larval instars of aquatic insects (Ephemeroptera, Trichoptera and Lepidoptera) in a *Potamogeton pectinatus* L. bed (Lake Geneva, Switzerland).

REVUE SUISSE DE ZOOLOGIE 107(1):139-151. 2000.

Barrat-Segretain, M.-H., Henry, C.P., Bornette, G.

Regeneration and colonization of aquatic plant fragments in relation to the disturbance frequency of their habitats.

ARCH. HYDROBIOL. 145(1):111-127. 1999.

Batson, W.T.

The rushes of North and South Carolina.

J. ELISHA MITCHELL SCI. SOC. 68(1):93-101. 1952.

Bennett, A.

Potamogeton polygonifolius in Newfoundland.

BOTANICAL GAZETTE 32:58-59. 1901.

Bergmann, B.A., Cheng, J., Classen, J., Stomp, A.-M.

Nutrient removal from swine lagoon effluent by duckweed.

TRANS. AMER. SOC. AGRIC. ENG. (ASAE) 43(2):263-269. 2000.

Bessey, C.E.

The yellow water crowfoot.

AMERICAN NATURALIST 24:475. 1890.

Blazencic, J., Blazencic, Z., Cvijan, M.

Floristical and ecological study of Charophyta in water ecosystems of National Park "Durmitor" (Montenegro, Yugoslavia).

EKOLOGIJA 28(1-2):33-54 (IN SERBO-CROATIAN; ENGLISH SUMMARY). 1994.

Blindow, I., Hargeby, A., Wagner, B.M.A., Andersson, G.

How important is the crustacean plankton for the maintenance of water clarity in shallow lakes with abundant submerged vegetation?

FRESHWATER BIOLOGY 44(2):185-197. 2000.

Broughton, S.

Impact of the seed-fly, *Ophiomyia lantanae* (Froggatt) (Diptera: Agromyzidae), on the viability of lantana fruit in Southeast Queensland, Australia.

BIOLOGICAL CONTROL 15:168-172. 1999.

Browning, J., Gordon-Gray, K.D.

Patterns of fruit morphology in *Bolboschoenus* (Cyperaceae) and their global distribution.

SOUTH AFRICAN J. BOT. 66(1):63-71. 2000.

Cameron, G.N., Glumac, E.G., Eshelman, B.D.

Germination and dormancy in seeds of *Sapium sebiferum* (Chinese tallow tree).

J. COASTAL RESEARCH 16(2):391-395. 2000.

Capers, R.S.

A comparison of two sampling techniques in the study of submersed macrophyte richness and abundance.

AQUATIC BOTANY 68:87-92. 2000.

Caplen, C.A., Werth, C.R.

Isozymes of the *Isoetes riparia* complex. II. Ancestry and relationships of polyploids.

SYSTEMATIC BOT. 25(2):260-280. 2000.

Castell, J.

Farming the waters: bringing aquatic plant and animal species to agriculture.

CAN. J. ANIMAL SCI. 80(2):235-243. 2000.

Chang, E.R., Dickinson, T.A., Jefferies, R.L.

Seed flora of La Perouse Bay, Manitoba, Canada: a DELTA database of morphological and ecological characters.

CANADIAN J. BOT. 78(4):481-496. 2000.

Charlton, W.A.

Studies in the Alismataceae. X. Floral organogenesis in *Luronium natans* (L.) Raf.

CAN. J. BOT. 77:1560-1568. 1999.

Crous, P.W., El-Gholl, N.E., Walker, S.E., Schubert, T.S.

Angular leaf spot disease of *Saururus* caused by *Phaeoramularia saururi* Comb. Nov.
MYCOTAXON 72:7-13. 1999.

Davis, M.A., Grime, J.P., Thompson, K.

Fluctuating resources in plant communities: a general theory of invasibility.
J. ECOLOGY 88(3):528-534. 2000.

Donabaum, K., Schagerl, M., Dokulil, M.T.

Integrated management to restore macrophyte domination.
HYDROBIOLOGIA 395/396:87-97. 1999.

Dos Santos, M.C., Lenzi, E.

The use of aquatic macrophytes (*Eichhornia crassipes*) as a biological filter in the treatment of lead contaminated effluents.
ENVIRON. TECHNOL. 21(6):615-622. 2000.

Duke, D., O'Quinn, P., Sutton, D.L.

Control of *Hygrophila* and other aquatic weeds in the Old Plantation Water Control District.
AQUATICS 22(3):4,7-8,10. 2000.

Dyck, B.S., Shay, J.M.

Biomass and carbon pool of two bogs in the experimental lakes area, northwestern Ontario.
CAN. J. BOT. 77(2):291-304. 1999.

Epler, J.H., Cuda, J.P., Center, T.D.

Redescription of *Cricotopus lebetis* (Diptera: Chironomidae), a potential biocontrol agent of the aquatic weed *Hydrilla* (Hydrocharitaceae).
FLORIDA ENTOMOLOGIST 83(2):171-180. 2000.

Ervin, G.N., Wetzel, R.G.

Allelochemical autotoxicity in the emergent wetland macrophyte *Juncus effusus* (Juncaceae).
AMERICAN J. BOT. 87(6):853-860. 2000.

Everitt, J.H., Escobar, D.E., Webster, C.F., Lonard, R.I.

Light reflectance characteristics and film image relations among three aquatic plant species.
TEXAS J. SCI. 52(2):153-158. 2000.

Feist, B.E., Simenstad, C.A.

Expansion rates and recruitment frequency of exotic smooth cordgrass, *Spartina alterniflora* (Loisel), colonizing

unvegetated littoral flats in Willapa Bay, Washington.
ESTUARIES 23(2):267-274. 2000.

Fonseca, M.S., Julius, B.E., Kenworthy, W.J.

Integrating biology and economics in seagrass restoration: how much is enough and why?
ECOLOGICAL ENGINEERING 15(3-4):227-237. 2000.

Franzaring, J., Tonneijck, A.E.G., Kooijman, A.W.N., Dueck, T.A.

Growth response to ozone in plant species from wetlands.
ENVIRON. EXPER. BOT. 44(1):39-48. 2000.

Gómez Méndez, C.E.

Evaluación de maleza acuática con relación a parámetros químicos de agua y sedimento en el DR-086 Soto La Marina, mediante SIG y Bioestadística.
THESIS, UNIDAD ACADÉMICA MULTIDISCIPLINARIA, AGRONOMÍA Y CIENCIAS, UNIVERSIDAD AUTÓNOMA DE TAMAULIPAS, MEXICO, 121 PP. (IN SPANISH; ENGLISH SUMMARY). 2000.

Gould, W.A., Walker, M.D.

Plant communities and landscape diversity along a Canadian arctic river.
J. VEG. SCI. 10(4):537-548. 1999.

Greulich, S., Bornette, G., Amoros, C., Roelofs, J.G.M.

Investigation on the fundamental niche of a rare species: an experiment on establishment of *Luronium natans*.
AQUATIC BOTANY 66(3):209-224. 2000.

Hach, C.V., Chin, D.V., Nhiem, N.T., Mortimer, M., et al

Effect of tillage practices on weed infestations and soil seed banks in wet-seeded rice.

IN: THIRD INTERNATIONAL WEED SCI. CONGRESS, ED. A. LEGERE, FOZ DO IGUAÇU, BRAZIL, JUNE 2000, PP. 51-52 (ABSTRACT). 2000.

Hattink, J.

Accumulation of technetium in duckweed.
THESIS, DELFT UNIVERSITY PRESS, THE NETHERLANDS. 2000.

Hedge, P., Kriwoken, L.K.

Evidence for effects of *Spartina anglica* invasion on benthic macrofauna in Little Swanport Estuary, Tasmania.
AUSTRAL ECOL. 25(2):150-159. 2000.

Henderson, L.

The Southern African Plant Invaders

Atlas (SAPIA) and its contribution to biological control.
AFRICAN ENTOMOL. MEMOIR 1:159-163. 1999.

Hofstra, D.E., Clayton, J.S., Getsinger, K.D.

Evaluation of new herbicides for the control of submerged weeds in New Zealand.
40TH ANNUAL MEETING, AQUATIC PLANT MGMT. SOC., SAN DIEGO, CA, JULY 2000, P. 9 (ABSTRACT). 2000.

Hoven, H.M., Gaudette, H.E., Short, F.T.

Isotope ratios of ²⁰⁶Pb/²⁰⁷Pb in eelgrass, *Zostera marina*, indicate sources of Pb in an estuary.
MAR. ENVIRON. RES. 48(4-5):377-387. 1999.

Hudon, C., Lalonde, S., Gagnon, P.

Ranking the effects of site exposure, plant growth form, water depth, and transparency on aquatic plant biomass.
CAN. J. FISH. AQUATIC SCI. 57 (SUPPL. 1):31-42. 2000.

Idso, S.B., Kimball, B.A., Pettit, G.R., Garner, L.C., et al

Effects of atmospheric CO₂ enrichment on the growth and development of *Hymenocallis littoralis* (Amaryllidaceae) and the concentrations of several antineoplastic and antiviral constituents of its bulbs.
AMERICAN J. BOT. 87(6):769-773. 2000.

James, M.R., Hawes, I., Weatherhead, M.

Removal of settled sediments and periphyton from macrophytes by grazing invertebrates in the littoral zone of a large oligotrophic lake.
FRESHWATER BIOL. 44(2):311-326. 2000.

Jayakumar, M., Eyini, M., Selvinthangadurai, P.

Changes in pigment composition and photosynthetic activity of aquatic fern (*Azolla microphylla* Kaulf.) exposed to low doses of UV-C (254nm) radiation.
PHOTOSYNTHETICA 37(1):33-38. 1999.

Karpiscak, M.M., Freitas, R.J., Gerba, C.P., Sanchez, L.R., Shamir, E.

Management of dairy waste in the Sonoran Desert using constructed wetland technology.
WATER SCI. TECHNOL. 40(3):57-65. 1999.

Karst, T.L., Smol, J.P.

Paleolimnological evidence of limnetic

nutrient concentration equilibrium in a shallow, macrophyte-dominated lake.
AQUAT. SCI. 62(1):20-38. 2000.

Kaufman, L.N., Landis, D.A.

Host specificity testing of *Galerucella californiensis* L. (Coleoptera: Chrysomelidae) on wild and ornamental plant species.
BIOLOGICAL CONTROL 18(2):157-164. 2000.

Kubaneck, J., Fenical, W., Hay, M.E., Brown, P.J., et al

Two antifeedant lignans from the freshwater macrophyte *Saururus cernuus*.
PHYTOCHEM. 54(3):281-287. 2000.

Kurniadie, D., Kunze, C.

Constructed wetlands to treat house wastewater in Bandung, Indonesia.
J. APPLIED BOT. 74(1-2):87-91. 2000.

Lippok, B., Gardine, A.A., Williamson, P.S., Renner, S.S.

Pollination by flies, bees, and beetles of *Nuphar ozarkana* and *N. advena* (Nymphaeaceae).
AMERICAN J. BOT. 87(6):898-902. 2000.

Lonsdale, W.M.

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University of Florida
Institute of Food and Agricultural Sciences
AQUATIC, WETLAND AND INVASIVE PLANT
INFORMATION RETRIEVAL SYSTEM (APIRS)
Center for Aquatic and Invasive Plants
7922 N.W. 71st Street
Gainesville, Florida 32653-3071 USA
(352) 392-1799 FAX: (352) 392-3462
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kpb@gnv.ifas.ufl.edu
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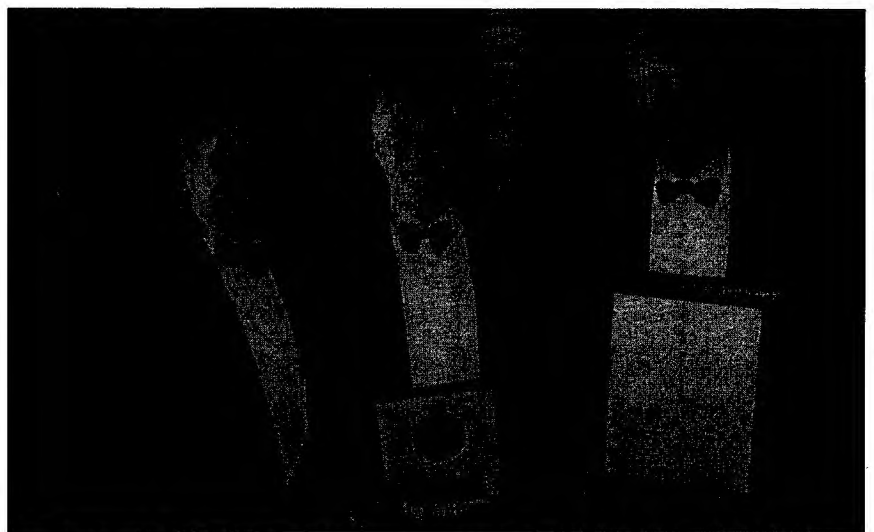
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**EDITORS: Victor Ramey
Karen Brown**

AQUAPHYTE is sent to managers, researchers and agencies in 71 countries around the world. Comments, announcements, news items and other information relevant to aquatic plant research are solicited.

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From left to right: Paul Cox, Director, NTBG; C.D.K. Cook, Honoree; Douglas McBryde Kinney, Chairman, NTBG Board of Trustees

Christopher D.K. Cook, explorer, taxonomist and teacher, who is also the global authority on aquatic vascular plants, has been awarded the **David Fairchild Medal for Plant Exploration**. The Fairchild Medal is the world's most prestigious award for plant discovery and conservation, an award which "honors distinguished service to humanity." The ceremony took place February 9, 2001, in Coconut Grove (Miami), Florida at *The Kampong*, an exquisite home overlooking Biscayne Bay and the former home of David Fairchild.

Presenting the medal (as well as a citation and a check) were Paul Alan Cox, director of the National Tropical Botanical Garden (NTBG), and Douglas McBryde Kinney, Chairman of the NTBG Board of Trustees. The NTBG is comprised of five gardens and three preserves in Florida and Hawaii and is dedicated to conservation, research and education relating to the world's tropical plants.

Professor Cook is the well-known and well-traveled author of numerous books and scientific articles on aquatic plants of the world, including *Waterplants of the World*, first published in 1974. He also developed Switzerland's Institute for Systematic Botany and the Botanic Gardens at the University of Zurich.