49th Annual Meeting of the Aquatic Plant Management Society

PROGRAM

Hyatt Regency
Milwaukee, Wisconsin
July 12-15, 2009

The Aquatic Plant Management Society, Inc. is an international organization of scientists, educators, students, commercial pesticide applicators, administrators, and concerned individuals interested in the management and study of aquatic plants. The membership reflects a diversity of federal, state, and local agencies, universities and colleges around the world, corporations, and small businesses. Membership applications are available at the meeting registration desk.

The Objectives of the Society are to assist in promoting the management of nuisance aquatic plants, to provide for the scientific advancement of members of the society, to encourage scientific research, to promote university scholarship, and to extend and develop public interest in the aquatic plant science discipline.

Our Mission: The Aquatic Plant Management Society strives to promote environmental stewardship through operations, research, education and outreach related to integrated management of vegetation in aquatic systems.

Table of Contents

Board of Directors

Carlton Layne
President
Aquatic Ecosystem Restoration Foundation
Marietta, Georgia

Jim Petta
Immediate Past President
Syngenta Professional Products
Arica, Chile

Greg MacDonald
President Elect
University of Florida
Gainesville, Florida

Linda Nelson
Vice President
U.S. Army Engineer R&D Center
Vicksburg, Mississippi

Sherry Whitaker
Treasurer
U.S. Army Engineer R&D Center
Vicksburg, Mississippi

Michael D. Netherland
Editor
U.S. Army Engineer R&D Center
Gainesville, Florida

Jeffrey D. Schardt
Secretary
Florida Fish and Wildlife Conservation Commission
Tallahassee, Florida

Alan "Bo" Burns
Director
BASF Corporation
Raleigh, North Carolina

Terry Goldsby
Director
AquaServices, Inc.
Guntersville, Alabama

Brad Howell
Director
Applied Biochemists
Germantown, Wisconsin

Tyler Koschnick
Director
SePRO Corporation
Medina, Ohio

Chetta Owens
Director
U.S. Army Engineer R&D Center
Lewisville, Texas

Susan B. Wilde
Director
University of Georgia
Athens, Georgia

Josh Cheshier
Student Representative
Mississippi State University
Mississippi State, Mississippi

Committee Chairs and Special Representatives

Bylaws and Resolutions	Jim Schmidt
Education and Outreach	Rob Richardson
Exhibits	Harry Knight
Finance	Richard M. Hinterman
Legislative	Joe Bondra
Meeting Planning	Bo Burns
Membership	Steve Cockreham
Nominating	Jim Petta
Past President's Advisory	Jim Petta
Program	Greg MacDonald
Publications	Michael D. Netherland
Regional Chapters	Linda Nelson
Scholastic Endowment	Greg Cheek
Strategic Planning	John H. Rodgers, Jr.
Student Affairs	Tyler Koschnick
Website	Mike Grodowitz
BASS Representative	Gerald Adrian
CAST Representative	John Madsen
ISAC Representative	Jeff Schardt
NALMS Representative	Mike Netherland
RISE Representative	Joe Bondra
WSSA Science Policy Director	Lee Van Wychen
Webmaster	Dave Petty
WSSA Representative	Linda Nelson

APMS Presidents and Meeting Sites

1961	T. Wayne Miller, Jr.	Fort Lauderdale, Florida
1962	T. Wayne Miller, Jr.	Fort Lauderdale, Florida
1963	William Dryden	Tampa, Florida
1964	Herbert J. Friedman	Tallahassee, Florida
1965	John W. Woods	Palm Beach, Florida
1966	Zeb Grant	Lakeland, Florida
1967	James D. Gorman	Fort Myers, Florida
1968	Robert D. Blackburn	Winter Park, Florida
1969	Frank L. Wilson	West Palm Beach, Florida
1970	Paul R. Cohee	Huntsville, Alabama
1971	Stanley C. Abramson	Tampa, Florida
1972	Robert J. Gates	Miami Springs, Florida
1973	Brandt G. Watson	New Orleans, Louisiana
1974	Alva P. Burkhalter	Winter Park, Florida
1975	Luciano "Lou" Val Guerra	San Antonio, Texas
1976	Ray A. Spirnock	Fort Lauderdale, Florida
1977	Robert W. Geiger	Minneapolis, Minnesota
1978	Donald V. Lee	Jacksonville, Florida
1979	Julian J. Raynes	Chattanooga, Tennessee
1980	William N. Rushing	Sarasota, Florida
1981	Nelson Virden	Jackson, Mississippi
1982	Roy L. Clark	Las Vegas, Nevada
1983	Emory E. McKeithen	Lake Buena Vista, Florida
1984	A. Leon Bates	Richmond, Virginia
1985	Max C. McCowen	Vancouver, British Columbia
1986	Lars W. J. Anderson	Sarasota, Florida
1987	Dean F. Martin	Savannah, Georgia
1988	Richard D. Comes	New Orleans, Louisiana
1989	Richard Couch	Scottsdale, Arizona
1990	David L. Sutton	Mobile, Alabama
1991	Joseph C. Joyce	Dearborn, Michigan
1992	Randall K. Stocker	Daytona Beach, Florida
1993	Clarke Hudson	Charleston, South Carolina
1994	S. Joseph Zolczynski	San Antonio, Texas
1995	Steven J. de Kozlowski	Bellevue, Washington
1996	Terence M. McNabb	Burlington, Vermont
1997	Kurt D. Getsinger	Fort Myers, Florida
1998	Alison M. Fox	Memphis, Tennessee
1999	David F. Spencer	Asheville, North Carolina
2000	J. Lewis Decell	San Diego, California
2001	Jim Schmidt	Minneapolis, Minnesota
2002	David P. Tarver	Keystone, Colorado
2003	Richard M. Hinterman	Portland, Maine
2004	Ken L. Manuel	Tampa, Florida
2005	Eric P. Barkemeyer	San Antonio, Texas
2006	Jeffrey D. Schardt	Portland, Oregon
2007	Donald W. Doggett	Nashville, Tennessee
2008	Jim Petta	Charleston, South Carolina
2009	Carlton Layne	Milwaukee, Wisconsin

Past APMS Award Recipients

Honorary Members (year of honor)

William E. Wunderlich (1967)
F. L. Timmons (1970)
Walter A. Dun (1976)
Frank S. Stafford (1981)
Robert J. Gates (1984)
Herbert J. Friedman (1987)
John E. Gallagher (1988)
Luciano "Lou" Val Guerra (1988)
Max C. McCowen (1989)
James D. Gorman (1995)
T. Wayne Miller, Jr. (1995)
A. Leon Bates (1997)
Richard Couch (1997)
William N. Rushing (1997)
Alva P. Burkhalter (2002)
J. Lewis Decell (2004)
Paul C. Myers (2005)
David L. Sutton (2006)
Dean F. Martin (2007)
Robert Gunkel (2008)

President's Award (year of honor)

T. O. "Dale" Robson (1984)
Gloria Rushing (1991)
William T. Haller (1999)
David Mitchell (1999)
Jeffrey D. Schardt (2002)
Jim Schmidt (2003)
Robert C. Gunkel, Jr. (2004)
Victor A. Ramey (2006)
William H. Culpepper (2007)
Kurt Getsinger (2008)

Max McCowen Friendship Award (year of honor)

Judy McCowen (1995)
John Gallagher (1997)
Paul C. Myers (2000)
William T. Haller (2002)
Bill Moore (2006)

T. Wayne Miller Distinguished Service Award (year of honor)

Gerald Adrian (2005)
Linda Nelson (2007)

Sustaining Members

The Aquatic Plant Management Society appreciates the valuable support of the following Sustaining Members. Thank you, Sustaining Members!

Applied Aquatic Management, Inc.
Eagle Lake, Florida

Applied Biochemists
Germantown, Wisconsin

Aqua Control Water Features
Spring Valley, Illinois

Aquarius Systems
North Prairie, Wisconsin

Aquatic Control, Inc.
Seymour, Indiana

Aquatic Eco-Systems, Inc.
Apopka, Florida

Aquatic Weed Technologies, Inc.
Roselle, Illinois

BASF Professional Vegetation Management
Raleigh, North Carolina

Becker Underwood
Ames, Iowa

BioSonics, Inc.
Seattle, Washington

Brewer International
Vero Beach, Florida

Cygnet Enterprises, Inc.
Flint, Michigan

Diversified Waterscapes, Inc.
Laguna Niguel, California

Phoenix Environmental Care, LLC
Valdosta, Georgia

ReMetrix, LLC
Carmel, Indiana

SePRO Corporation
Carmel, Indiana

Syngenta Professional Products
Greensboro, North Carolina

United Phosphorus, Inc.
King of Prussia, Pennsylvania

Meeting Sponsors

The Aquatic Plant Management Society appreciates the generous support of the U.S. Army Engineer Research and Development Center, Environmental Laboratory, Vicksburg, Mississippi, and the following meeting sponsors. Through the kindness of their support and contributions, we are able to conduct a successful and enjoyable meeting.

Platinum

Syngenta Professional Products
Greensboro, North Carolina

United Phosphorus, Inc.
King of Prussia, Pennsylvania

Gold

Aquatic Ecosystem Restoration Foundation
Flint, Michigan

Silver

BASF Professional Vegetation Management
Research Triangle Park, North Carolina

SePRO Corporation
Carmel, Indiana

Bronze

Applied Biochemists
Germantown, Wisconsin

Midwest APMS
Swartz Creek, Michigan

Valent Professional Products
Memphis, Tennessee

Helena Chemical Company
Collierville, Tennessee

Phoenix Environmental Care, LLC
Valdosta, Georgia

Contributor

Aquatic Control, Inc.
Seymour, Indiana

Cygnet Enterprises, Inc.
Flint, Michigan

Wilbur-Ellis Company
Kennewick, Washington

Brewer International
Vero Beach, Florida

Professional Lake Management
Milford, Michigan

Scholastic Endowment Sponsors

The Aquatic Plant Management Society appreciates the generous support of the following scholastic endowment sponsors. Through the kindness of their contributions, we are able to conduct a successful and enjoyable meeting.

Reverse Raffle Grand Prize

Cygnet Enterprises, Inc.
Flint, Michigan

Cygnet Enterprises, Inc. has graciously donated a $1,500 VISA gift card for the Reverse Raffle

Silent Auction

Allied Biological, Inc.
Hackettstown, New Jersey

Applied Biochemists
Germantown, Wisconsin

Brewer International
Vero Beach, Florida

Clean Lakes, Inc.
Martinez, California

Diversified Waterscapes, Inc.
Laguna Niguel, California

Great Lakes Bio Systems, Inc.
Sturtevant, Wisconsin

Dr. Dean Martin
Tampa, Florida

PLM Lake and Land Management Corporation
Milford, Michigan

SePRO Corporation
Carmel, Indiana

Applied Aquatic Management
Eagle Lake, Florida

Aquatic Control, Inc.
Seymour, Indiana

Dr. Gregory Cheek
Marco Island, Florida

Cygnet Enterprises, Inc.
Flint, Michigan

Duke Energy Carolinas
Huntersville, North Carolina

Helena Chemical Company
Collierville, Tennessee

Phoenix Environmental Care, LLC
Valdosta, Georgia

Dr. John H. Rodgers, Jr.
Clemson, South Carolina

Exhibitors

The Aquatic Plant Management Society appreciates the following companies
For exhibiting their products and services.

Airmax Eco-Systems was built on one simple philosophy “To Make Pond Care Simple”. Our staff has years of experience so you don’t have to. Although the products we manufacture are of the finest quality, we understand that our service and technical expertise must consistently surpass our customer’s expectations.

Since 1968, **Applied Biochemists** has been dedicated to developing, manufacturing and marketing a variety of algaecides, aquatic herbicides and biological formulations for aquatic vegetation control and water quality improvement. Recognized brands include Aquashade, Cutrine-Plus and Navigate. Recent achievements have been made in successful development of targeted algal management programs through our funded university research.

Aquamarine designs, manufactures and markets a wide range of Aquatic Plant Harvesting Systems (Harvesters, Transport Barges, Aquatic Rakes, Trailers, Trailer Conveyors, Shore Conveyors and Weed Crushers) and also Floating Trash Collecting Vessels (Trash Hunters). Our equipment is designated for removal of nuisance plants and floating trash from water reservoirs, ports, rivers and lakes.

Aquarius Systems, a division of D&D Products, is the oldest manufacturer of surface water management equipment in the world. Our product line includes aquatic plant cutters and harvesters, amphibious excavators, canal cleaners and trash skimming vessels. Please stop by our exhibit booth or visit our website to learn more about how Aquarius Systems can help resolve your water management issues.

Since 1966, **Aquatic Control** has provided high quality products, services, and staff for managing lakes, ponds, and other water resources. Our professional staff includes: Certified fisheries scientists, fisheries biologists, factory trained fountain specialists, and licensed aquatic applicators. We supply quality products/services to companies and clients to fill their needs.

BASF is the world's leading chemical company, manufacturing a wide range of innovative products for use in aquatic environments including Habitat® herbicide and Clearcast(TM) herbicide. With its proven expertise, BASF provides vegetation management resources to protect and restore land and waterways threatened by non-native, invasive species. For more information, visit www.vmanswers.com

BioSafe Systems, LLC, the BioSecurity Company, offers green solutions for a broad range of disease control. These products are alternatives to chemicals that leave behind toxic residues that can affect the health and welfare of people, plants, animals, and our groundwater supply.

Brandt is an industry leader and innovator in the enhancement of aquatic environments, offering a unique range of specialty products designed to improve the health and aesthetics of waterscapes. From their super-strength colorant to microbial clarifiers, Brandt has products designed for aquatic improvement and maintenance.

Biosorb, Inc. was founded in 1998 providing natural-based products for horticultural, turf, ornamental, golf course, landscape, agricultural, and environmental industries. The company owns proprietary patented technology based on microscopic delivery systems called Biocar® made from cereal grain and oil-seed byproducts. In products such as HydraClear®, Biocar® technology coats underwater plants such as hydrilla providing direct contact of active material to the target species. TopFilm™, the adjuvant for rainfastness/weatherability, is used in markets where heavy rainfall or irrigation tends to wash products off the foliage. TopFilm™ has a Statement for Organic Use and the natural microsponges have been qualified as a Sustainable Ag Practice. www.Biosorb-Inc.com

Brewer International offers surfactants, drift control agents, defoamers, and basal diluents for the weed and brush control market. Spray adjuvants enhance the performance of pesticides. Brewer International also manufactures a broad range of products used in the irrigation, industrial cleaning, and aquatic markets. Brewer is also a proud member of AERF, RISE, APMS, and regional aquatic plant management societies.

At **CPS Timberland**, we are committed to being the leading provider of agricultural inputs in each of our markets. We will attract and retain outstanding employees by motivating and rewarding them for their accomplishments in providing exceptional service to our valued customers.

Cygnet Enterprises, Inc. and affiliates, is one of the largest distributors of aquatic herbicides, algaecides, and lake management devices in the United States. We are a distributor for all of the major manufacturers of aquatic products including Applied Biochemists, SePRO, UPI, Syngenta, and many more. Our offices are located nation-wide in Michigan, California, Washington, Pennsylvania, Indiana, and North Carolina. For more information regarding our products and services, please feel free to contact us at 1-800-359-7531.

Diversified Waterscapes, Inc. (DWI) is a manufacturer of water treatment products that are “kinder and gentler” to lakes, streams and ponds throughout the U.S. These environmentally friendly products, known as the formula f-series, are used in water features on commercial properties, municipalities, golf courses, homeowner associations and the ag industry. Maintenance services, training and consulting round out DWI to make it a “one-stop-shop”. DWI can claim confidence and assurance in the statement we are the “Solution for your troubled waters”.

Helena Chemical Company is a national distributor of crop protection and crop production inputs. Helena has over 350 sales locations across the country that supply customers with crop protectants, fertilizer products, seed and related services. In addition, the Helena Product Group develops and markets a number of products in the following categories: Adjuvants, Nutritionals, BioScience, Value-Added Products and Seed Treatments.

Family owned for over 4 decades, **Kasco Marine** has been a recognized leader in products that promote healthy water quality in ponds and lakes. Kasco manufactures a complete range of floating fountains, pond aerators, water circulators and de-icers for projects of all sizes.

The **LittLine™** is a Patent Pending Littoral Zone Treatment Technology that was developed by **Clean Lakes, Inc.** to support aquatic pesticide applications for the control of Invasive Aquatic Species (vegetation, cyanobacteria, mussels and fish). Through the use of LittLine™ technology, aquatic pesticide applications can target any portion of the water column, rather than the entire water column, potentially cutting pesticide use by up to 80%.

At **Nufarm Americas**, we are passionately committed to providing our customers better choices to help them build better businesses. Whether we're working in our labs, formulation plants, test plots, offices or in the field, we constantly seek ways to provide more effective products and solutions that help organizations and businesses thrive. We are a world-leading manufacturer and marketer of aquatic, crop protection, turf and ornamental, and industrial vegetation management/forestry products. Our diversified product portfolio of herbicides, insecticides, fungicides, and plant growth regulators helps protect against damage caused by weeds, pests, and disease.

Phoenix Environmental Care manufactures a broad line of specialty products for the Turf, Nursery, Ornamental and Aquatic markets. Phoenix presently offers a variety of aquatic herbicides including: Avocet (glyphosate), Current (copper sulfate), GullWing (imazapyr), Kraken (triclopyr), RedWing (Diquat), and Whitecap (fluridone) aquatic herbicides, and Symmetry aquatic algaecide.

ReMetrix is the nation's leading mapping firm focusing exclusively on assessing and monitoring invasive and aquatic vegetation. The company employs a small team of scientists expert in the use of various advanced mapping technologies such as hydroacoustics, GIS, and remote sensing. ReMetrix has mapped nearly a half million acres for submerged and invasive vegetation presence, species, and distribution. The company works in freshwater and tidal environments and is highly experienced with data collection and analyses.

Pond scum, also known as MUCK, contains toxic gases and harbors nutrients that cause excessive weed and algae problems, which deteriorates the ecosystem of a pond. Now there is a unique, efficient, and economical way of removing the MUCK and restoring new life to your pond – **Sediment Removal Solutions**! No mechanical dredging, no damage to landscape, no draining of pond.

The industry leader in aquatic plant management, **SePRO Corporation** has provided professional focus on specialty markets since 1993. Current product line for the professional lake manager includes: Sonar* A.S. aquatic herbicide, Sonar SRP aquatic herbicide, Sonar PR Precision Release* aquatic herbicide, Sonar Q* Quick Release aquatic herbicide, Avast!® Aquatic Herbicide, FasTEST* immunoassay system, Nautique* aquatic herbicide, Captain* algaecide, K-Tea™ algaecide, Komeen® Aquatic Herbicide, AquaPro* aquatic herbicide, Revive* biological water quality enhancer, Renovate® aquatic herbicide, and Galleon SC* aquatic herbicide.

Invasive weeds can devastate both natural and commercial habitats. **Syngenta Professional Products** provides high performance products to control these destructive weeds while helping to restore the habitat of aquatic environments. Proven herbicides for the weed control industry from Syngenta include Reward® and Touchdown PRO®.

United Phosphorus, Inc., (UPI) is leading the value revolution as a premier supplier of trusted and proven post patent crop protection technologies for agricultural and specialty crops. As a worldwide leader in the development and manufacture of post patent solutions, UPI is geared to provide growers with high-quality products defend crops and increase yields.

General Information

Program Organization
The Agenda is organized by day and time. Posters and abstracts are organized in alphabetical order by first author.

Name Badges
For all events and functions at the meeting, your name badge is your ticket. Wear it to all activities during the meeting. All individuals participating in any of the meeting events or activities must be registered and have a name badge. Non-registered guests may purchase tickets for the President's Reception, Guest Tour, Poster Session Reception, and Awards Banquet at the meeting registration desk.

Meeting Registration Desk
The meeting registration desk is located in the Regency Prefunction area in front of the Regency C and D Conference Rooms. For specific times, please see the Agenda in this Program. Messages will be posted at the meeting registration desk.

Exhibits
Exhibits will be open from 7:30 a.m. Monday to 3:00 p.m. Wednesday in Executive Ballrooms A-D and Atrium.

Posters
Posters will be open for viewing from 7:30 a.m. Monday to 3:00 p.m. Wednesday in Executive Ballrooms A-D and the Atrium. A special Poster Session and Reception will be held on Monday from 5:30 p.m. to 7:00 p.m. in Executive Ballrooms A-D and the Atrium. Poster presenters are required to attend the special Poster Session to answer questions. In addition, presenters are requested to be in attendance during scheduled refreshment breaks.

Refreshment Breaks
Continental breakfasts, mid-morning, and afternoon refreshment breaks, graciously cosponsored by Phoenix Environmental Care LLC, Helena Chemical Company, Aquatic Control, Inc., Brewer International, Cygnet Enterprises, Inc., and Wilbur-Ellis Company, will be served each day of the meeting in Executive Ballrooms A-D and the Atrium. For specific times, please see the Agenda in this Program.

APMS Student Affairs Luncheon
The Student Affairs Luncheon will be held Monday, 12:00 p.m. - 1:30 p.m. in the Gilpatrick Room. All students that register for the meeting are invited to attend. This luncheon will be a great opportunity to meet other students, interact with the APMS leadership, and learn how to become more involved in the Society. Tyler Koschnick, Student Affairs Committee Chair, will be the moderator, please contact Tyler by 12:00 p.m. Sunday, July 12 and confirm your attendance. This luncheon is graciously sponsored by SePRO Corporation.

APMS Annual Business Meeting
The APMS Annual Business Meeting will be held Tuesday, 4:45 p.m. - 5:15 p.m. in the Regency C and D Conference Rooms. All APMS members are encouraged to attend.

APMS Regional Chapters Presidents' Breakfast
The Regional Chapters Presidents' Breakfast will be held Tuesday, 6:30 a.m. - 8:00 a.m. in the Milwaukee Room. Two representatives from each APMS regional chapter are invited to attend this breakfast. Linda Nelson, APMS Vice President and Regional Chapters Committee Chair, will be the moderator for discussions on aquatic plant management activities within each region. Please contact Linda by 8:00 a.m. Monday, July 13 and confirm your attendance. This breakfast is graciously sponsored by Helena Chemical Company.

APMS Past Presidents' Luncheon
All APMS Past Presidents are invited to attend the Past Presidents' Luncheon on Tuesday, 12:00 p.m. - 1:30 p.m. in the Milwaukee Room. Don Doggett, Past President from 2007, will be the moderator for discussions on affairs of the Society. Please contact Don by 12:00 p.m. Monday, July 13 and confirm your attendance. The luncheon is graciously sponsored by Valent Professional Products.

APMS Special Events

President's Reception*, Sunday, July 12, 7:00 p.m. - 9:00 p.m., Regency C and D Conference Rooms.*
The APMS cordially invites all registered delegates, guests, and students to the President's Reception, graciously sponsored by Syngenta Professional Products. Enjoy a casual gathering visiting with old friends and meeting new friends, while savoring delicious hors d'oeuvres and your favorite beverage. Non-registered guests may purchase tickets at the meeting registration desk.

Poster Session and Reception*, Monday, July 13, 5:30 p.m. - 7:00 p.m., Atrium.*
The APMS cordially invites all registered delegates, guests, and students to the Poster Session and Reception, graciously sponsored by BASF Professional Vegetation Management. This reception will provide for the viewing of posters and professional interactions and discussions in a casual setting, while enjoying delicious hors d'oeuvres and your favorite beverage. Non-registered guests may purchase tickets at the meeting registration desk.

Guest Tour*, Tuesday, July 14, 9:00 a.m. – 2:00 p.m., Meet at 1st Floor Lobby, Hyatt Regency Hotel*
The APMS cordially invites all registered guests of meeting delegates to the Guest Tour, graciously sponsored by Applied Biochemists. The guided tour takes you on a replica of an old-fashioned trolley (air-conditioned) throughout the historic, ethnic neighborhoods and unique architecture and shops near downtown Milwaukee. You'll visit the Mitchell Park Domes for a walk through three geodesic domes, each home to different plant life environments. Then, enjoy fine local cuisine with lunch at Mader's German Restaurant, rated Milwaukee's #1 ethnic restaurant. One final stop will be the Pier Wisconsin on the Lake Michigan Lakefront. Here you can visit Discovery World Museum for unique interactive natural science and technology experiences (great for kids!). Non-registered guests may purchase tickets at the meeting registration desk. The tour is limited to 45 participants, so please confirm your attendance by signing up for the tour at the registration desk by noon on Monday, July 13 to ensure an accurate count for seating and lunch arrangements.

Awards Banquet*, Wednesday, July 15, 6:00 p.m. - 10:00 p.m., Regency C and D Conference Rooms.*
The APMS cordially invites all registered delegates, guests, and students to the APMS Awards Banquet, graciously sponsored by United Phosphorus, Inc. This year's banquet will once again prove to be a memorable occasion. After dinner, we will recognize those who have served and contributed to the Society, welcome new officers and directors, and present awards to the student paper and poster participants. Our evening will conclude with the reverse raffle grand prize drawing, graciously sponsored by Cygnet Enterprises, Inc. Non-registered guests may purchase tickets at the meeting registration desk.

Spur-of-the-Moment Meeting Room

Do you have a spur-of-the-moment meeting and need a room? We have a room set up conference style for 25 guests. For available times and location, please check at the meeting registration desk.

Post-Conference Student Tour

Following the annual meeting on July 16, students will have an opportunity to participate in a tour to observe and learn about regional aquatic plant management issues in coordination with the Wisconsin Department of Natural Resources, and US Army Engineer Research and Development Center. We will visit field sites surrounding the Milwaukee metro area as well as tour the Chain of Lakes in Madison by boat. We'll wrap up the tour enjoying a brat and spotted cow at the University of Wisconsin Memorial Union Terrace overlooking beautiful Lake Mendota. The group will depart the Hyatt at 8:00 am on Thursday, July 16 and return Friday morning, July 17 about 9:00 am. The tour is graciously sponsored by the Aquatic Ecosystem Restoration Foundation. Accommodations for Thursday night will most likely be provided at the Aldo Leopold Nature Center, Black Earth Campus (near Madison). Contact Heather Theel (Heather.J.Theel@usace.army.mil), APMS Student Affairs Committee Tour Coordinator, or Tyler Koschnick (tylerk@sepro.com), AMPS Director and Student Affairs Committee Chair, for more details.

Agenda

Sunday, July 12

Sunday's Agenda-at-a-Glance

7:30 am - 5:00 pm	APMS Board of Directors Meeting *(Milwaukee Room)*
12:00 pm - 5:00 pm	Exhibits Setup *(Executive Ballrooms A-D and Atrium)*
12:00 pm - 5:00 pm	Posters Setup *(Executive Ballrooms A-D and Atrium)*
1:00 pm - 5:00 pm	Registration *(Regency Prefunction)*
7:00 pm - 9:00 pm	President's Reception *(Regency C-D)* *Sponsored by Syngenta Professional Products*

Monday, July 13

Monday's Agenda-at-a-Glance

7:30 am - 8:00 am	Continental Breakfast *(Executive Ballrooms A-D and Atrium)*
	Sponsored by Phoenix Environmental Care, LLC
7:30 am - 5:00 pm	Registration *(Regency Prefunction)*
7:30 am - 5:00 pm	Exhibits Open *(Executive Ballrooms A-D and Atrium)*
7:30 am - 5:00 pm	Posters Open *(Executive Ballrooms A-D and Atrium)*
8:15 am - 12:00 pm	Session I *(Regency C-D)*
9:45 am - 10:15 am	Refreshment Break *(Executive Ballrooms A-D and Atrium)*
	Sponsored by Phoenix Environmental Care, LLC
12:00 pm - 1:30 pm	Lunch on Your Own
12:00 pm - 1:30 pm	APMS Student Affairs Luncheon *(Gilpatrick Room)*
	Sponsored by SePRO Corporation
12:00 pm - 1:30 pm	Aquatic Ecosystem Restoration Foundation Meeting *(Milwaukee Room)*
1:30 pm - 4:45 pm	Session II *(Regency C-D)*
3:00 pm - 3:30 pm	Refreshment Break *(Executive Ballrooms A-D and Atrium)*
	Sponsored by Phoenix Environmental Care, LLC
5:30 pm - 7:00 pm	Poster Session and Reception *(Executive Ballrooms A-D and Atrium)*
	Sponsored by BASF Professional Vegetation Management

Session I: Presidential Address and Special Session on Building Partnerships – Cooperation Across the Pond

8:15 am - 12:00 pm
Regency C-D
Moderator: Carlton Layne, *APMS President, Aquatic Ecosystem Restoration Foundation, Marietta, Georgia*

8:15 am **Opening Remarks and Announcements**

8:20 am **Presidential Address**
Carlton Layne
Aquatic Ecosystem Restoration Foundation, Marietta, Georgia

8:40 am **Keynote Speaker**
From *Elodea canadensis* Through *Salvinia molesta* – The Rise of Invasion Biology and Its Interaction with Management
Dan Simberloff
Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville, Tennessee

9:20 am **Great Lakes Aquatic Invasive Species: Cooperative Efforts to Prevent the Spread**
Phil Moy
Wisconsin Sea Grant Program, University of Wisconsin – Manitowac, Manitowac, Wisconsin

9:45 am **Refreshment Break** *(Executive Ballrooms A-D and Atrium)*

10:15 am **Our Waters, Our Partners, Our Investments - Wisconsin's Aquatic Invasive Species Strategy**
Jeff Bode
Wisconsin Department of Natural Resources, Madison, Wisconsin

10:35 am **Management of Aquatic Plants in Minnesota: A Brief History and Current Status of Management of Invasive Aquatic Plants**
Chip Welling
Minnesota Department of Natural Resources, Saint Paul, Minnesota

10:55 am **Removing Invasives – One Partner at a Time**
Wendy Woyczik
Fish and Wildlife Service, Horicon National Wildlife Refuge, Mayville, Wisconsin

11:15 am **Needed National Infrastructure – A Hub for Coordination and Cooperation in a Multi-jurisdictional Environment**
Don Schmitz
Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida

11:35 am **Panel Discussion**
All Session Presenters
Please submit questions to the moderator prior to discussion.

12:00 pm **Lunch on Your Own**

Session II

1:30 pm - 4:45 pm
Regency C-D
Moderator: Greg MacDonald, *Agronomy Department and Center for Aquatic and Invasive Plants, University of Florida Gainesville, Florida*

1:30 pm **Science to Support Natural Resource Management of Aquatic Invasive Plants**
Jennifer Hauxwell
Fisheries and Aquatic Sciences Research Program, Wisconsin Department of Natural Resources, Madison, Wisconsin

2:00 pm **Corroboration of a Field Study and Bioenergetics Model to Evaluate Bluegill Growth after Eradication of Invasive Eurasian Watermilfoil (*Student Presentation)***
Krisan M. Webb and Eric D. Dibble
Department of Wildlife and Fisheries, Mississippi State University, Mississippi State, Mississippi

2:15 pm **Suitability of Using Introduced *Hydrellia* spp. for Management of Monoecious *Hydrilla verticillata* (L.f.) Royle**
Julie G. Nachtrieb[1], Michael J. Grodowitz[2], and Nathan E. Harms[3]
[1]U.S. Army Engineer Research and Development Center, Lewisville, Texas
[2]U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi
[3]University of North Texas, Lewisville, Texas

2:30 pm **A Novel Method of Nuisance Algae Control by Immobilized Microalgae *(Student Presentation)***
James Herrin[1], Rebecca Haynie[2], Senthil Chinnasamy[1], Susan Wilde[2], and K. C. Das[1]
[1]Driftmier Engineering Center, University of Georgia, Athens, Georgia
[2]D.B. Warnell School of Forestry and Natural Resources, University of Georgia Athens, Georgia

2:45 pm **Aeration as an Effective Lake Management Tool**
Bob Robinson
Kasco Marine Inc., Prescott, Wisconsin

3:00 pm **Refreshment Break** *(Executive Ballrooms A-D and Atrium)*

3:30 pm **Wisconsin's Aquatic Plant Management Strategy – Managing Invasives/Protecting Natives**
Tim Asplund
Wisconsin Department of Natural Resources, Madison, Wisconsin

4:00 pm **Detecting and Predicting Herbicide Injury on Waterhyacinth Using Remote Sensing *(Student Presentation)***
Wilfredo Robles and John D. Madsen
Geosystems Research Institute, Mississippi State University, Mississippi State, Mississippi

4:15 pm **Monoecious Hydrilla Tuber Dynamics over Two Years of Management *(Student Presentation)***
Justin J. Nawrocki, Robert J. Richardson, Rory L. Roten, Steve T. Hoyle, and Andrew P. Gardner
North Carolina State University, Raleigh, North Carolina

4:30 pm **Washington Update**
Lee Van Wychen
Weed Science Society of America, Washington, DC

4:45 pm **Adjourn**

Poster Session

5:30 pm - 7:00 pm
Executive Ballroom and Atrium

Tolerance of Selected Bedding Plants to Four Herbicides in Irrigation Water *(Student Poster)*
Sarah T. Berger, Lyn A. Gettys, and William T. Haller
Center for Aquatic and Invasive Plants, University of Florida, Gainesville, Florida

Flowering Rush (*Butomus umbellatus* L.): a New Invader to the Northwest *(Student Poster)*
Joshua C. Cheshier[1], Peter Rice[2], and John D. Madsen[1]
[1]*Geosystems Research Institute, Mississippi State University, Mississippi State, Mississippi*
[2]*Division of Biological Sciences, University of Montana, Missoula, Montana*

Invasive Aquatic Plant Distribution and Management in the Ross Barnett Reservoir *(Student Poster)*
Michael C. Cox, Ryan M. Wersal, and John D. Madsen
Geosystems Research Institute, Mississippi State University, Mississippi State, Mississippi

Balancing Control and Realism in Scientific Experiments to Evaluate Better Aquatic Plant Management; Mississippi State University Aquatic Research Facilities
Eric D. Dibble, Ericka Schlickeisen, and Krisan Webb
Department of Wildlife and Fisheries, Mississippi State University, Mississippi State, Mississippi

Mapping Invasive Aquatic and Wetland Weeds with QuickBird Satellite Imagery
James H. Everitt, C. Yang, and R. S. Fletcher
U.S. Department of Agriculture – Agricultural Research Service, Weslaco, Texas

The Influence of Species and Water Depth on Aquatic Plant Re-establishment in Little Bear Creek Reservoir, Alabama *(Student Poster)*
Jonathan P. Fleming[1, 2], John D. Madsen[1], and Eric D. Dibble[2]
[1]*Geosystems Research Institute, Mississippi State University, Mississippi State, Mississippi*
[2]*Department of Wildlife and Fisheries, Mississippi State University, Mississippi State, Mississippi*

Insect Herbivores of *Heternathera dubia* in the United States
Nathan Harms[1] and Michael Grodowitz[2]
[1]*University of North Texas, Lewisville, Texas*
[2]*U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi*

Alligatorweed Control with Imazamox, Penoxsulam, and Other Herbicides *(Student Poster)*
Trevor Israel, Robert J. Richardson, Rory L. Roten, and Andrew P. Gardner
North Carolina State University, Raleigh, North Carolina

Native Macrophyte Community Response to Herbicidal Treatments of *Potamogeton crispus (Student Poster)*
Ajay R. Jones, James A. Johnson, and Raymond M. Newman
Department of Fisheries, Wildlife and Conservation Biology, University of Minnesota, St. Paul, Minnesota

U.S. Army Corps of Engineers, Chemical Control and Physiological Processes Team: A Research Overview
Christopher R. Mudge and Kurt D. Getsinger
U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi

Evaluation of Water Exchange Patterns and Granular Fluridone Applications in Lake Gaston *(Student Poster)*

Justin J. Nawrocki[1], Kurt D. Getsinger[2], Michael D. Netherland[3], and Robert J. Richardson[1]
[1]North Carolina State University, Raleigh, North Carolina
[2]U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi
[3]U.S. Army Engineer Research and Development Center, Gainesville, Florida

Aquatic Macrophytes in the Los Ortices Lagoon *(Student Poster)*

Gina Suescun Otero, Raul Rodriguez Martinez, and Roberto Sanchez
Universidad de Pamplona, Bucaramanga, Santander, Columbia

Cross-Resistance in Fluridone-Resistant Hydrilla to Other Bleaching Herbicides

Atul Puri[1], William T. Haller[1], and Michael D. Netherland[2]
[1]Center for Aquatic and Invasive Plants, University of Florida, Gainesville, Florida
[2]U.S. Army Engineer Research and Development Center, Gainesville, Florida

Watermeal Control with Flumioxazin and Other Herbicides *(Student Poster)*

Rory L. Roten[1], P. Lloyd Hipkins[2], Robert J. Richardson[1], Steve T. Hoyle[1], and Andrew P. Gardner[1]
[1]North Carolina State University, Raleigh, North Carolina
[2]Virginia Polytechnic Institute, Blacksburg, Virginia

Using Herbicides to Control Water Shield in Fulton County Arkansas

George Selden[1] and Brad McGinley[2]
[1]Aquaculture/Fisheries Center of Excellence, University of Arkansas, Pine Bluff, Arkansas
[2]University of Arkansas Cooperative Extension Service, Fulton County, Arkansas

Quinclorac Dissipation and Control of Eurasian Watermilfoil (*Myriophyllum spicatum* L.) *(Student Poster)*

Joseph D. Vassios and Scott J. Nissen
Colorado State University, Fort Collins, Colorado

Algal and Aquatic Plant Ecology at the University of Georgia: An Overview of Current Research Projects

Susan B. Wilde, Rebecca S. Haynie, and James A. Herrin
D.B. Warnell School of Forestry and Natural Resources, University of Georgia, Athens, Georgia

Tuesday, July 14

Tuesday's Agenda-at-a-Glance

6:30 am - 8:00 am	APMS Regional Chapters Presidents' Breakfast *(Milwaukee Room)*
	Sponsored by Helena Chemical Company
7:30 am - 8:00 am	Continental Breakfast *(Executive Ballrooms A-D and Atrium)*
	Co-sponsored by Professional Lake Management
7:30 am - 5:00 pm	Registration *(Regency Prefunction)*
7:30 am - 5:00 pm	Exhibits Open *(Executive Ballrooms A-D and Atrium)*
7:30 am - 5:00 pm	Posters Open *(Executive Ballrooms A-D and Atrium)*
8:30 am - 12:00 pm	Session III *(Regency C-D)*
9:00 am - 2:00 pm	Guest Tour
	Sponsored by Applied Biochemists
10:00 am - 10:30 am	Refreshment Break *(Executive Ballrooms A-D and Atrium)*
	Co-sponsored by Aquatic Control, Inc.
12:00 pm - 1:30 pm	Lunch on Your Own
12:00 pm - 1:30 pm	APMS Past Presidents' Luncheon *(Milwaukee Room)*
	Sponsored by Valent Professional Products
1:30 pm - 4:15 pm	Session IV *(Regency C-D)*
3:00 pm - 3:30 pm	Refreshment Break *(Executive Ballrooms A-D and Atrium)*
	Co-sponsored by Brewer International
4:15 pm - 4:45 pm	Regional Chapter Updates *(Regency C-D)*
4:45 pm - 5:15 pm	APMS Annual Business Meeting *(Regency C-D)*

Session III

8:30 am - 12:00 pm
Regency C-D
Moderator: Michael D. Netherland, *U.S. Army Engineer Research and Development Center, Gainesville, Florida*

8:30 am

Invasive Aquatic Plant Species in Europe
Tenna Riis[1] and Andreas Hussner[2]
[1]Department of Biological Sciences, Aarhus University, 8000 Århus C, Denmark
[2]Department of Geobotanik, Heinrich-Heine-University Düsseldorf, Düsseldorf, Germany

9:00 am

Response of Selected Aquatic and Riparian Plants to DPX-KJM44 (Aminocyclopyrachlor) *(Student Presentation)*
Rory L. Roten[1], Robert J. Richardson[1], Steve T. Hoyle[1], and P. Lloyd Hipkins[2]
[1]North Carolina State University, Raleigh, North Carolina
[2]Virginia Polytechnic Institute, Blacksburg, Virginia

9:15 am

Do Eurasian and Northern Watermilfoils Hybridize More Frequently Than We Think? *(Student Presentation)*
Matthew Zuellig and Ryan Thum
Grand Valley State University, Muskegon, Michigan

9:30 am

Advances in Technology for Control of Eurasian Watermilfoil (*Myriophyllum spicatum*) and Other Submersed Plants
Tyler J. Koschnick[1], Hamid Ullah[2], Cole M. Hulon[2], and Sarah Miller[2]
[1]SePRO Corporation, Medina, Ohio
[2]SePRO Corporation, SePRO Research and Technology Campus, Whitakers, North Carolina

9:45 am

Hung Out to Dry: Fitness Loss Due to Desiccation of Aquatic Invasive Plants and Implications for Efficient Risk Management *(Student Presentation)*
Matthew A. Barnes[1], Christopher L. Jerde[1], Anna Noveroske[1], Elise K. DeBuysser[1], W. Lindsey Chadderton[2], and David M. Lodge[1]
[1]University of Notre Dame, Notre Dame, Indiana
[2]The Nature Conservancy, c/o Center for Aquatic Conservation, University of Notre Dame, Notre Dame, Indiana

10:00 am **Refreshment Break** *(Executive Ballrooms A-D and Atrium)*

10:30 am **Large-scale Herbicide Monitoring on the Kissimmee Chain of Lakes: Lake Tohopekaliga**
Jeremy G. Slade[1], Michael D. Netherland[2], Sarah Berger[3]
[1]*Center for Aquatic and Invasive Plants, University of Florida, Gainesville, Florida*
[2]*U.S. Army Engineer Research and Development Center, Gainesville, Florida*
[3]*Osceola County Extension, University of Florida, Kissimmee, Florida*

10:45 am **Responses of Cyanobacteria to Algaecides: Efficacy and Microcystin Measurements *(Student Presentation)***
Brenda M. Johnson, West M. Bishop, and John H. Rodgers, Jr.
Department of Forestry and Natural Resources, Clemson University, Clemson, South Carolina

11:00 am **Distribution, Viability, and Longevity of Curlyleaf Pondweed Turions in Minnesota Lakes**
Raymond M. Newman[1], Sarah S. Roley[1,2], and James A. Johnson[1]
[1]*Fisheries, Wildlife and Conservation Biology, University of Minnesota, Saint Paul, Minnesota*
[2]*Biological Sciences, University of Notre Dame, Notre Dame, Indiana*

11:30 am **The Use of Aquatic Herbicides to Control Common Reed: *Phragmites australis* (Cav.) Trin. Ex Steud. *(Student Presentation)***
Joshua C. Cheshier and John D. Madsen
Geosystems Research Institute, Mississippi State University, Mississippi State, Mississippi

11:45 am **Differential Effect of Mesotrione and Topramezone on Pickerelweed and Sagittaria *(Student Presentation)***
Brett W. Bultemeier and W.T. Haller
Center for Aquatic and Invasive Plants, University of Florida, Gainesville Florida

12:00 pm **Lunch on Your Own**

Session IV

1:30 pm - 4:45 pm
Regency C-D
Moderator: Atul Puri, *Center for Aquatic and Invasive Plants, University of Florida, Gainesville, Florida*

1:30 pm **Biocontrol of Aquatic Weeds in Puerto Rico**
Edwin Abreu-Rodríguez[1] and **Lourdes S. Bernier Castrello**[2]
[1]*Agricultural Experiment Station, University of Puerto Rico, Isabela, Puerto Rico*
[2]*Puerto Rico Department of Natural and Environmental Resources, San Juan, Puerto Rico*

1:45 pm **Predicting Potential Distribution of the Invasive Aquatic Weed *Hygrophila polysperma* (Roxb.) T. Anders (*Acanthaceae*) Using Maximum Entropy (MaxEnt) Modeling *(Student Presentation)***
Abhishek Mukherjee[1], James P. Cuda[1] and William A. Overholt[2]
[1]*Entomology and Nematology Department, University of Florida, Gainesville, Florida*
[2]*Biological Control Research & Containment Laboratory, University of Florida, Ft. Pierce, Florida*

2:00 pm **Beach Vitex Response to Herbicides *(Student Presentation)***
Sarah L. True, Robert J. Richardson, Rory L. Roten, and Andrew P. Gardner
North Carolina State University, Raleigh, North Carolina

2:15 pm **Managing Shallow Eutrophic Lakes for Improved Native Submersed Macrophyte Growth**
William F. James
U.S. Army Engineer Research and Development Center, Spring Valley, Wisconsin

2:30 pm **Indirect Effect of Aquatic Plant Management on Fish Assemblages in Mississippi Delta Oxbow Lakes *(Student Presentation)***
Matthew R. Spickard and Eric D. Dibble
Department of Wildlife and Fisheries, Mississippi State University, Mississippi State, Mississippi

2:45 pm **Effects of Planting Density, Elevation and Propagule Age on Native Plant Restoration after Invasive Species Removal in Freshwater Depression Marshes in South Florida**
(Student Presentation)
Kathryn A. Villazon[1], Carrie Reinhardt-Adams[1], Michael Kane[1], and Greg MacDonald[2]
[1]Department of Environmental Horticulture, University of Florida, Gainesville, Florida
[2]Department of Agronomy, University of Florida, Gainesville, Florida

3:00 pm **Refreshment Break** *(Executive Ballrooms A-D and Atrium)*

3:30 pm **Genetic Diversity and Geographic Origins of Invasive Variable-Leaf Watermilfoil**
Ryan Thum
Annis Water Resources Institute, Grand Valley State University, Muskegon, Michigan

4:00 pm **Status of the Demonstration Project on Hydrilla and Hygrophila in the Upper Kissimmee Chain of Lakes**
Stacia A. Hetrick
Osceola County Extension, University of Florida, Kissimmee, Florida

4:15 pm **Regional Chapter Updates** *(Regency C-D)*
Brazil, Florida, MidSouth, Midwest, Northeast, South Carolina, Texas, Western

4:45 pm **APMS Annual Business Meeting** *(Regency C-D)*

5:15 pm **Adjourn**

Wednesday, July 15

Wednesday's Agenda-at-a-Glance

7:30 am - 8:00 am	Continental Breakfast *(Executive Ballrooms A-D and Atrium)* *Co-sponsored by Cygnet Enterprises, Inc.*
7:30 am - 3:00 pm	Registration *(Regency Prefunction)*
7:30 am - 3:00 pm	Exhibits Open *(Executive Ballrooms A-D and Atrium)*
7:30 am - 3:00 pm	Posters Open *(Executive Ballrooms A-D and Atrium)*
8:15 am - 12:00 pm	Session V *(Regency C-D)*
9:45 am - 10:00 am	Refreshment Break *(Executive Ballrooms A-D and Atrium)* *Co-sponsored by Wilbur-Ellis Company*
12:00 pm - 1:15 pm	Lunch on Your Own
1:15 pm - 3:00 pm	Session VI *(Regency C-D)*
3:00 pm - 5:00 pm	Exhibits Teardown *(Executive Ballrooms A-D and Atrium)*
3:00 pm - 5:00 pm	Posters Teardown *(Executive Ballrooms A-D and Atrium)*
3:15 pm - 5:00 pm	APMS Board of Directors Meeting *(Gilpatrick Room)*
6:00 pm - 7:00 pm	Reception *(Atrium)* *Sponsored by United Phosphorus, Inc.*
7:00 pm - 10:00 pm	Awards Banquet *(Regency C-D)* *Sponsored by United Phosphorus, Inc.*

Session V

8:15 am - 12:00 pm
Regency C-D
Moderator: Jeff Schardt, *Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida*

8:15 am **The New Taxonomy of Plants: What Impact Does This Have on Aquatic Plants?**
[1]**Brett W. Bultemeier**, W.S. Judd[2], and L.A. Gettys[1]
[1]*Center for Aquatic and Invasive Plants, University of Florida, Gainesville Florida*
[2]*Botany Department, University of Florida, Gainesville, Florida*

8:30 am **Progress in Strategic Efforts to Manage Alligatorweed [*Alternanthera philoxeroides* (Mart.) Griseb] in Australia**
Nimal Chandrasena
Ecowise Environmental Pty Ltd, Penrith, Australia

8:45 am **Overwintering Behavior of *Hydrellia pakistanae* (Diptera: Ephydridae), Biocontrol Agent of *Hydrilla verticillata (Student Presentation)***
Nathan Harms[1] and Michael Grodowitz[2]
[1]*University of North Texas, Lewisville, Texas*
[2]*U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi*

9:00 am **A Novel Biobased Method for Harvesting Algae for Biofuels Production**
Rebecca S. Haynie[1], Susan B. Wilde[1], James A. Herrin[1], J.L. Shelton[1], K.C Das[2], and S. Chinnasamy[2]
[1]*D.B. Warnell School of Forestry and Natural Resources, University of Georgia, Athens, Georgia*
[2]*Biorefining and Carbon Cycling Program, Department of Biological & Agricultural Engineering, University of Georgia, Athens, Georgia*

9:15 am **Comparison of Laboratory and Field Responses of *Lyngbya magnifica* to Similar Algaecide Exposures *(Student Presentation)***
West M. Bishop, Brenda M. Johnson, and John H. Rodgers Jr.
Department of Forestry and Natural Resources, Clemson University, Clemson, South Carolina

9:30 am **Effects of Water Depth on the Growth of Parrotfeather (*Myriophyllum aquaticum* Vell. Verc.) *(Student Presentation)***
Ryan M. Wersal and John D. Madsen
Geosystems Research Institute, Mississippi State University, Mississippi State, Mississippi

9:45 am **Refreshment Break** *(Executive Ballrooms A-D and Atrium)*

10:00 am **Evaluation of Lake-wide Herbicide Treatments for Controlling Curlyleaf Pondweed (*Potamogeton crispus* L.) in Minnesota Lakes *(Student Presentation)***
James A. Johnson and Raymond M. Newman
Department of Fisheries, Wildlife and Conservation Biology, University of Minnesota, Saint Paul, Minnesota

10:15 am ***Hydrocotyle ranunculoides* L.f. – Origins and Control Options**
Jonathan R. Newman[1], Richard Shaw[2], and Manuel A. Duenas[1]
[1]*Centre for Ecology and Hydrology, Crowmarsh Gifford, Wallingford, Oxon, United Kingdom*
[2]*CABI E-UK, Egham, Surrey, United Kingdom*

10:30 am **Aquatic Herbicide Dissipation Following Application of a Granule and Liquid Formulation**
Tyler J. Koschnick[1], David Petty[2], Bob Johnson[3], Cole M. Hulon[4], and Richard Dirks[5]
[1]*SePRO Corporation, Medina, Ohio*
[2]*NDR Research, Plainfield, Indiana*
[3]*SePRO Corporation, Carmel, Indiana*
[4]*SePRO Corporation, SePRO Research and Technology Campus, Whitakers, North Carolina*
[5]*ReMetrix LLC, Carmel, Indiana*

10:45 am **Effects of Plant Growth Regulation on Hydrilla Efficacy and Aquatic Habitat Complexity**
Heather J. Theel, Linda S. Nelson, and Christopher R. Mudge
U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi

11:00 am **Phenological Attributes of *Egeria densa* Suggest Alternative Strategies for Control in the Sacramento - San Joaquin Delta**
Lars W. J. Anderson and Doreen Gee
U.S. Department of Agriculture, Agricultural Research Service, Exotic and Invasive Weed Research, Davis, California

11:15 am **Pulsed Electric Fields (PEF) for Control of Sediment Aquatic Weed Propagules**
Tom Barr[1] and Lars Anderson[2]
[1]*University of California, Davis, California*
[2]*U.S. Department of Agriculture, Agricultural Research Service, Exotic and Invasive Weed Research, Davis, California*

11:30 am **Control of Eurasian and Hybrid Milfoil and Impacts on Native Emergent Plants**
LeeAnn M. Glomski[1] and Michael D. Netherland[2]
[1]*U.S. Army Engineer Research and Development Center, Lewisville, Texas*
[2]*U.S. Army Engineer Research and Development Center, Gainesville, Florida*

11:45 am **Penoxsulam and Endothall Combination for Control of *Hydrilla verticillata***
Mark A. Heilman[1], Tyler J. Koschnick[2], David P. Tarver[3], Cole M. Hulon[1], and Charles Seacrist[4]
[1]*SePRO Corporation, SePRO Research and Technology Campus, Whitakers, North Carolina*
[2]*SePRO Corporation, Medina, Ohio*
[3]*SePRO Corporation, Tallahassee, Florida*
[4]*SePRO Corporation, Brandon, Florida*

12:00 pm **Lunch on Your Own**

Session VI

1:15 pm - 3:00 pm
Regency C-D
Moderator: Tyler Koschnick, *SePRO Corporation, Medina, Ohio*

1:15 pm **Combinations of Endothall with 2,4-D and Triclopyr for Enhanced Control of Eurasian Watermilfoil with Short Contact Times**

John D. Madsen[1], Ryan M. Wersal[1], and Kurt D. Getsinger[2]
[1]Geosystems Research Institute, Mississippi State University, Mississippi State, Mississippi
[2]U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi

1:30 pm **Twenty Years of Herbicide Concentration and Exposure Time Studies for Submersed Plant Control: What Have We Learned and Where Are We Going?**
Michael Netherland[1], Kurt Getsinger[2], Linda Nelson[2], Angela Poovey[2], John Skogerboe[3], and LeeAnn Glomski[4]
[1]U.S. Army Engineer Research and Development Center, Gainesville, Florida
[2]U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi
[3]U.S. Army Engineer Research and Development Center, Spring Valley, Wisconsin
[4]U.S. Army Engineer Research and Development Center, Lewisville, Texas

1:45 pm **NPDES Permits in Your Future?**
John H. Rodgers, Jr., Brenda M. Johnson, and West M. Bishop
Department of Forestry and Natural Resources, Clemson University, Clemson, South Carolina

2:00 pm **Toxic Cyanobacteria and Their Effect on Wildlife and Human Health**
Susan B. Wilde[1], Rebecca S. Haynie[1], and S. K. Williams[2]
[1]D.B. Warnell School of Forestry and Natural Resources, University of Georgia, Athens, Georgia
[2]Belle Baruch Institute for Marine Biology and Coastal Research, University of South Carolina, Columbia, South Carolina

2:15 pm **Hey 'Mon' – This is Guyana….**
Michael Grodowitz
U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi

2:30 pm **Improved Control of Invasive Species in the UK Using Glyphosate and TopFilm®**
Jonathan R. Newman
Centre for Ecology and Hydrology, Crowmarsh Gifford, Wallingford, Oxon, United Kingdom

2:45 pm **APMS Online Version of "Understanding Invasive Aquatic Weeds" Instructional Booklet**
Jeffery D. Schardt
Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida

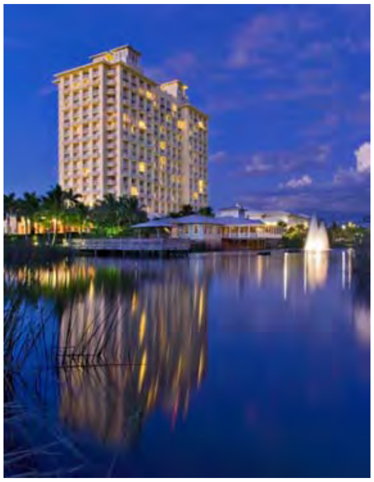
3:00 pm **Closing Remarks and Adjourn 49th Annual Meeting**
Carlton Layne
Aquatic Ecosystem Restoration Foundation, Marietta, Georgia

3:15 pm **APMS Board of Directors Meeting** *(Gilpatrick Room)*

6:00 pm **Reception** *(Atrium)*

7:00 pm **APMS Annual Awards Banquet** *(Regency C-D)*

NEXT YEAR
50th Annual Meeting
Hyatt Regency Coconut Point
Bonita Springs, Florida
July 11–14, 2010



Abstracts

Abstracts are printed as submitted by authors. Abstracts are listed alphabetically by presenting author. Presenting author appears in **bold.**

Phenological Attributes of *Egeria densa* Suggest Alternative Strategies for Control in the Sacramento - San Joaquin Delta

Lars W. J. Anderson and Doreen Gee
U.S. Department of Agriculture, Agricultural Research Service, Exotic and Invasive Weed Research, Davis, California

Egeria densa has spread to over 12,000 acres in the Sacramento-San Joaquin Delta and is currently under a long-term management program that relies primarily on multiple, spring (April-May) applications of fluridone. This approach has been quite successful in reducing biovolume (biomass) and cover. However, remnant stands of *E. densa* persist through the fall, and are capable of generating sufficient growth to provide an over-winter source of re-growth. Sampling in winter showed that partially and fully defoliated stems were present on the bottom (1 to 5 m deep) in several sites. When exposed to elevated temperature, these nearly 70 % of the stems produced one or more lateral shoots within 2 to 3 weeks after removal for field sites. Even defoliated stems that had been cut to 2 cm lengths were capable of generating new shoots, though only ca. 30% did so. The ability of *E. densa* to produce adequate growth for over wintering reserves during the late summer and fall after initial effective applications of a systemic herbicide suggests that a second exposure phase might reduce the regrowth capacity. The opportunistic advantage provided by abundant above-sediment over wintering propagules may also explain the greater abundance of *E. densa* compared to other non-native species such as *Myriophyllum spicatum*, and *Potamogeton crispus* as well as native plants such as *Elodea canadensis, Stuckenia pectinata and Ceratophyllum demersum.*

Wisconsin's Aquatic Plant Management Strategy – Managing Invasives/Protecting Natives

Tim Asplund
Wisconsin Department of Natural Resources, Madison, Wisconsin

Aquatic plant management (APM) in Wisconsin has shifted in recent years from a focus on nuisance relief and small scale control of vegetation along riparian shorelines to a broader focus on whole-lake scale management of aquatic invasive species (AIS) and protection and restoration of native plant communities. Several factors have led to this shift, including a growing public awareness of the value of healthy aquatic plant communities, new regulatory authorities to require APM planning and monitoring, the availability of grant funds for the prevention and control of AIS, and recent advances in APM tools and best management practices. This talk will summarize the successes and challenges of this evolving approach to aquatic plant management in Wisconsin.

Hung Out to Dry: Fitness Loss Due to Desiccation of Aquatic Invasive Plants and Implications for Efficient Risk Management *(Student Presentation)*

Matthew A. Barnes[1], Christopher L. Jerde[1], Anna Noveroske[1], Elise K. DeBuysser[1], W. Lindsey Chadderton[2], and David M. Lodge[1]
[1]*University of Notre Dame, Notre Dame, Indiana*
[2]*The Nature Conservancy, c/o Center for Aquatic Conservation, University of Notre Dame, Notre Dame, Indiana*

The ability to undergo vegetative reproduction contributes to the invasive success of many aquatic invasive plants. In addition to aiding dispersal via natural pathways, vegetative reproduction promotes human-mediated dispersal as plant fragments can "hitchhike" between water bodies by attaching to boats and trailers. Therefore, the inspection of boats entering and leaving water bodies represents an important risk management strategy for preventing the spread of non-indigenous plants. However, even without inspection efforts, desiccation of plant fragments may reduce fitness, so overland transport of fragments may decrease the risk of initiating new invasions. Nevertheless, current lake to lake transport models of invasive species, such as gravity models, do not directly consider fitness loss in the transport pathway. Here, we compare the desiccation rates of a suite of invasive plants found throughout North America: *Myriophyllum spicatum, Cabomba caroliniana,* and *Egeria densa*. In this experiment, we air-dried plant fragments of varying lengths (3-23 cm) for a range of time periods (0-24 hours). Additionally, we evaluated the desiccation of coiled fragments, similar to plants wrapped around the propeller of a boat. Following desiccation, we returned fragments into a tank of water in individual jars and monitored recovery, survival, and the formation of roots over 8-10 weeks. We assessed differences between desiccation treatments using

time-to-event survival analysis. For control fragments, which received no desiccation treatment, survival and root production readily occurred across all fragment lengths of all species, and the expected waiting time for root production was less than two weeks. In contrast, fragments that experienced desiccation for more than 24 hours posed little or no risk of surviving. We believe these results and similar analyses on other aquatic invasive species, such as *Hydrilla verticillata* in the United States and Canada can increase the effectiveness of management efforts by considering fitness loss in the transport pathway.

Pulsed Electric Fields (PEF) for Control of Sediment Aquatic Weed Propagules

Tom Barr[1] and Lars Anderson[2]
[1]*University of California, Davis, California*
[2]*U.S. Department of Agriculture, Agricultural Research Service, Exotic and Invasive Weed Research, Davis, California*

Control of sediment based aquatic weed propagules (tubers) often requires multiyear treatment programs, permitting, monitoring and other requirements using traditional herbicides. A physical method, pulsed electric fields (PEF), has been investigated as an efficient alternative to kill and reduce *Hydrilla verticillata*. *Potamogeton americana* and *Stuckenia pectinata* tubers in flooded sediments. PEF requires no chemical permitting, registration and water may be used immediately after treatment. PEF offers a much more efficient use of energy (roughly 5%) than continuous electric field as it is a non thermal method of irreversible cell membrane breakdown. PEF is used in “pulses” to reduce the total required power consumption for peak effective threshold treatment. By exceeding the cell membrane’s transmembrane potential (TMP), PEF very rapidly (nanosecond to microsecond pulses) causes cell lysis and rupture. This time scale and efficient energy usage allows a mechanical pulled roller plate (*e.g.* rotary disc plow) for treatment to be considered. Fuel cost for PEF energy demand is estimated at two gallons of diesel per acre of treated sediment to 20cm depth (assuming 8000kW energy at 25kJ/liter). Intact conductivities and electric field obstruction types where considered for exposure at 1 to 50kJ/liter. Sediment characteristics can influence the electric fields and will reduce the efficacy, however, multi roller systems and multi pass applications may be done as frequently as desired for control to address such obstructions.

Tolerance of Selected Bedding Plants to Four Herbicides in Irrigation Water *(Student Poster)*

Sarah T. Berger, Lyn A. Gettys and William T. Haller
Center for Aquatic and Invasive Plants, University of Florida, Gainesville Florida

‘Cocktail Whiskey’ begonia (*Begonia semperflorens*), ‘Sun Devil Extreme’ vinca (*Catharanthus roseus*), ‘Million Gold’ melampodium (*Melampodium paludosum*) and ‘Super Elfin’ impatiens (*Impatiens walleriana*) were irrigated with water treated with quinclorac, topramezone, imazamox and penoxsulam to identify herbicide concentrations that cause phytotoxic effects. Plants were irrigated four times over a 10-d period with the equivalent of 0.5 inch of treated water during each irrigation and then irrigated with tap water until they were harvested 28 d after the first herbicide treatment. Visual quality and dry weight data revealed that melampodium was the most sensitive of the bedding plants to quinclorac, imazamox and penoxsulam, whereas vinca was the most sensitive species to topramezone. Noticeable reductions in visual quality and dry weight of melampodium were evident after exposure to 240, 580 and 10 ppb of quinclorac, imazamox and penoxsulam, respectively, while dry weight of vinca was reduced after exposure to 110 ppb of topramezone. Current irrigation restrictions on imazamox, penoxsulam and topramezone are adequate to minimize damage to these bedding plants if herbicide-treated waters are used for four irrigation events. However, irrigation restrictions should be established for quinclorac to prevent damage to sensitive bedding plants such as melampodium.

Comparison of Laboratory and Field Responses of *Lyngbya magnifica* to Similar Algaecide Exposures *(Student Presentation)*

West M. Bishop, Brenda M. Johnson, and John H. Rodgers, Jr.
Department of Forestry and Natural Resources, Clemson University, Clemson, South Carolina

Algaecides are often a viable option for mitigating filamentous cyanobacterial infestations. Selecting an effective algaecide and concentration for control of problematic algae at a site is crucial for decreasing time, costs, and potential adverse ecological effects. Laboratory studies can facilitate predictions of efficacious treatments in field situations, though must be subsequently confirmed. This research focused on predicting responses of *Lyngbya magnifica* from a farm pond in Six Mile, SC from similar exposures of Phycomycin® in the laboratory. Laboratory experiments identified the efficacious algaecide and concentration necessary to achieve control (92 mg Phycomycin®/ g algae). Field treatment was concurrent with laboratory exposures at the effective concentration with site algae and water. Chlorophyll *a* and biomass were measured initially and 1, 4, 7, 10, and 21 DAT for both laboratory and field exposures. Comparison of responses for this site indicated that the laboratory prediction was successful for determining an effective algaecide and concentration to control the targeted algal species. Field measurements can confirm predictions of effective laboratory exposures.

Our Waters, Our Partners, Our Investments - Wisconsin's Aquatic Invasive Species Strategy

Jeff Bode
Wisconsin Department of Natural Resources, Madison, Wisconsin

Wisconsin faces an onslaught of aquatic invasive species. From a deadly fish virus found in Lake Michigan and Lake Winnebago to Eurasian watermilfoil that can choke our waterways, many non-native species pose threats to our lakes and rivers. We have a lot at stake. This presentation shows the status of our waters and describes how our partnerships and our investments are paying big dividends. The good news is most Wisconsin lakes and streams don't have the most troublesome invasive species and over ninety percent of boaters are practicing the steps necessary to prevent future spread of aquatic invasive species. Together with our partners, Wisconsin is moving forward as a leader in the prevention, containment and control of invasive species.

Differential Effect of Mesotrione and Topramezone on Pickerelweed and Sagittaria (*Student Presentation*)

Brett W. Bultemeier and W.T. Haller
Center for Aquatic and Invasive Plants, University of Florida, Gainesville, Florida

After the discovery of fluridone resistant hydrilla (*Hydrilla verticillata*) in Florida there was a renewed focus on finding new herbicides for use in aquatic ecosystems. The Center for Aquatic and Invasive Plants, at the University of Florida, has been actively screening herbicides since 2003 and found several potential compounds that could be used to control aquatic vegetation. Mesotrione and topramezone, HPPD (4-hydroxyphenylpyruvate dioxygenase) inhibiting herbicides, showed activity on hydrilla at low application rates. The selectivity of both herbicides is being evaluated on native species to determine the likelihood of using these products in the field. Pickerelweed (*Pontederia cordata*) and sagittaria (*Sagittaria lancifolia*) were planted in 6-inch pots and placed either in 5 gal buckets with 2-3 inches of water covering the pots, or placed on greenhouse benches and watered until the soil was completely saturated every 2 days. These plants were then treated as either a one time foliar spray (the plants on the bench top) or a submersed treatment (the plants in the buckets). Plants were allowed 8 weeks of growth after treatment, plant biomass was harvested, dried, and an EC50 was calculated for each of the treatments. Pickerelweed was more sensitive to mesotrione (6.8 µg a.i. L^{-1}, 0.42 g a.i. ac^{-1}) than topramezone (19.6 µg a.i. L^{-1}, 2.0 g a.i. ac^{-1}) in both submersed and foliar treatments respectively. Sagittaria, however, is more sensitive to topramezone (9.6 µg a.i. L^{-1}, 4.5 g a.i. ac^{-1}) than mesotrione (134 µg a.i. L^{-1}, 66.6 g a.i. ac^{-1}) in both submersed and foliar treatments respectively. This is a surprising result because both herbicides affect the same enzyme (HPPD) in the carotenoid biosynthesis pathway. This differential response suggests different uptake, metabolism, sequestration or some other phenomenon is causing reduced efficacy.

The New Taxonomy of Plants: What Impact Does This Have on Aquatic Plants?

Brett W. Bultemeier[1], W.S. Judd[2], and L.A. Gettys[1]
[1]*Center for Aquatic and Invasive Plants, University of Florida, Gainesville Florida*
[2]*Botany Department, University of Florida, Gainesville, Florida*

In the early-mid 18th century, Carl Linnaeus forever changed the biological sciences by introducing the idea of a binomial system for classifying organisms. This system was developed largely for plants, but was quickly adapted for all organisms and became the standard system of classification that is still in use today. The binomial nomenclature uses the genus and species ranking that we commonly recognize, but also sought to rank these organisms into larger groups such as families, orders, kingdoms etc. This early classification allowed scientists to communicate with each other in a standardized manner as to what species they were researching. The early ranking of plants was based almost exclusively on morphological characteristics and relied heavily on floral structures to place each species into groups. Flash forward to the taxonomy that is used today and a much different landscape is developing. With the advent and rapid development of powerful genetic techniques, many of the old classifications of Linnaeus are being reevaluated. Where morphological and floral features once dominated, it is now chloroplastic DNA and other genetic markers that rule the day in classifying plant relationships. Morphological features are still useful for identification, but many plants are organized into groups that are cryptic at best based on morphological features. For instance, in aquatics the *Lemnaceae*, once considered its own family, is now nested inside the *Araceae* with water lettuce. Placing the *Lemnaceae* (the world's smallest flowering plant) into the *Araceae*, which have a large and often showy floral structure, is hard to understand without using genetic information. Some taxonomists have proposed completely dissolving the Linnaeus binomial system and using one that nests plants within clades (that have no specific rank) of increasing size. The taxonomic systems are beginning to change from a system used to identify plants based on morphological features, to one that seeks to relate plants based on evolutionary connections. We should all be aware of what is happening in this field, but keep our perspective on how and why we use taxonomy in aquatic plant management.

Biocontrol of Aquatic Weeds in Puerto Rico

[1]Edwin Abreu-Rodriguez and **Lourdes S. Bernier Castrello[2]**
[1]Agricultural Experiment Station, University of Puerto Rico, Isabela, Puerto Rico
[2]Puerto Rico Department of Natural and Environmental Resources, San Juan, Puerto Rico

The most abundant aquatic weeds in Puerto Rico were water hyacinth (*Eichhornia crassipes*), alligatorweed (*Alternanthera philoxeroides*) and water lettuce *Pistia stratiotes*). The only control methods applied were chemical and mechanical. During the early 1980, biocontrol was integrated to the government aquatic plant control program and *Neochetina eichhorniae* was introduced. This effort ended the following year due to lack of funding. The program was reinitiated in 1996 (COE-DNER-UPR). The alligatorweed flea beetle (*Agasicles hygrophila*) was released in two areas in July 1997. Additional importations were conducted with a total of 31,195 insects released. The insect was established and has reduced dramatically the expansion of alligatorweed. The second agent introduced for the control of alligatorweed was the alligatorweed stem borer (*Arcola malloi*) but multiple efforts to establish it failed. The biocontrol of water lettuce was initiated with the introduction of *Neohydronomus affinis* in August 1998. A total of 2,375 weevils were released in five areas. This insect was quickly established and after five years, water lettuce was under control and only small infested plants were observed in the released areas. The next step was to target water hyacinth, the most problematic weed around the world. This task began in 2002 at Lake Carraízo where the weevils *Neochetina bruchi* and *Neochetina eichhorniae* were introduced. Initially 5,000 weevils were imported, with two additional importations. A portion of the weevils was released; others were used to establish a colony. Five years later, a total of 56 releases were conducted and 58,645 weevils and 7,337 infested plants were released. The plant coverage of the water was reduced to less than 10% and plant height was reduced from 100 cm to less than 60 cm. The lake was completely clear with only small water hyacinth plants observed and restricted to the borders. Another part of the program was enhancement of the education component. Early detection of hydrilla (*Hydrilla verticillata*) and giant salvinia (*Salvinia molesta*) was made including advice on control measures and recommendations to reduce dispersion. New efforts are being directed towards the biocontrol of salvinia with the introduction of *Cyrtobagous salviniae.*

Progress in Strategic Efforts to Manage Alligatorweed [*Alternanthera philoxeroides* (Mart.) Griseb] in Australia

Nimal Chandrasena
Ecowise Environmental Pty Ltd, Penrith, Australia

Alligatorweed is acknowledged as the aquatic invader that poses the largest threat to Australian waterways and moist, terrestrial habitats. Despite control efforts over several decades, it is now widespread across NSW, and is present in Queensland, ACT and Victoria, as well. With deeply entrenched, historical infestations, Sydney and Hunter regions in NSW are regarded as ‘core’ infestation areas. A recent study identified the major operational vectors causing spread in these two regions as: flood, recreational activities (boating and water-related sports), earthmoving equipment and aquatic weed harvesting activities. Other important vectors were irrigation, landscaping, floodplain agriculture, and waste and soil dumping in urban areas. In addition, locations of infestations in catchments and waterways (whether upstream, middle or downstream), infestation sizes and their nature - whether aquatic or terrestrial, were also rated as important factors, contributing to spread. Using an agreed Risk Assessment Framework, a risk assessment of the above vectors, operating at major infestation locations in the two regions, was carried out. This allowed the ranking of the locations as ‘Low’, ‘Medium’, ‘High’ or ‘Very High’ risk sites, in terms of the collective risks of spread posed by those vectors. This prioritization is a first strategic step towards controlling the vectors, to prevent a nation-wide alligatorweed outbreak. The study compiled available alligatorweed infestation data from the Sydney and Hunter regions into a single spatial ArcView GIS database, setting a new baseline. The assigned risks of spread for the infested sites are displayed in maps covering the two regions. The digitized ArcView datasets can be updated with future mapping, and are amenable for further analyses of risk factors. They form the basis for strategic targeting of heavily infested sites and for future monitoring of changes in alligatorweed abundance in the regions. Consultations with stakeholders identified inadequate resourcing and coordination of management effort as major constraints to successful management. Other constraints include the inadequate priority attached to the species, inconsistency in on-ground contractor performance and ineffective implementation of local management plans. The study also highlighted community engagement and stakeholder cooperation as critical elements to improve alligatorweed management in NSW, and more broadly in Australia.

Flowering Rush (*Butomus umbellatus* L.): A New Invader to the Northwest *(Student Poster)*

Joshua C. Cheshier[1], Peter Rice[2], and John D. Madsen[1]
[1]*Geosystems Research Institute, Mississippi State University, Mississippi State, Mississippi*
[2]*Division of Biological Sciences, University of Montana, Missoula, Montana*

Flowering rush (*Butomus umbellatus*) is an invasive perennial that is a nuisance in lacustrine environments across the midwestern and northwestern United States and southern Canada. The first introduction of flowering rush was reported in 1897 along the St. Lawrence River in Quebec. Flowering rush forms monotypic stands that displace native vegetation and colonize previously unvegetated littoral zones impacting ecosystem services provided by open water habitat. Flowering rush reproduces both sexually and asexually through the formation of seeds and vegetative bulbils which are formed on the inflorescence as well as the rhizomes. These reproductive propagules aid in the spread of flowering rush and are able to travel through riverine systems into new areas. To date, management consists of physical removal, successive cuttings, and chemical control. In a preliminary replicated field trial on Flathead Lake, MT during a drawdown period, imazamox, imazapyr, and triclopyr were applied to the exposed, above ground tissues. Imazamox and two rates of imazapyr at 0.56, 1.10 and 1.68 kg ai/ha respectively, provided control ($p<0.001$) up to 90 days after treatment (DAT). Triclopyr at 2.52 kg ae/ha provided control up to 30 DAT; however, new shoots began to emerge and by 90 DAT triclopyr treated plots did not significantly differ from the untreated control plots. Imazamox and imazapyr are effective herbicides for controlling exposed flowering rush. No controls for submerged flowering rush have yet been sufficiently evaluated.

The Use of Aquatic Herbicides to Control Common Reed: *Phragmites australis* (Cav.) Trin. Ex Steud. (*Student Presentation*)

Joshua C. Cheshier and John D. Madsen
Geosystems Research Institute, Mississippi State University, Mississippi State, Mississippi

Common reed (*Phragmites australis*) is an invasive perennial grass that is a nuisance in aquatic and riparian environments across the United States. Common reed forms monotypic stands that displace native vegetation which provide food and cover for wildlife. Common reed has high genetic variability, with two unique haplotypes, I and M, having the greatest distribution. Haplotypes I and M are both invasive. Our objectives were to evaluate whether there is a difference in the susceptibility of haplotypes to available herbicides and identify the most effective aquatic labeled herbicides for control of common reed. A replicated mesocosm study was conducted in 1136 L tanks using two distinct haplotypes, I and M. Restriction fragment length polymorphism methodologies were used to identify populations of I and M used in this study. Diquat at 2.24 and 4.49 kg ai/ha, glyphosate at 2.10 and 4.21 kg ae/ha, imazamox at 0.561 and 1.12 kg ai/ha, imazapyr at 0.842 and 1.68 kg ai/ha, and triclopyr at 3.36 and 6.73 kg ae/ha were applied to the foliage with a non-ionic surfactant at a rate of 0.25% v:v. Common reed was rated weekly for 12 weeks after treatment (WAT) to assess percent control. At 12 WAT, healthy plant tissue was harvested, dried, and weighed. Data were analyzed using a mixed procedure in SAS to assess differences among herbicide treatments as well as potential haplotype differences. Means were separated by least squares means at the $p=0.05$ level of significance. Haplotype was not a significant factor ($p=0.1824$); therefore, we found no evidence of differential susceptibility between haplotypes to herbicides. At 12 WAT, both 2.10 and 4.21 kg ae/ha rates of glyphosate and 0.842 and 1.68 kg ai/ha rates of imazapyr significantly reduced common reed ($p<0.01$). Triclopyr at the maximum label rate of 6.73 kg ae/ha significantly reduced biomass ($p<0.01$). Glyphosate, imazapyr, and triclopyr are effective herbicides for common reed control.

Invasive Aquatic Plant Distribution and Management in the Ross Barnett Reservoir (*Student Poster*)

Michael C. Cox, Ryan M. Wersal, and John D. Madsen
Geosystems Research Institute, Mississippi State University, Mississippi State, Mississippi

Encompassing 13,400 hectares (33,000 acres) just north of Jackson, Mississippi, the Ross Barnett Reservoir is the largest man-made impoundment in Mississippi. Maintained by the Pearl River Valley Water Supply District (PRVWSD), the reservoir is the primary potable water supply for the City of Jackson. Three invasive aquatic plant species that have caused major problems are waterhyacinth (*Eichhornia crassipes* (Mart.) Solms.), alligatorweed (*Alternanthera philoxeroides* (Mart.) Griseb.), and hydrilla (*Hydrilla verticillata* L.F. Royle). Waterhyacinth and alligatorweed have been under active management for almost a decade, primarily through the use of systemic herbicides, resulting in a significant decrease in their occurrence in the Ross Barnett Reservoir. Hydrilla was first observed in the Reservoir in 2005 and has since been aggressively managed with the systemic herbicide fluridone and the contact herbicide endothall. As a result of the 2005 survey, it was estimated that hydrilla could encompass over 2,800 hectares (7,000 acres) of the Ross Barnett Reservoir if control techniques and continued assessments were not implemented. The PRVWSD has begun to develop a long term strategic management plan to address the growth and spread of these species. To ensure that these management techniques

are successful, surveys of the littoral zone plant community have been conducted since 2005 to monitor and record changes in the occurrence of plant species as well as to assess management techniques. There a total of 26 aquatic or riparian species. The native plant American lotus (*Nelumbo lutea* Willd.) was the most observed species, increasing in occurrence from 17% to 25% from 2005 to 2008 respectively. All non-native species: alligatorweed, waterhyacinth, hydrilla, parrotfeather (*Myriophyllum aquaticum* (Vell.) Verdc.), and brittle naiad (*Najas minor* All.) had an occurrence below 10% across all years. Alligatorweed was the most commonly observed invasive species. Reductions in the presence of alligatorweed and waterhyacinth in the Ross Barnett Reservoir can be attributed to the aggressive management of these species. Hydrilla has been reduced to less than 100 acres, indicating that fluridone treatments were generally successful. However, scattered plants and possible overwintering by root crowns suggest rigorous surveying and monitoring is needed to ensure successful management of hydrilla.

Balancing Control and Realism in Scientific Experiments to Evaluate Better Aquatic Plant Management; Mississippi State University Aquatic Research Facilities

Eric D. Dibble, Ericka Schlickeisen, and Krisan Webb
Department of Wildlife and Fisheries, Mississippi State University, Mississippi State, Mississippi

The design and implementation of appropriately scaled experiments to address management questions often presents a challenge, as natural aquatic systems are difficult to replicate and frequently easy to simplify. For any given management issue, a variety of experimental approaches ranging from lab bench top to natural ecosystem-level can be employed, depending on the primary objective of the research question. Small-scale experiments are best suited for questions that require precise control of variables, but connection to natural processes and realism is often lost at the expense of simplified testable hypotheses. Larger-scale and field-scale experiments maintain realism, but are subsequently difficult to replicate and control. Mid-scale approaches, such as the use of mesocosm systems, represent a point along the Diamond (1986) continuum of experimental community ecology that spans between small- and large-scale experimentation, although in an attempt to decrease variability and increase reproducibility, realism may be reduced. Ultimately, the best approach is one that integrates small-scale research programs with field studies, and addresses management questions at a variety of scales. Mississippi State University houses a diversity of facilities appropriate for research in aquatic community ecology and management that offer the tools necessary to conduct experiments with hybrid designs at multiple scales. We summarize previous studies conducted at four different experimental scales (laboratory, mesocosm, pond and lake) that have examined questions pertinent to a better understanding of aquatic plant management and its role in aquatic ecosystems.

Mapping Invasive Aquatic and Wetland Weeds with QuickBird Satellite Imagery

James H. Everitt, C. Yang, and R. S. Fletcher
U.S. Department of Agriculture, Agricultural Research Service, Weslaco, Texas

The invasion and spread of noxious plant species in waterways and wetlands present serious problems to management of these areas. The inaccessibility and often great expanses of many wetlands make ground inventory and assessment difficult, time consuming, expensive, and often inaccurate. Remote sensing techniques offer rapid acquisition of data with generally short turn-around time at costs lower than ground surveys. This paper presents an overview on the application of QuickBird multi-spectral satellite imagery for detecting weeds in waterways and wetlands in Texas. Unsupervised image analysis was used to classify false color composite (green, red, and near-infrared) satellite images of weed infestations and accuracy assessments (producer's and user's accuracies) were performed on classified maps of the images. Plant species studied included giant reed (*Arundo donax* L.), waterhyacinth [*Eichhornia crassipes* (Mart.) Solms], spiny aster [*Leucosyris spinosa* (Benth.) Greene], and giant salvinia (*Salvinia molesta* Mitchell). Accuracy assessment results for the four weed species were: giant reed, producer's accuracy = 94.4%, user's accuracy = 100%; waterhyacinth, producer's accuracy = 100%, user's accuracy = 80%; spiny aster, producer's accuracy = 90%, user's accuracy = 93.1%; giant salvinia, producer's accuracy = 93.9%, user's accuracy = 92%. Our results indicate that QuickBird satellite imagery combined with image analysis can be a useful tool for distinguishing and mapping invasive weeds in waterways and wetlands. The satellite imagery can measure the entire spatial extent of an area and serve as a permanent geographically located image data base to monitor future contraction or spread of weed populations over time.

The Influence of Species and Water Depth on Aquatic Plant Re-establishment in Little Bear Creek Reservoir, Alabama *(Student Poster)*

Jonathan P. Fleming[1-2], John D. Madsen[1], and Eric D. Dibble[2]
[1]Geosystems Research Institute, Mississippi State University, Mississippi State, Mississippi
[2]Department of Wildlife and Fisheries, Mississippi State University, Mississippi State, Mississippi

Reestablishment of native aquatic macrophytes has been used to restore habitat for fish and other organisms, with additional positive effects on water quality. Species selection for re-vegetation efforts may be of great importance due to lake-specific ecological factors that may affect survival. In addition, environmental factors such as water depth and temperature may have an influence on plant survival due to post-planting water level fluctuations and species-specific light and temperature preferences. Previous re-vegetation efforts using a variety of aquatic plant species in Little Bear Creek Reservoir in Northwest Alabama indicated that American pondweed (*Potamogeton nodosus* Poir.) was the only species to show significant survival rates ($p < 0.05$). Several factors may have led to low survival of other species, such as low water levels and high water temperatures. Our objective for 2008 was to test whether planting depth or species selection contributed to the overall survival of plants inside protective exclosures, in order to make our future efforts more efficient. We performed an experiment in which we planted three species along a depth gradient (.30, .60, and 1 meter): sago pondweed (*Stuckenia pectinata* (L.) Böerner), water celery (*Vallisneria americana* Michx.), and American pondweed. Our results indicated that the depth in which species were initially planted had no effect on pooled survival ($p < 0.05$) but species did have an effect ($p < 0.05$), with American pondweed again having the highest survival (93%). As our work continues in this effort, the results of these trials will provide us with information that will aid in future native aquatic plant reestablishment in Little Bear Creek Reservoir and potentially in other areas where plant restoration can benefit aquatic systems.

Control of Eurasian and Hybrid Milfoil and Impacts on Native Emergent Plants

LeeAnn M. Glomski[1] and Michael D. Netherland[2]
[1]U.S. Army Engineer Research and Development Center, Lewisville, Texas
[2]U.S. Army Engineer Research and Development Center, Gainesville, Florida

Eurasian watermilfoil (*Myriophyllum spicatum* L.) and hybrid milfoil (*Myriophyllum spicatum* x *M. sibiricum*) are invasive submersed plants found throughout the Great Lakes and the Pacific Northwest regions. Triclopyr and 2,4-D are both auxin mimic herbicides and they are commonly used to control these species at recommended use rates of 1.5 to 2.5 mg L^{-1} and 2.0 to 4.0 mg L^{-1} respectively. Laboratory and mesocosm trials have revealed no difference in response between Eurasian and hybrid milfoil when exposed to operational use rates of either herbicide; however, the higher use rates have been shown to injure and significantly reduce biomass of waterlilies, spatterdock and soft-stem bulrush. Recent field and greenhouse data have shown that Eurasian and hybrid milfoil can be controlled with extended exposures to low concentrations (25 to 250 µg L^{-1}) of triclopyr and 2,4-D. Preliminary work has indicated that extended exposures to low rates of these herbicides had no impact on spatterdock shoot and root biomass. The ability to utilize low concentrations of triclopyr and 2,4-D in areas with limited water exchange may represent a cost-effective, selective, and large-scale treatment strategy. More research is needed to determine the impact of low rates and extended exposures of auxin mimic herbicides on native vegetation.

Hey 'Mon' – This is Guyana….

Michael Grodowitz
U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi

Guyana is part of the Amazon-Orinoco watershed and is covered by an intricate network of waterways used for transportation, irrigation, drainage, and domestic purposes. In all, there are 3,700 miles of navigable waterways, the only transportation routes in most areas, and even more miles of smaller, non-navigable drainage canals. In fact, the name Guyana is an Amerindian word meaning 'Land of Many Waters'. Drainage can be described as poor with sluggish river flow because the average gradient of the main rivers is only one foot to every 10 miles. Eight rivers flow into the sea along a coast length of 270 miles. Such an environment is highly suitable for the growth of problematic aquatic plants including waterhyacinth, waterlettuce, alligatorweed, cabomba, and several native & non-native riparian grass species. Free flowing waterways with adequate storage capacity are vital for agricultural productivity and prevention of flooding along coastal Guyana; however, several hundred tons of aquatic weeds clog the country's waterways annually thereby increasing flooding, obstructing navigation, increasing mosquito breeding habitat, and impeding water use. At the present, aquatic plant management consists mainly of hand removal with only a minimal amount of chemical applications. Because of these problems, the goverment of Guyana requested assistance from the United Nations, Food and Agricultural Organization (FAO) to develop and implement an integrated program for the management of these problem aquatic plants. FAO requested that I provide assistance in developing a national level manangement plan focusing on biological control strategies in an integrated fashion. Because of

the high costs associated with the use of chemicals and mechanical control options, FAO requested that focus be on the use of biological control strategies. In this instance the use of biological control is an interesting proposition since many of the biological control agents used for these plants are supposedly native to the Amazon basin. This begs the question “Why are these agents not already exerting control pressure on the plants?” This presentation will explore plant problems in Guyana and discuss possible solutions inclduing the use of native biocontrol agents.

Insect Herbivores of *Heternathera dubia* in the United States (*Student Poster*)

Nathan Harms[1] and Michael Grodowitz[2]
[1]*University of North Texas, Lewisville, TX*
[2]*U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi*

Herbivory, commonly observed on aquatic plants, can slow growth, decrease reproduction, hinder plant dispersal, facilitate transmission of infectious diseases, and contribute to overall reduced competitive success, making it an important consideration in plant management strategies. Insect herbivory can exert considerable pressure on individual species and ultimately impact aquatic plant community structure through the alteration of competitive pressures. To better understand this impact, a first step is to initiate surveys to identify potential insect herbivores thereby creating host plant-insect association lists. Once these are compiled, the herbivores’ role in macrophyte community structure, establishment and competition can be better elucidated. This paper summarizes the results of a series of surveys of potential insect herbivores associated with *Heteranthera dubia* conducted from 2006-2008. This species was selected because of its importance to aquatic plant restoration projects and because of its broad distribution in the U.S. Plants were collected in the field, invertebrates removed, and signs of feeding damage noted. Based on these observations a species list was created containing a minimum of eleven potential insect herbivores from nine sites in Texas, Washington, Minnesota, and Wisconsin. Of these, three species were collected from the order Lepidoptera, one from the Coleoptera, three from Diptera, and four from Trichoptera. Several taxa were collected at multiple sites. For example, *Hydrellia* spp. (Diptera: Ephydridae) larvae and pupae were commonly collected from *H. dubia* at sites in Washington, Minnesota, Wisconsin, and New York. Another commonly encountered insect herbivore genus, *Paraponyx* spp., was collected at four sites in Wisconsin, New York, and Texas. While the majority of herbivores were identified as possessing generalist diets, one collected in Texas, *Bagous floridanus*, has an unknown diet but it is well documented that many *Bagous* spp. are host specific. While *Hydrellia* species identifications could not be determined with any accuracy since only larval stages were collected, several of these may also prove to be host-specific. Damage observed in the field included extensive tunneling in the stems of the plant and, in some cases, substantial chewing damage to the leaves. To the best of our knowledge, all represent new host plant-insect associations.

Overwintering Behavior of *Hydrellia pakistanae* (Diptera: Ephydridae), Biocontrol Agent of *Hydrilla verticillata* (*Student Presentation*)

Nathan Harms[1] and Michael Grodowitz[2]
[1]*University of North Texas, Lewisville, Texas*
[2]*U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi*

Hydrellia pakistanae has been used for more than 20 years in the United States for management of *Hydrilla verticillata*. While much is known about the biology of this species little, if any, information is available on overwintering biology. In the winter of 2007-2008, researchers at the Lewisville Aquatic Ecosystem Research Facility, Lewisville, TX, initiated studies to determine overwintering biology of *H. pakistanae.* This was accomplished using a variety of different trapping and extraction methods to identify the location of life stages throughout the winter months. Two methods were used to collect and quantify adults; floating soap-traps in ponds and Berlese funnel extractions of pond-edge debris. Immature stages (larvae and pupae) were located using Berlese funnel extraction techniques on fresh hydrilla coupled with microscopic examination of hydrilla leaves and stems. Larvae were detected in stem tissue beginning in November with a gradual decline occurring through June. Peak numbers occurred in December with >0.6 immatures/20 cm stem length. Coincidentally, larval presence in the leaves declined dramatically in December and was not detected again in substantial quantities until May. Immature *Hydrellia* spp., regardless of position in leaves or within stem, were mainly found in the apical 20 cm of plant tissue. Approximately 70% were found in the apical 20 cm, as compared to only 23% and 7% for the 20-40 cm and >40cm plant sections, respectively. Adults were absent from ponds from January until April, when populations began to increase. *Vallisneria americana* and *Potamogeton nodosus* were also examined to eliminate the possibility of other plant species acting as winter hosts. No *H. pakistanae* were reared from either native species throughout the study period. Based on these data, *H. pakistanae* appears to overwinter primarily as first and second instars by tunneling into the stem of hydrilla. Reasons for this stem boring behavior are unknown; however, during winter senescence when the structural stability of the hydrilla plant is weakened the stem probably provides relatively greater protection as well as increased oxygen to the larvae. This paper provides the first published information on the overwintering behavior of *H. pakistanae* in its introduced range.

Science to Support Natural Resource Management of Aquatic Invasive Plants

Jennifer Hauxwell
Fisheries and Aquatic Sciences Research Program, Wisconsin Department of Natural Resources, Madison, Wisconsin

Good science provides a foundation upon which the advantages and disadvantages of various aquatic invasive plant control techniques can be evaluated. In recent years, we have conducted research to inform the Wisconsin Department of Natural Resources and the public for setting reasonable expectations associated with Eurasian watermilfoil control, both short and long-term. This talk will provide an overview of recent findings related to: 1) developing and implementing a standardized monitoring protocol for aquatic plants, 2) understanding the factors associated with Eurasian watermilfoil distribution and abundance in Wisconsin lakes, 3) evaluating strategic management of Eurasian watermilfoil, and 4) evaluating the benefits and drawbacks associated with whole-lake herbicide treatments.

A Novel Biobased Method for Harvesting Algae for Biofuels Production

Rebecca S. Haynie[1], Susan B. Wilde[1], James A. Herrin[1], J.L. Shelton[1], K.C Das[2], and S. Chinnasamy[2]
[1]*D.B. Warnell School of Forestry and Natural Resources, University of Georgia, Athens, Georgia*
[2]*Biorefining and Carbon Cycling Program, Department of Biological & Agricultural Engineering, University of Georgia, Athens, Georgia*

Identifying and producing a sustainable source of bio-energy is becoming an increasingly relevant research pursuit. The goal of our efforts is to develop a high-output source of biofuel that can be produced with minimal inputs of energy and resources. Certain strains of microalgae have very high lipid content and have been used to produce a biofuel, known as bio-oil. By utilizing urban and industrial wastewaters as a nutrient source, the UGA Biorefinery has established massive cultures of *Scenedesmus bijuga*, *Chlorella minutissima*, and *Chlamydomonas globosa*, which are highly desirable strains of microalgae for biofuel production. Harvesting the algae and lipid extraction is difficult because of the high-water content of the algae. Our research is currently focused on developing a “bioconverter” system that will harvest, assimilate and concentrate these valuable algal lipids, thus facilitating a more efficient extraction. The first organism we have identified as a potential bioconverter is the Asian freshwater clam, *Corbicula fluminea*. Preliminary analyses have shown that 1 clam can reduce algal biomass with an initial concentration of 20 mg/L by 94% in 1 hour. Our group has performed several small-scale pilot studies to determine feeding preferences, lipid extraction techniques, and optimal measurements of algae filtration and removal rates by the clams (biomass, optical density, chlorophyll-A). We are currently conducting experiments using a series of continuously circulating mesocosms. Each mesocosm contains a mesh container of clams which allows algae in but does not allow pseudofeces and other wastes to become resuspended. This study serves as a small-scale model of a partitioned aquaculture system (PAS), which utilizes aquaculture wastewater in a flow-through system to provide nutrients for growing other desirable organisms, such as algae for biofuel production. Our project goal includes the final development of a PAS that will include our bioconverter.

Penoxsulam and Endothall Combination for Control of *Hydrilla verticillata*

Mark A. Heilman[1], Tyler J. Koschnick[2], David P. Tarver[3], Cole M. Hulon[1], Charles Seacrist[4]
[1]*SePRO Corporation, SePRO Research and Technology Campus, Whitakers, North Carolina*
[2]*SePRO Corporation, Medina, Ohio*
[3]*SePRO Corporation, Tallahassee, Florida*
[4]*SePRO Corporation, Brandon, Florida*

Additional management approaches for *Hydrilla verticillata* continue to be examined to improve long-term strategies for best management of this key invasive submersed species in the US. Current laboratory studies and field trials are examining the combination of the systemic ALS herbicide penoxsulam (2-(2,2-difluoroethoxy)-6-(trifluoromethyl-N-(5,8- dimethoxy[1,2,4] triazolo[1,5-c]pyrimidin-2-yl))benzenesulfonamide) and the contact herbicide endothall (3,6-endoxohexahydrophthalic acid) for selective hydrilla management. In laboratory time studies, the penoxsulam:endothall combination has decreased exposure requirements for penoxsulam while reducing necessary use rates of endothall for initial reduction of hydrilla biomass and increasing duration of control versus endothall alone. Initial field evaluations at scales now exceeding 250 hectares are documenting hydrilla control for up to 8 months with ongoing monitoring to determine ultimate duration of hydrilla control at different scales of use under different herbicide dissipation scenarios. Selectivity of the penoxsulam:endothall combination is also under investigation through controlled laboratory studies and extensive monitoring of non-target plant populations as part of initial field evaluations.

A Novel Method of Nuisance Algae Control by Immobilized Microalgae *(Student Presentation)*

James Herrin[1], Rebecca Haynie[2], Senthil Chinnasamy[1], Susan B. Wilde[2], K. C. Das[1]
[1]Driftmier Engineering Center University of Georgia, Athens, Georgia
[2]D.B. Warnell School of Forestry and Natural Resources, University of Georgia, Athens, Georgia

Excessive growth of algae is a problem for many users of aquatic systems. Aquarists go to great lengths to control algae in their display systems and unwanted algal growth can result in off-flavor and dissolved oxygen issues in aquaculture ponds and reservoirs. The excessive growth of nuisance algae is often a result of eutrophication from feed applications and fertilizers transported with sediment by runoff. Immobilized bacteria and microalgae are potent candidates for bioremediation of various types of wastewaters. Our research study uses the immobilized microalgae, *Chlorella sorokiniana*, to assess its nutrient removal potential from aquaculture wastewater as a method to control nuisance algae growth in fish ponds. *C. sorokiniana* was immobilized in calcium alginate gel beads and a bench-scale batch study was conducted to evaluate the nutrient removal (N and P) potential of immobilized algae at various time intervals viz. 4, 8, 12, 24, 48, 72 and 96 h. These results were further confirmed with studies conducted in reactors filled with immobilized algae operated in a batch mode. The bioreactors were comprised of clear PVC pipe and a small submersible pump. Three bioreactors were filled with immobilized *C. sorokiniana* and three were filled with empty gel beads which served as controls. Each reactor was positioned over a reservoir containing synthetic wastewater and placed under fluorescent lights with a 12/12 h light/dark cycle. The reactors were run to treat 10 batches of synthetic wastewater in order to assess the performance of the immobilized algal system. Treated wastewater samples collected from each bioreactor were incubated in a temperature controlled growth chamber to study the growth of nuisance algae. This study indicated that the immobilized algae can treat and remove the nutrients from aquaculture wastewater and prevent the growth of nuisance algae.

Status of the Demonstration Project on Hydrilla and Hygrophila in the Upper Kissimmee Chain of Lakes

Stacia A. Hetrick
Osceola County Extension, University of Florida, Kissimmee, Florida

Hydrilla (*Hydrilla verticillata*) and hygrophila (*Hygrophila polysperma*) are aquatic weeds that cause serious environmental and economic impacts in Florida and managing them is challenging. Osceola County, Florida was awarded a $2.881 million grant to find new and alternative methods of control for hydrilla, hygrophila and other exotic aquatic vegetation in the Upper Kissimmee Chain of Lakes in Osceola County. The specific objectives of the project are to evaluate the effectiveness of experimental use permit herbicides and biological controls in the treatment of hydrilla and hygrophila; to evaluate new technology processes or practices, or a new combination of these for the control of these two plants using small-scale field work; to implement and monitor successful practices and processes identified in the previous objectives using large-scale field demonstrations; and to demonstrate the project results to the industry and public. So far, this project has contributed to the registration of two new aquatic herbicides- penoxsulam and imazamox- and several additional experimental use herbicides are being evaluated for aquatic registration in the future. Monitoring of large-scale hydrilla treatments using registered herbicides has provided insight into the effectiveness of different combinations, application rates, and timing. In addition, seven new natural enemies of hydrilla and hygrophila have been discovered and are being evaluated for host-specificity and effectiveness in controlling the two plants. A production process is also in development for a fungus, *Mycoleptodiscus terrestris* (Mt) that would serve as a bioherbicide for hydrilla. Lastly, the results of the project are being communicated to the industry, public, and governmental partners through various demonstration and outreach strategies including a website, teacher workshops, field days, presentations for community groups and scientific meetings, exhibits at community events, and various publications.

Alligatorweed Control with Imazamox, Penoxsulam, and Other Herbicides (*Student Poster*)

Trevor Israel, Robert J. Richardson, Rory L. Roten, and Andrew P. Gardner
North Carolina State University, Raleigh, North Carolina

Field and greenhouse research was conducted in North Carolina to evaluate alligatorweed control with foliar applications of imazamox, penoxsulam, and comparison herbicides. In greenhouse trials, alligatorweed was transplanted into four inch square pots and treated when it reached 8 to 12 inches in height. In greenhouse trial 1, imazamox was applied at 0.031, 0.062, 0.124, 0.186, 0.25, and 0.5 lb ai/A. Alligatorweed dry weight at one month after treatment (MAT) was reduced to less than 20% of control dry weight with rates of 0.186 lb ai/A or greater. Imazamox GR_{80} calculated by non-linear regression of dry weight response yielded a rate of 0.146 lb ai/A. In greenhouse trial 2, penoxsulam was applied at 0.0044, 0.0089, 0.022, 0.0445, 0.089, and 0.178 lb ai/A. Alligatorweed dry weight was reduced to less than 10% of control dry weight with penoxsulam rates of 0.089 and 0.178 lb ai/A. Penoxsulam GR_{80} calculated by non-linear regression of dry weight response yielded a rate of 0.052 lb ai/A. In the primary field trial conducted in 2007 and 2008, treatments included imazamox (0.094, 0.188, 0.376, and 0.752 lb ai/A), penoxsulam (0.0876, 0.1752, 0.35, and 0.7 lb ai/A), and imazapyr (2 lb ai/A). In 2007, control at 2 MAT was 75 to 91% with imazamox, 25 to 93% with penoxsulam, and 99% with imazapyr. At 2 MAT in 2008, control was 99% with imazapyr and 65% with 0.752 lb ai/A imazamox, but did not exceed 17% with other treatments. No control was observed from imazamox or penoxsulam at 12 MAT. An additional field trial was conducted in 2006, 2007, and 2008 to evaluate glyphosate, imazamox, imazapyr, penoxsulam, and triclopyr on alligatorweed. Of the herbicides evaluated, only imazapyr controlled alligatorweed at least 85% at 2 MAT or later.

Managing Shallow Eutrophic Lakes for Improved Native Submersed Macrophyte Growth

William F. James
U.S. Army Engineer Research and Development Center, Spring Valley, Wisconsin

Direct biomass control programs (i.e., herbicide, biocontrol, mechanical) that target non-native macrophyte species may not always produce the desired goal of restoring native macrophyte community dominance in shallow aquatic systems. Native re-establishment is often complicated by eutrophic conditions, enhanced nutrient recycling, and frequent nuisance algal blooms that result in poor light penetration and limited colonizable macrophyte habitat. Thus, plans for re-establishing native submersed macrophyte growth also need to consider lake management strategies that reduce nutrient inputs (primarily phosphorus) and limit algal productivity in order to improve underwater light habitat. Half Moon Lake, Wisconsin, is a eutrophic, urban oxbow lake exhibiting high densities of the non-native *Potamogeton crispus* in early summer followed by high chlorophyll, total phosphorus, and light attenuation. These patterns are, unfortunately, typical for lakes located in agricultural regions of the upper Midwestern United States. Although Half Moon Lake is shallow and supports a native submersed macrophyte community, poor underwater light conditions limit their growth and propagation. Since high algal biomass (blue-greens and dinoflagellates) and productivity in summer is subsidized by internal phosphorus loading from nutrient-rich sediments in the lake, internal phosphorus loading needs to be reduced in order to increase light penetration. This research examined current algal, nutrient, light attenuation characteristics, and underwater light habitat for submersed macrophyte growth and projected changes in these variables and improvement in light penetration as a result of managing the lake to control internal phosphorus loads from sediment via alum treatment. Alum dosage requirements were based on the concentration required to immobilize redox-sensitive phosphorus in the sediment.

Responses of Cyanobacteria to Algaecides: Efficacy and Microcystin Measurements (*Student Presentation*)

Brenda M. Johnson, West M. Bishop and John H. Rodgers, Jr.
Department of Forestry and Natural Resources, Clemson University, Clemson, South Carolina

Cyanobacteria can achieve densities or produce secondary compounds (i.e. toxins, taste, and/or odor) that restrict critical water resource uses and require immediate intervention. In many situations algaecides are the preferred management option due to rapid activity and their ability to at least temporarily alleviate the problem. Decisions made regarding applications of algaecides to manage harmful algal blooms (HABs) involve consideration of the potential for leaking or release of algal toxins post-treatment. Laboratory experiments can identify an efficacious algaecide and application rate that control the targeted algal species for a specific site and can estimate the potential for toxin release due to these algaecide applications. The objectives of this research were to: 1) Measure responses of cyanobacteria in samples collected from Mona Lake (Muskegon, MI) to selected algaecide exposures in the laboratory, 2) Compare total microcystin concentrations prior to and following algaecide exposures, and 3) Identify a potential algaecide for management. Responses to treatments were compared based on taxon composition, densities present, chlorophyll-*a* concentrations, and total microcystin concentrations pre- and post-treatment. Copper exposures ($\leq$ 0.4 mg Cu/ L) as Cutrine®-Ultra significantly decreased chlorophyll-*a* concentrations and cell densities. In these laboratory experiments, total microcystin concentrations did not increase following effective algaecide treatments.

Evaluation of Lake-wide Herbicide Treatments for Controlling Curlyleaf Pondweed (*Potamogeton crispus* L.) in Minnesota Lakes (*Student Presentation*)

James A. Johnson and Raymond M. Newman
Department of Fisheries, Wildlife and Conservation Biology, University of Minnesota, Saint Paul, Minnesota

Curlyleaf pondweed (*Potamogeton crispus* L.) occurs in over 800 Minnesota lakes. Its early season growth, propensity to form dense surface mats, and ability to out-compete many native aquatic plants allow it to degrade the ecological and recreational quality of lakes. To address the need for improved long-term control strategies in Minnesota, we evaluated the effectiveness of early-spring lake-wide herbicide treatments for curlyleaf pondweed management from 2006 to 2008. Six infested lakes were treated annually for three consecutive years with endothall (0.75-1.00 ppm) or fluridone (2-4 ppb). Three additional lakes with established curlyleaf pondweed infestations served as untreated reference lakes. We conducted point-intercept vegetation surveys in May, June, and August annually on each lake and collected biomass samples during each survey. We also evaluated curlyleaf reproduction by assessing the production of new curlyleaf turions on standing plants and tracked changes in turion distribution and density (turions/m^2) in lake sediments with annual fall turion surveys. We observed significantly reduced curlyleaf growth and reproduction in treated lakes. Comparing within years, post-treatment (June) curlyleaf occurrence generally decreased to less than 60% of pre-treatment (May) levels. Comparing between years, early-spring curlyleaf occurrence in 2008 was generally less than 50% of the levels observed in 2006, and June curlyleaf biomass did not exceed 10 dry g/m^2 in any of the treated lakes but ranged from 20-350 g/m^2 in the untreated lakes. Turion production was inhibited in treated lakes to < 0.1% of levels observed in untreated lakes. Sediment turion density in treated lakes was 20-60% lower (-20 to -220 turions/m^2) in 2008 than in 2006, while untreated lakes showed a 40-80% increase (+100 to +430 turions/m^2) in sediment turion density over the same period. Despite the reduced turion density in treated lakes, viable turions remained after multiple consecutive years of treatment. These results suggest that lake-wide herbicide treatments can effectively reduce curlyleaf pondweed growth and reproduction, but more than three consecutive years of treatment may be needed to reduce turion densities sufficiently to meet management goals.

Native Macrophyte Community Response to Herbicidal Treatments of *Potamogeton crispus* (*Student Poster*)

Ajay R. Jones, James A. Johnson, and Raymond M. Newman
Department of Fisheries, Wildlife and Conservation Biology, University of Minnesota, St. Paul, Minnesota

Curlyleaf pondweed (*Potamogeton crispus* L.) is one of the most wide-ranging and prolific invasive macrophytes in North America. Some of the major problems associated with curlyleaf pondweed include dense extensive mats of nuisance growth, obstruction of native macrophyte growth and nutrient loading upon senescence. Lake-wide, early-season herbicide treatments of curlyleaf pondweed may provide an effective control strategy that would also reduce harm to native macrophyte communities. We examined the response of native plant communities to spring herbicide treatments of curlyleaf pondweed from 2006 through 2008. Seven lakes were treated with herbicides and three nontreated lakes were used as reference lakes to observe the occurrence of curlyleaf pondweed and the subsequent native macrophyte response. Plant communities were assessed in littoral zone (<4.6 m depth) with the point intercept method (100 to 400 points per lake) in early spring (before treatment), late spring and late summer. For each survey, approximately 40 random biomass samples (0.33m2) were taken throughout the study lakes to estimate plant biomass. In the reference lakes, curlyleaf persisted at moderate to high frequencies over the three years, and no consistent changes in native frequency were seen. Herbicidal treatments proved effective for controlling curlyleaf; curlyleaf decreased in occurrence within 1 month following treatment. In most of the treatment lakes, early spring (pre-treatment) curlyleaf occurrence declined between 2006 and 2008. The total frequency of occurrence of native plants did not decrease in most of the treatment lakes. Native macrophyte species richness also showed little change with continued treatment, although shifts in abundance of some species were observed. Native plant biomass increased between 2006 and 2008 for most treatment lakes, while native biomass decreased in two of the untreated lakes. The unchanged species richness and frequency of occurrence of native plants along with increases in biomass, indicates that herbicidal treatments of curlyleaf pondweed may not have a negative effect on native macrophyte communities. However, native plant communities were not fully restored with three years of treatment. Early-season lake-wide herbicidal treatments of curlyleaf pondweed may be a treatment option that will reduce curlyleaf occurrence and density without harming native plants.

Advances in Technology for Control of Eurasian Watermilfoil (*Myriophyllum spicatum*) and Other Submersed Plants

Tyler Koschnick[1], Hamid Ullah[2], Cole Hulon[2], and Sarah Miller[2].
[1]*SePRO Corporation, Medina, Ohio*
[2]*SePRO Corporation, SePRO Research and Technology Campus, Whitakers, North Carolina*

Auxin herbicides have been registered and widely used for aquatic plant management since the mid 1940's. 2,4-D was first registered in 1945 and recently went through the US Environmental Protection Agency's (EPA) re-registration process with the amine, ester, and acid (a.e.) formulations supported for aquatic use. Triclopyr (Renovate) was registered by EPA for aquatic use in 2002, and a granule formulation of triclopyr (Renovate OTF) was approved in 2006. Studies were conducted to evaluate combinations of these two active ingredients to determine potential for positive interaction when applied together at various ratios. It was discovered that combinations of triclopyr + 2,4-D resulted in positive interaction and enhanced efficacy on Eurasian watermilfoil. This paper will discuss results from these studies and describe development of a new 2,4-D formulation (Sculpin G) and triclopyr + 2,4-D formulation (Renovate MAX G) submitted for aquatic registration.

Aquatic Herbicide Dissipation Following Application of a Granule and Liquid Formulation

Tyler J. Koschnick[1], David Petty[2], Bob Johnson[3], Cole Hulon[4], and Richard Dirks[5]
[1]*SePRO Corporation, Medina, Ohio*
[2]*NDR Research, Plainfield, Indiana*
[3]*SePRO Corporation, Carmel, Indiana*
[4]*SePRO Corporation, Whitakers, North Carolina*
[5]*ReMetrix LLC, Carmel, Indiana*

A consistent issue in aquatic plant management has been the ability to deliver herbicides into a 3-dimensional environment in such a way as to maximize their efficacy. Rapid dissipation is likely a primary reason for poor submersed weed control in many situations. For decades, applicators customized sub-surface injection systems to deliver herbicides into deeper water in attempts to get maximum efficacy. Granule and pelletized formulations of aquatic herbicides have also been developed to assist delivery and maximize exposure times (Aquathol Super K, Navigate, and Sonar Q, PR, and SRP; more recently Renovate OTF (2006) and SonarOne (2008). Concentration exposure time studies have provided a general understanding of the requirements for herbicide effectiveness following aqueous exposure, but a void remains understanding which application technique or formulation maximizes retention and exposure time and in which situations. A study was designed to compare the retention and vertical distribution of residues following a simultaneous application of a liquid (Rhodamine WT dye) and granule (Renovate OTF) formulation to a 10 acre area in a 325 acre lake. Rhodamine WT dye was injected through 45 foot trailing hoses; Renovate OTF (granule) was applied through forced air systems above the water surface. Concentrations were determined in water samples collected at four permanent stations within the treatment area at five depths and several stations outside the treatment area at time intervals from 0.5 to 96 hours following the application. Dilution from untreated water (edge effect) and internal currents generally had a dramatic effect on retention and apparent redistribution of concentrations. This paper will detail the results of this study and discuss potential implications for submersed plant management.

Combinations of Endothall with 2,4-D and Triclopyr for Enhanced Control of Eurasian Watermilfoil with Short Contact Times

John D. Madsen[1], Ryan M. Wersal[1], and Kurt D. Getsinger[2]
[1]*Geosystems Research Institute, Mississippi State University, Mississippi State, Mississippi*
[2]*U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi*

Eurasian watermilfoil (*Myriophyllum spicatum* L.) is a widespread problem in the United States, which is manageable in most aquatic systems with a suite of approaches. One remaining problematic habitat for managing Eurasian watermilfoil is those areas with high water exchange rates, which results in low potential contact time for herbicides. By combining a contact herbicide (endothall) with systemic herbicides (either 2,4-D or triclopyr), efficacy and long-term control provided by the contact herbicide is enhanced, while the required contact time for the systemic herbicides are reduced. We performed mesocosm tank studies that demonstrated enhanced control of Eurasian watermilfoil using endothall with 2,4-D or triclopyr under varying contact times. In the first study, we observed 90% control in treatments of 2 ppm 2,4-D and 1 ppm endothall at both 48 and 24 hr, and better than 70% control with concentrations as low as 0.5 ppm 2,4-D with 0.25 ppm endothall at 24 hr. In the second study, we found enhanced control at 1 ppm endothall and 0.5 to 0.125 ppm triclopyr with 12 to 24 hr exposure, as compared to triclopyr alone at those concentrations. Treatments with 6 hr exposure resulted in poor control. Initial field trials in Pend Oreille Lake, ID, resulted in significant reductions in Eurasian watermilfoil after treatment. Combinations of a contact herbicide (endothall) with a systemic herbicide (2,4-D or triclopyr) can result in enhanced control of Eurasian watermilfoil in environments with short exposure time or high water exchange rates.

Great Lakes Aquatic Invasive Species: Cooperative Efforts to Prevent the Spread

Phil Moy
Wisconsin Sea Grant Program, University of Wisconsin – Manitowac, Manitowac, Wisconsin

While the issue of non-native species in the Great Lakes is not a new one, the pathways of introduction have changed over time. Still the activities of people and movement of trade goods remain the underlying causes. Once established, the possibility for eradication of a Great Lakes invader is remote. The best option is to prevent the initial introduction or failing that, to prevent the spread outside the Great Lakes basin. This presentation will reflect briefly on the invasion chronology of the 185 non-native species in the Great Lakes and will examine in greater detail the sources, effects, management and containment of a handful of these species.

U.S. Army Corps of Engineers, Chemical Control and Physiological Processes Team: A Research Overview

Christopher R. Mudge and Kurt D. Getsinger
U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi

Management of invasive aquatic plants in public waters has become a high priority in many regions of the U.S. Once introduced, these plants rapidly expand in coverage, spread into nearby water bodies, and form dense monocultures in littoral zones and along shorelines. Existing infestations threaten water quality, fish and wildlife habitat, and the reduction of overall biodiversity. Operating under the U.S. Army Corps of Engineers Aquatic Plant Control Research Program, the Chemical Control and Physiological Processes Team develops and evaluates environmentally sound strategies for managing invasive aquatic and wetland plants using herbicides and plant growth regulators. Assessments are conducted using a multi-tiered approach from small-scale environmental chambers and greenhouses to outdoor mesocosm/pond facilities located in key water-resource regions of the country, e.g. Florida, the Gulf Coast, and the Great Lakes. Results of these small-scale experiments are confirmed in an assortment of field trials. Research focus areas include selective control of invasive species to restore native plant communities, integration of non-chemical control techniques, and prevention of herbicide resistance. Work is conducted on a cost-reimbursable basis with sponsors and cooperators including Federal and state agencies, non-profit groups, and the private sector. Coordination with the U.S. Environmental Protection Agency and state regulatory agencies is undertaken to support the review and registration of new aquatic herbicides and amendments to established labels. Information and technology developed via research efforts are transferred to natural resource managers, the private sector, and the general public through workshops and symposia, and the publication of technical reports, popular articles, and peer-reviewed scientific literature. The research thrust of the team has expanded to new focus areas in recent years. Management has extended beyond the traditional use of herbicides for control of aquatic plants in quiescent water bodies to developing technology for fluvial systems and evaluation of new, reduced risk herbicides. Flowing water environments present new challenges as understanding and coupling water exchange characteristics and required herbicide concentration and exposure time relationships will be vital to obtaining successful weed control in these situations. The recent increase in the number of registered and experimental use aquatic herbicides has required evaluation of these products on new and existing weeds as well as impacts on non-target plants. In addition, hybridization of native and invasive aquatic plants has resulted in new weed populations, in which use of traditional management techniques have not been thoroughly evaluated.

Predicting Potential Distribution of the Invasive Aquatic Weed *Hygrophila polysperma* (Roxb.) T. Anders (*Acanthaceae*) Using Maximum Entropy (MaxEnt) Modeling *(Student Presentation)*

Abhishek Mukherjee[1], James P. Cuda[1] and William A. Overholt[2]
[1]*Entomology and Nematology Department, University of Florida, Gainesville, Florida*
[2]*Biological Control Research & Containment Laboratory, University of Florida, Ft. Pierce, Florida*

Hygrophila (*Hygrophila polysperma* Roxb.) T. Anders, (Family: *Acanthaceae*) is a rooted submerged or emerged perennial aquatic invasive weed in Florida. It has been classified as a federal noxious weed, Florida State category II invasive plant and Florida Exotic Pest Plant Council listed category I invasive species. This herbaceous weed is typically found in flowing fresh water channels and structured shorelines. Hygrophila forms dense vegetative stands that occupy the entire water column, affecting navigation, irrigation and flood control structures.Documented increase in the number of water bodies invaded by hygrophila in recent years suggests that current methods employed to control this weed are insufficient. Classical biological control on the other hand is reported to be a feasible option. A predictive model of hygrophila distribution can significantly contribute in formulating more structured survey efforts particularly in the native range to find candidate natural enemies. In addition, predictive map will provide a much needed tool to weed managers to survey for this weed in areas predicted as susceptible to invasion. In our current project we used Maximum Entropy (MaxEnt) model to predict potential worldwide distribution of hygrophila. MaxEnt is one of several algorithms available over internet free of charge that is used to build ecological niche models. It uses presence only georeference point locations of the target species and environmental parameters to generate a predictive model. In total, 234 point locations collected from various sources were used during this simulation. The current distribution of hygrophila was predicted using 20 climatic parameters that include altitude and 19 other bioclimatic variables with spatial resolution of 2.5 arc-minutes available from the WORLDCLIM database. Besides its known occurrence in India, this model predicted that in its native range hygrophila is likely to be found from Bangladesh, Nepal, Bhutan, parts of Myanmar, Thailand, Laos, and Vietnam. The result also predicted its probable presence in Northern part of Australia, including parts Queensland that has been marked as very suitable. Interestingly the model also assumed its presence in northern part of Argentina, Paraguay, east coast of Mexico and northern part of Cuba. In the United States, according to the model's prediction most parts of Florida, except the Florida Keys were found to be very suitable for hygrophila growth. A possible expansion of its range along the coastal regions of the southern states with parts of Alabama, Mississippi, Louisiana, and Texas also has been predicted by this model. The analysis suggested that in the United States spread of this invasive weed will be restricted to the warmer and wetter part of the country. The predicted worldwide distribution matched well with that already known for hygrophila. As evident from the fact its spread has been predicted to

Mexico and Australia, where this species has already been reported. In Florida this model also correctly predicted the already reported distribution of this species. Though this study is in its preliminary stage, initial results suggest that this model can truly depict the known worldwide distribution of this species. We are currently undertaking further analysis to improve this model.

Suitability of Using Introduced *Hydrellia* spp. for Management of Monoecious *Hydrilla verticillata* (L.f.) Royle

Julie G. Nachtrieb[1], Michael J. Grodowitz[2] and Nathan E. Harms[3]
[1]U.S. Army Engineer Research and Development Center, Lewisville, Texas
[2]U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi
[3]University of North Texas, Lewisville, Texas

Two species of introduced leaf-mining flies, *Hydrellia pakistanae* and *H. balciunasi*, suppress dioecious hydrilla by reducing photosynthesis, thereby impacting biomass production, tuber formation, and fragment viability. However, only limited research has been conducted evaluating the flies' effectiveness on monoecious hydrilla. To determine the suitability of using hydrilla flies for monoecious hydrilla management a variety of studies were conducted, including small container bioassays, greenhouse-based fly rearing, a tank study comparing short-term impacts between hydrilla biotypes, small ponds to evaluate establishment, and field releases. When reared on monoecious hydrilla, *H. pakistanae* survival was reduced by 40 and 26 percent during bioassays and greenhouse rearing, respectively, in comparison to those reared on the dioecious biotype. *Hydrellia* spp. also exhibited a 9 day increase in developmental time when reared for extended periods on monoecious hydrilla under greenhouse conditions. *Hydrellia* spp. colonization and percent leaf damage between biotypes also differed significantly using small-scale tank experimentation. Initial fly stocking rates were equal, but four weeks after release fly levels in dioecious tanks were 5.3 fold higher than on the monoecious biotype. Percent leaf damage in dioecious tanks was also initially 2.4 fold greater than monoecious. Small pond experimentation revealed similar results. Even with high numbers of flies in nearby dioecious ponds as a source for colonization, immature numbers were approximately 50-fold higher on the dioecious biotype in comparison to monoecious. Most importantly, release of close to 2,000,000 *Hydrellia* spp. at sites on Lake Gaston, NC since 2004 have failed to provide convincing evidence of establishment let alone population increase and impact. Experiments and field studies conducted since 2004 indicate that the monoecious biotype is not as suitable a host for introduced *Hydrellia* spp. as is dioecious hydrilla. This conclusion is based in part on reduced survival and longer developmental time in bioassay experiments and greenhouse colony rearing as well as lower colonization success and subsequent low population growth rates in larger outdoor systems. Additionally, lack of long-term establishment on Lake Gaston indicates poor suitability of the monoecious biotype as a host plant for the introduced *Hydrellia* spp.

Evaluation of Water Exchange Patterns and Granular Fluridone Applications in Lake Gaston (*Student Poster*)

Justin J. Nawrocki[1], Kurt D. Getsinger[2], Michael D. Netherland[2], and Robert J. Richardson[1]
[1]North Carolina State University, Raleigh, North Carolina
[2]U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi

A water exchange study was performed in June of 2008 on Lake Gaston. Two areas were treated with a sub-surface application of rhodamine WT dye and fluorometers were used to measure the concentrations of the dye in the water column. Permanent sampling stations inside the treatment area were established to track the dissipation and calculate dye half-life. Readings were taken at predetermined time intervals and at multiple depths in the water column. Dye dissipation outside the treatment area was tracked on the surface to establish water movement and current patterns. The water exchange sites overlapped fluridone treatment sites; therefore, dissipation rates of fluridone were also measured. An initial granular fluridone application was performed in early June 2008 and was followed by smaller bump treatments in July and August 2008. Ten sites inside the herbicide treatment areas were established and five sets of water residue samples were taken over a two month period, starting immediately after the initial treatment. Samples were taken at the surface, mid depth and just above the sediment to determine if thermoclines affect the movement and dissipation of slow release granular products such as Sonar PR, SRP and Q. FasTests were preformed on the samples to determine the aqueous concentrations of fluridone. Results of the dye and fluridone dissipation study may influence the rate and placement of herbicide in future applications.

Monoecious Hydrilla Tuber Dynamics over Two Years of Management (*Student Presentation*)

Justin J. Nawrocki, Robert J. Richardson, Rory L. Roten, Steve T. Hoyle, and Andrew P. Gardner
North Carolina State University, Raleigh, North Carolina

Hydrilla [*Hydrilla verticillata* (L.f.) Royle] is the most economically damaging aquatic weed in the United States. Long term control of hydrilla is complicated by persistent subterranean turions (tubers) that the plant forms each year. Elimination of the tuber bank is essential for control and eradication. Research was conducted in North Carolina to evaluate monoecious hydrilla tuber dynamics. Tuber surveys were initiated on three North Carolina lakes to determine the effects of specific management techniques on monoecious hydrilla tuber numbers over time. Sampled lakes included Lake Gaston, Lake Tillery, and the Tar River Reservoir. Tuber counts were conducted in spring and late fall of 2007 and 2008 on each lake using a four-inch core sampler. Additional samples were collected on certain lakes during the summer. Sampling was also initiated in 2008 on Shearon Harris Reservoir in North Carolina. Sample points were selected based upon the presence of an established tuber population. GPS coordinates of sample points were marked to ensure that repeated sampling would occur within a limited area. Management practices on the lakes included fluridone treatment or no treatment on Lake Gaston, fluridone treatment on Lake Tillery, a combination of fluridone application and drought-induced summer drawdown on the Tar River Reservoir, and no management on Shearon Harris Reservoir. De-watering or fluridone application in 2007 and 2008 resulted in a 53, 67, and 74% annual decrease in tuber numbers in Lake Gaston, the Tar River Reservoir, and Lake Manitou, respectively. Tuber densities in Tar River declined from 697 per m^2 in spring 2007 to 78 per m^2 in fall 2008. On Lake Gaston, tuber densities declined in areas treated both years from 329 to 82 per m^2. If these rates remain steady over time, six to ten years would be required to achieve 99.5% reductions in tuber numbers. In contrast, areas of Lake Gaston that were fluridone treated in 2007 but not in 2008, had new tuber formation in 2008 to recover density levels to 78% of those in spring 2007. Densities in these areas were 361 tubers per m^2 in spring 2007, 139 per m^2 in spring 2008, and 268 per m^2 in fall 2008. On the unmanaged Shearon Harris Reservoir, densities averaged 1,700 tubers per m^2 in fall 2008.

Twenty Years of Herbicide Concentration and Exposure Time Studies for Submersed Plant Control: What Have We Learned and Where are We Going?

Michael Netherland[1], Kurt Getsinger[2], Linda Nelson[2], Angela Poovey[2], John Skogerboe[3], and LeeAnn Glomski[4]
[1]*U.S. Army Engineer Research and Development Center, Gainesville, Florida*
[2]*U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi*
[3]*U.S. Army Engineer Research and Development Center, Spring Valley, Wisconsin*
[4]*U.S. Army Engineer Research and Development Center, Lewisville, Texas*

The results of an herbicide application designed to control submersed plants will primarily be impacted by two key factors: 1) the concentration of the herbicide in water that surrounds the target plant, and; 2) the length of time a target plant is exposed to dissipating concentrations of that herbicide. This dose/response phenomenon is herbicide and plant specific, and has been defined as a concentration and exposure time (CET) relationship. Over the past twenty years, ERDC researchers have conducted numerous CET evaluations of registered and Experimental Use Permit herbicides on invasive submersed plants such as hydrilla (*Hydrilla verticillata*), Eurasian watermilfoil *(Myriophyllum spicatum*), curlyleaf pondweed (*Potamogeton crispus*), and egeria (*Egeria densa*), as well as on problem populations of native plants such as variable watermilfoil (*M. heterophyllum*), sago pondweed (*Stuckenia pectinata*), and cabomba (*Cabomba caroliniana)*. In order to determine the potential for species-selective use of herbicides, CET relationships have also been developed for numerous non-target native submersed plants including vallisneria *(Vallisneria americana*), pondweeds (*Potamogeton* spp.), elodea (*Elodea canadensis*), and coontail (*Ceratophyllum demersum)*, as well as emergent native plants including water lilies (*Nymphaea* spp.), nuphar (*Nuphar* spp.), bulrush (*Scirpus* spp.), spikerush (*Eleocharis* spp.) and native grasses. These research efforts conducted in controlled-environment growth chambers and outdoor mesocosms have resulted in nearly 40 peer-reviewed publications by ERDC researchers. This work has also defined and established regional and national use patterns for many aquatic herbicides. In addition to presenting some of the key findings of prior research, we will focus on recent efforts evaluating the impacts of environmental factors, plant phenology, and herbicide formulations on various CET relationships. Ongoing CET research projects will also be discussed in the context of developing new use patterns for existing and newly registered products. Given the registration activity for new aquatic chemistry and formulations, the interest in selectivity patterns of herbicides, ongoing challenges with controlling plants in situations where rapid residue dispersion is likely, and the recent interest in potential impacts on treatments on threatened and endangered plant species, there is a clear need for new and refined CET studies. As the management questions become more complex, it is likely that study designs as well as facilities will need to be updated to keep pace.

Hydrocotyle ranunculoides L.f. – Origins and Control Options

Jonathan R. Newman[1], Richard Shaw[2], and Manuel A. Duenas[1]
[1]*Centre for Ecology and Hydrology, Crowmarsh Gifford, Wallingford, Oxon, United Kingdom*
[2]*CABI E-UK, Egham, Surrey, United Kingdom*

Hydrocotyle ranunculoides L.f. is an invasive aquatic macrophyte. The origin is considered by some to be North America, but the presence of co-evolved insect herbivores suggests a South American origin with spread through Central America to North America at some time in the recent past. Outside its' native range it is widespread in the United Kingdom, the Netherlands, Belgium, and present in France, Ireland, Italy, Germany, Australia, Angola, Ethiopia, Kenya, Malawi, Tanzania, Uganda, Democratic Republic of Congo, Madagascar, Rwanda, Zimbabwe and possibly also Sudan. Wherever it grows in introduced areas it is considered to be a problematic invasive species, and although it can be dominant in some South American wetland sites, the scale of the habitat reduces the impact of the species in such situations. There is some evidence to suggest that warm tropical wetland sites encourage heterotrophic nutrition at the expense of photosynthetic C_3 metabolism, and the evolution of aggressive floating macrophytes is a response to lack of carbon in the aquatic environment. *H. ranunculoides* is an example of such a species. Data from work on nutrient conversion in aquatic habitats in the UK will be presented. Control options for the species are limited, with mechanical control being the most popular option, although chemical control can be successful with adjuvants. Biological control offers the greatest potential for sustainable management of this species in introduced habitats and preliminary data will be presented that indicate the high potential for biological control of *H. ranunculoides* in Europe.

Improved Control of Invasive Species in the UK Using Glyphosate and TopFilm®

Jonathan R. Newman
Centre for Ecology and Hydrology, Crowmarsh Gifford, Wallingford, Oxon, United Kingdom

The loss of active ingredients for chemical control of aquatic invasive species as a result of the EU Plant Protection Products Directive (91/414/EEC) has required increased use of glyphosate applied to emergent foliage. However, specialist adaptations to the aquatic environment, such as hydrophobic leaf surfaces, thick leaf cuticle and even some physiological processes resulting in rapid flushing through of foliar applied herbicides resulted in poor or limited control of the alien species *Hydrocotyle ranunculoides*, *Myriophyllum aquaticum* and *Ludwigia grandiflora*. In addition, some species native to the UK have shown "resistance" to foliar applied glyphosate, including *Nymphoides peltata* and *Potamogeton natans.* In trials during 2008, the addition of TopFilm, a microcrystalline soya based adjuvant, to glyphosate at rates of between 500 and 1000 mL per hectare improved control of all these species over that achieved using glyphosate on its own. Following these trials TopFilm was approved by the UK Pesticide Safety Directorate as the only adjuvant for use in aquatic situations in Europe. It has also been used in combination with glyphosate to manage *Fallopia japonica* in the south west of England. The results of further work on control of *Crassula helmsii* carried out in 2009 will also be presented. *C. helmsii* can be controlled using glyphosate when emergent, but not when growing below the water surface. *C. helmsii* is usually restricted to the shallow margins of small lakes and ponds. The water level in these ponds can be drawn down to expose the submerged growth form. Glyphosate and TopFilm at 1200 mL per hectare were applied to the exposed material at a trial site in March 2009 and the water levels were allowed to rise again naturally to fill the pond, covering the treated material. Initial observations show some control of submerged material, but future data will be presented. If successful, further work will be carried out to determine if glyphosate can be used as a herbicide for control of other submerged macrophytes in combination with specialist adjuvants.

Distribution, Viability, and Longevity of Curlyleaf Pondweed Turions in Minnesota Lakes

Raymond M. Newman[1], Sarah S. Roley[1,2], and James A. Johnson[1]
[1]*Fisheries, Wildlife and Conservation Biology, University of Minnesota, Saint Paul, Minnesota.*
[2]*Biological Sciences, University of Notre Dame, Notre Dame, Indiana*

Curlyleaf pondweed (*Potamogeton crispus* L.) is a problematic invasive exotic aquatic macrophyte in North America. It reproduces primarily via vegetative propagules called turions. Control efforts have focused on eliminating turion production and thus it is important to know turion longevity as well as the distribution and viability of turions in lakes and within lake sediments. To determine turion longevity, we collected mature turions from 3 lakes and buried them in mesh bags in the sediment of four lakes and sampled annually for viability. Buried turions were viable for at least four years and continued sampling will determine ultimate longevity. To determine turion distribution and viability, we collected sediment cores from three water depths in four lakes over two years. Turions were enumerated from the top 5cm, 5-10cm, 10-20cm and 20-30cm of each core and then tested for sprouting (viability). Turion densities in water depths ≤ 3m were variable among lakes, ranging from an average of 41/m^2 in Round Lake to 939/m^2 in Lake Sarah. Turion densities were highest at 1 to 2-m water depth (382 to 2003/m^2), and were always lower at 3-m water depth (25 to 340/m^2). Most turions (50 to 75%) were in the top 5cm of sediment, but were common in the next 5cm (30%) and were found as deep as 30cm in two lakes at densities ranging from 14 to 74/m^2. Burial depth was partly dependent on sediment composition; turions were buried deeper in softer organic sediments and burial depth in some lakes was limited by clay or sand/gravel layers. The buried turions were viable (generally ≥ 50% sprouted) and represent a potentially significant source of recruitment. Management efforts will need to control turion production for at least four years to prevent recruitment and the importance of buried turions to recruitment deserves more consideration.

Aquatic Macrophytes in the Los Ortices Lagoon (*Student Poster*)

Gina Suescun Otero, Raul Rodriguez Martinez, Roberto Sanchez
Universidad de Pamplona, Pamplona- Bucaramanga, Bucaramanga, Santander, Colombia

The Los Ortices lagoon is located 1581 meters above sea level, Latitude of 6|°, 43- 72 ° 52 Longitude, the methodology consist on using samples taken from the lagoon. These were tested for pH, color, alkalinity and chlorides. The following plants were present in the vegetation of the lagoon borders: *Polygonum puctatum*, *Mikanuia micrantha*, *Nymphoides humboldtianum*, *Stachyrpheta cayenensis*, *Salvia* sp, *Ludwigia palustris* and *Paspalum* sp. It is recognized that there is an urgent need to build consciousness among stakeholders (including watershed inhabitants and professionals at local and national levels). The multisectoral processes and the necessary approaches to formulate conservation of the limnentic ecosystem is discussed.

Cross-Resistance in Fluridone-Resistant Hydrilla to other Bleaching Herbicides

Atul Puri[1], William T. Haller[1], and Michael D. Netherland[2]
[1]*Center for Aquatic and Invasive Plants, University of Florida, Gainesville, Florida*
[2]*U.S. Army Engineer Research and Development Center, Gainesville, Florida*

The development of fluridone resistance by hydrilla (*Hydrilla verticillata*) has significantly impacted hydrilla management and research is ongoing to develop alternate herbicides for effective hydrilla control. We determined the potential development of cross-resistance in fluridone-resistant hydrilla to other bleaching herbicides such as norflurazon, mesotrione and topramezone. Experiments were conducted to monitor changes in phytoene, β-carotene and chlorophyll contents as a function of hydrilla biotype and herbicide treatment. Hydrilla shoot tips were collected from fluridone-susceptible (S) and –resistant (R) biotypes and exposed to 5, 25, 50, 75 and 100 µg L^{-1} of herbicide. The susceptible biotype showed an increase in phytoene and decrease in β-carotene and chlorophyll contents when treated with 5 µg L^{-1} fluridone, whereas higher doses of fluridone were required to affect these pigments in the resistant biotype. There was no difference in response by S and R biotypes to mesotrione and topramezone and both biotypes showed significant affect in these pigments at 5 µg L^{-1}. Higher doses of norflurazon were needed to affect these pigments in R as compared to the S biotype. Regression analysis was utilized to calculate EC_{50} values to quantify the relationship between herbicide dose and pigment contents. The R biotype had higher EC_{50} values (phytoene, β-carotene and chlorophyll) for fluridone and norflurazon than the S biotype, while there were no differences in EC_{50} values between S and R biotypes for mesotrione and topramezone. These studies confirmed negative cross-resistance of fluridone-resistant hydrilla to mesotrione and topramezone and a positive cross-resistance to norflurazon.

Invasive Aquatic Plant Species in Europe

Tenna Riis[1] and Andreas Hussner[2]
[1]*Department of Biological Sciences, Aarhus University, 8000 Århus C, Denmark*
[2]*Departmant of Geobotanik, Heinrich-Heine-University Düsseldorf, Germany*

Invasive aquatic plant species in freshwater habitats are becoming an increasing problem in several European countries causing management problems and huge economical costs. In New Zealand, Australia and North America there have been concerns about the consequences of invasive aquatic plant species as well as implemented management plans in at least the last three decades while in Europe the problem is just starting to concern managers and policy makers. Here we will outline the present situation in Europe including presenting the major aquatic weeds, show some results from studies about these plants' biology and competitive abilities, and present our ideas to how the planning of future management and control of invasive aquatic plants could be developed in Europe.

Aeration as an Effective Lake Management Tool

Bob Robinson
Kasco Marine Inc., Prescott, Wisconsin

Dissolved oxygen is the single most important water quality parameter. Artificial addition of oxygen (aeration) in some cases is essential to the metabolism of aerobic aquatic organisms as well as critical in increasing redox numbers to speed of the decomposition of organics including nutrients and sediments. Aeration can be an effective tool at improving oxygen levels as well as overall water quality, but should not be viewed as a panacea for all water quality problems. Instead it should be viewed as only one of the tools in an aquatic manager's toolbox. The intent of this talk is to give the listener a brief overview of commonly used aeration techniques including aspirators, diffusers, alternative energy, paddlewheels, surface aerators, decorative fountains, aerating fountains and circulators. SAE (Standard Aeration Efficiency) numbers are a good way to compare units, but difficult to use for sizing purposes. Pros and cons of all types of aeration including horsepower application rates as well as what is to be expected with a properly designed aeration system will be covered including winterkill prevention in the North. All lakes should be viewed as individual organisms so each pond's response to management will be slightly different. Aeration is not the cure for all water quality problems and will not instantly rid ponds of scum, algae, moss and all the other green stuff that pond owners mostly dislike. But, with the proper device, you will be able to improve overall water quality as well as purchase an insurance policy to protect an established fishery.

Detecting and Predicting Herbicide Injury on Waterhyacinth Using Remote Sensing *(Student Presentation)*

Wilfredo Robles and John D. Madsen
Geosystems Research Institute, Mississippi State University, Mississippi State, Mississippi

Many large-scale nuisance aquatic plant control programs are based on herbicide applications. Implementation of large-scale control programs requires accurate detection of herbicide injury in order to determine efficacy. Studies were conducted in the fall and summer of 2006 and 2007 at the R.R. Foil Plant Research Facility mesocosm tank facility, Mississippi State University, to detect and predict herbicide injury on waterhyacinth treated with four different rates of imazapyr and glyphosate. Both herbicides were applied separately at recommended rates (0.6 and 3.4 kg ae / ha, respectively) and three rates lower than recommended using a CO_2 backpack sprayer. Injury was visually estimated using a phytotoxicity rating scale whereas reflectance measurements were collected using a handheld hyperspectral sensor. Reflectance measurements were then transformed into a Landsat 5 TM simulated data set to obtain pixel values for each spectral band. Statistical analysis was performed to determine if a correlation exists between bands 3, 4, 5, and 7 and phytotoxicity ratings. Simulated data from Landsat 5 TM indicate that band 4 is the most useful band that detects herbicide injury of waterhyacinth affected by glyphosate and imazapyr. When Band 4 is used to predict injury after two weeks after treatment, the relationship between observed and predicted phytotoxicity is significant (r^2 = 0.39 and 0.46). However, the predictability of herbicide injury is better when plants have developed sufficient symptomology to influence spectral changes of Band 4.

NPDES Permits in Your Future?

John H. Rodgers, Jr., Brenda M. Johnson, and West M. Bishop
Department of Forestry and Natural Resources, Clemson University, Clemson, South Carolina

National Pollutant Discharge Elimination System (NPDES) permits were developed under the Clean Water Act (CWA) for point and non-point sources of pollution. They have been applied to a variety of sites since the CWA was passed in 1972. Algaecides and herbicides have been used in the past in aquatic systems regulated by NPDES permits. Applications of algaecides and herbicides may require a permit in the future. This constitutes a curious juxtaposition of the CWA and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA, pesticide act). Based on prior experience with NPDES permits and pesticides, the requirement can be relatively straightforward or onerous. It is certain that if the requirement is implemented widely, it will not be "business as usual" for this profession.

Response of Selected Aquatic and Riparian Plants to DPX-KJM44 (Aminocyclopyrachlor) (*Student Presentation*)

Rory L. Roten[1], Robert J. Richardson[1], Steve T. Hoyle[1], and P. Lloyd Hipkins[2]
[1]*North Carolina State University, Raleigh, North Carolina*
[2]*Virginia Polytechnic Institute, Blacksburg, Virginia*

Field and greenhouse trials were conducted to determine the responses of several aquatic and riparian plants to the experimental herbicide DPX-KJM44 (also formulated as DPX-MAT20), proposed common name aminocyclopyrachlor.

Greenhouse trials were conducted in North Carolina and Virginia on azolla, giant salvinia, Japanese knotweed, water lettuce, and watermeal. Broadcast rates ranged from 1 to 8 oz ai/A, while in-water rates (only the watermeal trial) were 0.1 to 2 ppm. A field trial was also conducted in North Carolina on Japanese knotweed. In greenhouse trials, azolla was controlled up to 99% with DPX-KJM44 foliar applications and dry weight was reduced to 10% of the untreated. Giant salvinia was not controlled with foliar application rates up to 8 oz ai/A. Japanese knotweed was controlled 93% with 5 oz ai/A DPX-KJM44. Dry weight was reduced to 20% of the untreated. Water lettuce control was 48% with 8 oz ai/A DPX-KJM44. Watermeal was not controlled with DPX-KJM44 or DPX-MAT20 in-water rates up to 2 ppm. Japanese knotweed control in the greenhouse was 74 to 96% with DPX-KJM44 rates of 1 to 5 oz ai/A. Dry weights were 19 to 30% of control weights. Japanese knotweed regrowth after initial harvest was minimal with higher rates and some plants treated with 5 oz ai/A did not regrow. In the field at 8 MAT, Japanese knotweed was controlled 60% with 12 oz ai/A DPX-KJM44 and 88% with 12 oz ai/A DPX-KJM44 plus 1.8 lb ai/A glyphosate.

Watermeal Control with Flumioxazin and Other Herbicides (*Student Poster*)

Rory L. Roten[1], P. Lloyd Hipkins[2], Robert J. Richardson[1], Steve T. Hoyle[1], and Andrew P. Gardner[1]
[1]*North Carolina State University, Raleigh, North Carolina*
[2]*Virginia Polytechnic Institute, Blacksburg, Virginia*

Field and greenhouse research was conducted in North Carolina and Virginia to evaluate watermeal (*Wolffia* spp.) response to flumioxazin. In the first greenhouse trial, flumioxazin was applied in-water at concentrations of 0.25, 0.5, and 1 ppm. Control at 17 days after treatment (DAT) was 79, 91, and 98%, respectively. In the second greenhouse trial, flumioxazin was applied in-water at concentrations of 0.1, 0.5, 1, and 2 ppm. Control was generally 100%, with only a single replicate among treatments not being completely controlled. The first field trial evaluated 0.5, 1, and 2 oz ai/A flumioxazin applied to floating hoops in a watermeal infested pond. At 7 DAT, control was 82% with 2 oz ai/A flumioxazin, but less than 34% with the other rates. The second field trial was conducted on whole ponds in North Carolina. Treatments included 0.75 lb ai/A flumioxazin, 100 ppb flumioxazin plus 2 gal/A diquat, 2 gal/A diquat, 0.4 lb ai/A carfentrazone, and 45 ppb fluridone. Of the treatments evaluated, only flumioxazin plus diquat or fluridone provided acceptable watermeal control. Watermeal coverage was 0% at one year following fluridone treatment or two months following application of flumioxazin plus diquat.

APMS Online Version of "Understanding Invasive Aquatic Weeds" Instructional Booklet

Jeffrey D. Schardt
Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida

In an effort to increase awareness about invasive plants, the Aquatic Plant Management Society produced a 16-page booklet describing problems and management strategies associated with five of the most invasive aquatic plants in US waters. The booklet was developed by plant managers in consultation with teachers with a target audience of 3rd through 7th grades; although the booklets were also used in high schools. APMS, its chapters, and a dozen additional stakeholders sponsored the printing and distribution of nearly 800,000 copies of the booklets nationwide from 2001 until inventory ran out in 2008. Rather than produce additional copies, the APMS Board is funding an interactive, online version of the activity booklet to be housed on the APMS website. The online version will follow the original booklet format with the addition of extensive use of popup photographs, graphics, and video clips of plant problems and management operations. There are five interactive activities that integrate aquatic plant information with math, language arts and geography.

Needed National Infrastructure – A Hub for Coordination and Cooperation in a Multi-jurisdictional Environment

Don C. Schmitz
Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida

Several recent U.S. GAO studies have documented specific problems such as insufficient interaction and cooperation between state and federal officials, policy-makers, and resource and agricultural managers. In addition, there is little framework or funding for rapid responses to new invasions on public conservation lands and waterways, ineffective use of existing information, too many jurisdictional disputes and turf issues, and few direct means to inform the public about biological invasions. To address these issues, a Presidential Executive Order established the interagency National Invasive Species Council in 1999. However, the Council lacks the infrastructure, support, resources, and mechanisms to help coordinate the ~650 federal and state programs and non-profit organizations that prevent, manage, and research invasive species nationwide. In this leadership vacuum, eight regional centers comprised of a mix of government agencies, institutions, and universities have been established to help resource managers manage and disseminate information, implement management programs, conduct management training and applied research, and increase public awareness about biological invasions. However, these regional efforts are not integrated and many only deal with one taxonomic group or one component of biological invasions such as research. It is proposed to integrate and expand these eight regional centers to become part of a national center or hub to create infrastructure that is needed to more effectively prevent, research, and manage biological invasions in a multi-jurisdictional environment. This nationwide center could help develop national standards and guidelines for natural resource invasive species prevention and management efforts that are currently lacking. The national center could coordinate early detection of and rapid response to new invaders in a multi-jurisdictional environment. The center could also establish and administer an Interstate Invasive Species Compact or insurance fund to remedy funding restraints and more adequately address the realities of new invasive species infestations. By functioning as a neutral party, the center could broker cooperative agreements between the states and even between agencies.

Using Herbicides to Control Water Shield in Fulton County Arkansas

George Selden[1] and Brad McGinley[2]
[1]*Aquaculture/Fisheries Center of Excellence, University of Arkansas, Pine Bluff, Arkansas*
[2]*University of Arkansas Cooperative Extension Service, Fulton County, Arkansas*

Water shield (*Brasenia schreberi*) is a perennial plant which grows rooted to the bottom, with relatively small oval leaves that float on the surface. It has a distinctive gelatinous slime coating the underside of the leaves. The water shield growth in a 12-acre pond in Fulton County Arkansas has recently become thick enough to render the pond unusable for fishing. During May of 2009, several different aquatic herbicides were applied to evaluate their effectiveness at controlling this nuisance plant.

From *Elodea canadensis* through *Salvinia molesta* – The Rise of Invasion Biology and Its Interaction with Management

Dan Simberloff
Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville, Tennessee

In 1842, *Elodea canadensis* was first recorded in Great Britain; its population exploded and by 1860 this invasion was considered a major economic disaster. However, by the early 20th century, the invasion mysteriously collapsed and *Elodea* has remained a minor component of the British flora. This entire episode, and a few other notable historical invasions, occurred before the advent of modern invasion biology and did not trigger a general interest in invasions. Charles Elton is often cited as having founded modern invasion biology with the publication of his 1958 monograph. In fact, invasions attracted little attention until the advent in 1982 of a program on invasions by the Scientific Committee on Problems of the Environment (SCOPE). Although the rationale for this project was specifically to place science in the service of management of problematic invasions, the SCOPE program engaged mostly academic scientists and few individuals directly attempting to manage invasions. The SCOPE program triggered a flourishing scientific discipline that has learned much about both invasion as a general process and the idiosyncrasies of individual invasions. However, invasion biologists have interacted only sporadically with managers, and many highly successful management programs have used little science beyond basic natural history of the target species. The past few years have witnessed a rapprochement between managers and invasion biologists that should be encouraged if humankind is to stem the flow of damaging invasive species.

Large-scale Herbicide Monitoring on the Kissimmee Chain of Lakes: Lake Tohopekaliga

Jeremy G. Slade[1], Michael D. Netherland[2], Sarah Berger[3]
[1]*Center for Aquatic and Invasive Plants, University of Florida, Gainesville, Florida*
[2]*U.S. Army Engineer Research and Development Center, Gainesville, Florida*
[3]*Osceola County Extension, University of Florida, Kissimmee, Florida*

Comprehensive data sets documenting what occurs during and after large-scale herbicide applications are needed. Therefore, intensive monitoring of water quality, herbicide residues, and macrophyte beds composed of hydrilla (*Hydrilla verticillata*) and native plants is being conducted on the Kissimmee Chain of Lakes (KCOL). The KCOL consists of four lakes (Tohopekaliga, Cypress, Hatchineha, and Kissimmee) that range in size from 4,000 to 35,000 acres and are heavily infested by hydrilla. Currently herbicide applications of endothall are being used due to vast areas of fluridone resistant hydrilla on the KCOL. Most recently, herbicide applications were performed on Lake Tohopekaliga (7,000 acres) in December 2008, Lake Cypress (835 acres) and Lake Hatchineha (640 acres) in March 2009, and Lake Kissimmee (1400 acres) in April 2009. Water quality (conductivity, dissolved oxygen, pH, and temperature) and water samples for herbicide residues were collected at several sample points inside and outside of treatment locations from the day of treatment to three weeks after treatment. At each sample point, water samples were collected and water quality was recorded at three depths (surface, mid-depth, and bottom). Prior to herbicide applications 2 x 2 m grids were set in plant beds composed of hydrilla and vallisneria (*Vallisneria americana*) at ratios (hydrilla:vallisneria) of 50:50, 80:20, and 20:80 on Lake Tohopekaliga. Biomass samples (n = 4) were collected from each grid before and after the herbicide applications and dried to a constant weight (g DW). Data showed that endothall residues persisted for nearly two weeks at a rate of 0.5 mg/L in treatment plots, and no adverse effects to water quality parameters were documented. Two months after treatment hydrilla was not present in any of the macrophyte grids, while vallisneria remained with no herbicidal symptoms. Additionally, fathometer transects performed in treatment plots also showed a significant removal of hydrilla. Efficacy and selectivity data will be collected throughout the remainder of the year. Information collected from this data will be used to determine application timing, use rates, and potential selectivity issues for future herbicide applications on the KCOL and other lakes in Florida.

Indirect Effect of Aquatic Plant Management on Fish Assemblages in Mississippi Delta Oxbow Lakes (*Student Presentation*)

Matthew R. Spickard and Eric D. Dibble
Department of Wildlife and Fisheries, Mississippi State University, Mississippi State, Mississippi

Mississippi delta oxbow lakes contain a diverse community of aquatic plants that vary in abundance along their shorelines. These communities provide unique habitat components important to growth and survival of fishes. However, when allowed to grow unregulated, these plants can form thick floating mats that restrict recreational access to the lakes and may have an effect on the fish community. Implementation of plant control regimes is critical to managing habitat for a viable fishery, yet little is known how the removal of plants will indirectly influence fish. To investigate the importance of aquatic plants as fish habitat we manipulated vegetated habitat in four oxbow lakes in the Mississippi Delta using herbicide. Imazapyr was applied at a rate of 100 gallons per vegetated acre with a concentration of 0.5% during September 2008 to two lakes. An additional two lakes received no treatment and served as reference. Using boat-mounted electrofishing, we sampled adult and juvenile fishes at three randomly selected sites in shoreline habitats in each study lake. Pretreatment sampling was conducted monthly during March-September 2008. Post-treatment collections were resumed March 2009 and will continue through September 2009. Aquatic plant composition and density was determined at each site, representing 14 different plant species. At total of 4,048 fish comprising 24 species and 11 genera were sampled. We discuss the relationship between the different aquatic plant communities and the fishes we measured in the Mississippi Delta oxbow lakes and how the removal of plants influenced these relationships. This represents one of the first field manipulations to better understand the role aquatic plants play as fish habitat in these systems.

Effects of Plant Growth Regulation on Hydrilla Efficacy and Aquatic Habitat Complexity

Heather J. Theel, Linda S. Nelson, and Christopher R. Mudge
U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi

Hydrilla (*Hydrilla verticillata* (L. f.) Royle) not only infests public waters causing severe economic losses to industry, recreation, and property values, but also alters habitat structure critical to fish foraging, growth, and ultimately survival. Intermediate levels of structural complexity are optimal for foraging and growth of largemouth bass (*Micropterus salmoides*) and bluegill (*Lepomis macrochirus*), where hydrilla's prolific growth often displaces native plants and subsequently increases habitat complexity beyond an optimal level. Plant growth regulators (PGRs) such as flurprimidol, and herbicides with growth regulating properties such as imazamox and bensulfuron methyl, have been reported to control/suppress hydrilla growth while maintaining some level of vegetated structure important for fish and invertebrates. However, the change in vegetative structure created by the use of PGRs and herbicides with growth regulating properties have not yet been compared or quantified in terms of habitat complexity. Therefore, we investigated the effects of a static exposure of flurprimidol (150 and 300 µg active ingredient (ai) L^{-1}) and bensulfuron methyl (5 µg ai L^{-1}), as well as a 14-day exposure of imazamox (50 and 100 µg ai L^{-1}) on hydrilla efficacy and aquatic habitat complexity (I_{hv}). Results at 12 weeks post-treatment indicate that all tested rates of flurprimidol, imazamox, and bensulfuron methyl significantly reduced hydrilla shoot length 48 to 78% compared to the untreated control. In addition, only imazamox (50 and 100 µg ai L^{-1}) and bensulfuron methyl (5 µg ai L^{-1}) significantly reduced hydrilla shoot biomass by an average of 68%. Habitat complexity was significantly reduced by all treatments compared to the control. Therefore, plant growth regulation may be a viable tool for some systems to decrease hydrilla's "weediness", while maintaining habitat complexity beneficial for fish and other aquatic fauna.

Genetic Diversity and Geographic Origins of Invasive Variable-Leaf Watermilfoil

Ryan Thum
Annis Water Resources Institute, Grand Valley State University, Muskegon, Michigan

The variable-leaf watermilfoil (*Myriophyllum heterophyllum*) has become a high-profile invasive aquatic plant in the northeastern and western regions of the USA. Using DNA sequences from one nuclear and one chloroplast marker, I demonstrate that the northeastern invasion is composed of morphologically cryptic but genetically distinct lineages with multiple geographic origins. Whereas some lineages originate from the Southeastern U.S., as historically assumed by plant taxonomists and lake managers, another more common lineage originates from the Midwest, a region where *M. heterophyllum* is considered native but was not previously recognized as distinct. In addition, a third invasive lineage exhibits genetic affinity to *M. pinnatum* and possibly represents rediscovery of historic native populations of this species. Invasive *M. heterophyllum* may thus be considered a complex of distinct lineages that may differ in their habitat affinities, potential for spread, and impacts. Future distribution forecasting and management methods should therefore consider these potential differences among distinct lineages.

Beach Vitex Response to Herbicides (*Student Presentation*)

Sarah L. True, Robert J. Richardson, Rory L. Roten, and Andrew P. Gardner
North Carolina State University, Raleigh, North Carolina

Beach vitex [*Vitex rotundifolia* (L.f.)] is a perennial woody shrub native to Hawaii and countries of the Pacific Rim. Beach vitex thrives on coastal sand dunes and was introduced into the southeastern United States for use as an ornamental and dune stabilizing plant. Today, however, it is considered a noxious weed and invasive species due to its aggressive spread and competition with native flora and fauna. Field and greenhouse studies were conducted from 2006 through 2008 to evaluate the efficacy of selected herbicides and mixtures on beach vitex. In one experiment, beach vitex control at 1 month after treatment (MAT) was greatest with glyphosate and glyphosate plus imazapyr (73% to 84%) and at 12 MAT, control increased to 90 and 94%, respectively. Control with triclopyr mixtures was less than 36% at 1 MAT and less than 11% at 12 MAT. In a second experiment, at 1 MAT glyphosate, imazapyr, and metsulfuron controlled beach vitex 66 to 82%. Control with aminopyralid, imazamox, and penoxsulam was less than 50%. At 8 MAT greatest control was observed with glyphosate and imazapyr (83 and 90%, respectively). Control levels with other treatments were significantly lower at 19 to 52%. In a greenhouse study at 3 weeks after treatment (WAT), control was 37 to 68% with glyphosate and 41 to 76% with imazapyr. At 5 WAT, control was 34 to 87% with glyphosate and 48 to 95% with imazapyr. Dry weight was 4.47 to 5.00 g in glyphosate treatments and 3.50 to 6.18 in imazapyr treatments as compared to the nontreated dry weight of 6.93 g. The absorption and translocation of glyphosate in beach vitex was evaluated with cut stem and foliar applications. Plants were treated with a prepared ^{14}C-glyphosate solution and harvested at 6, 24, 48, 92, and 196 hours after treatment (HAT). In beach vitex cut stems, time of harvest was not significant indicating that all absorption and translocation occurred within the first six hours after treatment. The greatest amount of herbicide recovered remained in the stump (348,408 DPM). A moderate amount translocated to the first root section (14,572 DPM) and a minimal amount translocated to root segments greater distances from the stump (1,657 and 617 DPM for second 10 cm of roots and end roots, respectively). In foliar treatments, the greatest recovered herbicide remained in the treated leaf at 17,828 DPM. Recovered 14C-glyphosate in other plant parts did not differ and ranged 1,222 to 4,300 DPM. At 6 and 24 HAT, 2,081 to 2,825 DPM were recovered. Greater amounts of 6,432 to 9,661 were recovered at 48 to 196 HAT. Translocation of the applied herbicide was generally low with both application methods.

Quinclorac Dissipation and Control of Eurasian Watermilfoil (*Myriophyllum spicatum* L.) (*Student Poster*)

Joseph D. Vassios and Scott J. Nissen
Colorado State University, Fort Collins, Colorado

The submerged macrophyte Eurasian watermilfoil (*Myriophyllum spicatum* L.) is an invasive aquatic species that has become widespread across much of the United States. In recent years Eurasian watermilfoil has become more prevalent along Colorado’s Front Range infesting ponds, reservoirs, and irrigation canals. The presence of Eurasian watermilfoil can negatively impact recreation, habitat, and the ability to efficiently deliver water. Quinclorac is an experimental herbicide that is currently being evaluated under and Experimental Use Permit. Two whole lake treatments were applied to ponds near Longmont, CO. These treatments were applied approximately one year apart, one in July 2007 (Pond 1), and the other in June 2008 (Pond 2). Pond 1 was treated with a 100 ppb concentration, and Pond 2 was treated with 50 ppb. Following treatment both efficacy and herbicide dissipation were monitored. Water samples were taken over the course of both trials and analyzed using High Performance Liquid Chromatography (HPLC). Efficacy is also being evaluated and at this point has resulted in two growing seasons of control in Pond 1, and one growing season in Pond 2. In addition to field trials, a greenhouse study was conducted to determine the quinclorac required for Eurasian watermilfoil control. Quinclorac was evaluated at 50, 100, 200, and 400 ppb. Visual ratings were conducted at 36 days after treatment (DAT). At 36 DAT all treatments had resulted in greater than 80% control. Based on these results it appears that quinclorac can provide Eurasian watermilfoil control at rates as low as 50 ppb. Field studies will continue to be monitored to determine if quinclorac can provide long-term control.

Effects of Planting Density, Elevation and Propagule Age on Native Plant Restoration after Invasive Species Removal in Freshwater Depression Marshes in South Florida (*Student Presentation*)

Kathryn A. Villazon[1], Carrie Reinhardt-Adams[1], Michael Kane[1] and Greg MacDonald[2]
[1]*Department of Environmental Horticulture, University of Florida, Gainesville, Florida*
[2]*Department of Agronomy, University of Florida, Gainesville, Florida*

Natural or anthropomorphic disturbances can alter important functions and values in wetlands by decreasing quantities of native vegetation, altering hydrology, or extracting minerals from the soil. Hence, it is important to restore these functions in disturbed wetlands for successful and optimal ecosystem function. After *Salix caroliniana* was excavated, land managers contacted us to establish a restoration study in the newly created ponds at the Florida Panther National Wildlife Refuge in Naples, Florida. A seedbank assay was performed to obtain native wetland plants for a revegetation study. Plants were selected from the assay based on wildlife value, survivability, and availability. Two elevations (0.9 m and 1.2 m above center of pond) were tested along with a dense and sparse planting, 0.457m and 0.914 m, respectively. Plant age (plug and 5 inch pot) was also tested as a function of elevation. Of the eight native species planted, plant volume differed significantly between ‘species’ ($P = 0.04$), ‘pond’ ($P = 0.02$) and ‘species*pond’ ($P = 0.02$). Plant volume differed significantly between ‘species’ ($P < 0.001$), ‘propagule size’ ($P < 0.001$), and ‘species*propagule size’ ($P < 0.001$). Six MAP, percent survival was greater in one study pond than the other. Plant volume increased over time for *Pluchea rosea* and *Lythrum alatum*, but was negligible for the other three species. When evaluated 12 MAP, *Bacopa caroliniana*, *Proserpinaca palustris*, and *Verbena hastata* survival was significantly higher for 5-inch potted plants than plugs. Planting at different elevations had little effect on plant growth and survivability for either density. The dense planting resulted in greater plant volume as compared to the sparse planting density. Transplants from 5 inch pots had greater survival than plants established from plugs. The results herein will provide useful information for future restoration projects for refuge managers and wetland restoration ecologists.

Corroboration of a Field Study and Bioenergetics Model to Evaluate Bluegill Growth after Eradication of Invasive Eurasian Watermilfoil *(Student Presentation)*

Krisan M. Webb and Eric D. Dibble
Department of Wildlife and Fisheries, Mississippi State University, Mississippi State, Mississippi

Bioenergetics models can be useful tools to assess affects of plant removal on fish growth in fisheries management, but corroboration between bioenergetics models and field studies are limited. The objectives of this study were to: 1) predict growth rates of bluegill (*Lepomis macrochirus* Rafinesque) using a bioenergetics model, 2) compare results to actual growth rates of females and, 3) evaluate affects of plant removal on bluegill growth. Bluegill were collected using electro-fishing in four Minnesota lakes during June and September from 2003-2007. Two lakes received a combined herbicide application of Aquathol and 2, 4-D to remove Eurasian watermilfoil (*Myriophyllum spicatum* L.), and curlyleaf pond weed (*Potamogeton crispus* L.), while two additional lakes were left untreated and used for reference. Caloric values were obtained from published literature and calculated using a multi-regression technique. Data were run in Bioenergetics 3.0 to predict specific growth rates based on actual consumed prey energy density. Growth rates of female fish were calculated and expressed as mean length at age. Trends in mean length at age for each lake were compared with specific growth rates from the bioenergetics model. Energetic return rates were low in lakes with high abundance of watermilfoil. Once plants were removed, energetic return rates were sufficient for growth. Comparison with actual growth rates showed similar trends to those predicted by the bioenergetics model. Our results suggest that fish growth in habitat dominated by watermilfoil strongly influenced prey consumption and the bioenergetics model was useful at predicting fish growth based on consumed prey energy after plant eradication.

Management of Aquatic Plants in Minnesota: A Brief History and Current Status of Management of Invasive Aquatic Plants

Chip Welling
Minnesota Department of Natural Resources, Saint Paul, Minnesota

Aquatic plant management in Minnesota includes activities intended to reduce, enhance or otherwise alter populations of aquatic plants by means of herbicides, biological agents, mechanical devices, physical alteration or transplanting. Minnesotans have managed aquatic plants in wetlands and lakes for many years. Management in wetlands has been focused on maintenance and creation of habitat to support fish and wildlife. Beginning in the late 1980s, concern among waterfowl hunters and conservationists about purple loosestrife (*Lythrum salicaria)* prompted efforts to improve management of this non-native, invasive emergent plant. Partnerships among the Minnesota Department of Natural Resources (MnDNR) and agencies in other states, plus federal agencies, led to development of an effective biological control program for purple loosestrife. Also, Eurasian watermilfoil (*Myriophyllum spicatum*) was discovered in Minnesota in the late 1980s. Almost immediately, this non-native, invasive submersed plant became very abundant in Lake Minnetonka, a highly valued lake in the Twin Cities. Matted Eurasian watermilfoil interfered with use of Minnetonka and other lakes, which led to concern among owners of lakeshore property and boaters. Soon after discovery, the MnDNR began to work with lake associations and local units of government to manage the problems caused by Eurasian watermilfoil. These efforts benefited from support from the U.S. Army Corps of Engineers Aquatic Plant Control Research Program (APCRP), the University of Minnesota, SePRO Corporation, UPI, Inc. and its predecessors, plus others. In the late 1990s, research by the APCRP showed that curly-leaf pondweed (*Potamogeton crispus)* could be controlled by treatment with herbicide when water temperatures are low. Further, treatments such as these were shown to reduce or prevent the production of turions, the principal propagule in this species. In addition, treatments done when water temperatures are low have the potential to minimize damage to native submersed plants, which tend to be dormant under these conditions. In recent years, the MnDNR has invested ever-increasing amount of resources into pilot projects designed to evaluate the potential to selectively control curly-leaf pondweed on a lake-wide basis in Minnesota.

Effects of Water Depth on the Growth of Parrotfeather (*Myriophyllum aquaticum* Vell. Verc.) (*Student Presentation*)

Ryan M. Wersal and John D. Madsen
Geosystems Research Institute, Mississippi State University, Mississippi State, Mississippi

Parrotfeather (*Myriophyllum aquaticum*) has invaded a range of habitats in the United States, including ditches, wetlands, lakes, and streams. The presence of parrotfeather in some of these habitats has resulted in reduced access and increased flooding. Despite having a submersed leaf form, parrotfeather is typically not a problem in deep water. A mesocosm trial was conducted to investigate the effects of varying water depths on parrotfeather growth. The study was conducted for 12 weeks from June through August 2008 as randomized complete block design in 28-1900 L tanks that were 158 cm deep. Treatment depths were 0 (water level at the surface of the pots), 37, 57, 97, 117, 138 cm. A platform was suspended in each tank to achieve the desired water depth and six pots of planted parrotfeather were placed on each platform. A platform was not used for the 138 cm depth as pots rested on the bottom of the tanks. After 12 weeks, plants were harvested and total length recorded. Plants were washed, sorted to emergent, submersed, stolon, and roots, dried and weighed. Plant length and mass data were subjected to a General Linear Model procedure in SAS with means separated by a Fisher's Protected LSD test at a $p = 0.05$ level of significance. Plant length was significantly longer in water depths of 0 to 77 cm. Total plant mass was greatest when plants were grown at the 0 cm depth. Likewise, emergent shoot, stolon, and root mass were greatest at this depth. Stolon mass comprised approximately 66% of total plant mass in the 0 cm depth. Submersed mass was greatest at the 37 cm depth indicating other factors such as light or temperature may influence the growth of this leaf form. Parrotfeather growth is greatest in shallow water depths, most notably emergent shoots which are often associated with nuisance problems. Shallow water is often easier to invade and subject to greater disturbance that could aid in spreading parrotfeather. These results can be used to identify optimal areas for parrotfeather spread and extrapolated for other aquatic plants with a creeping growth form.

Algal and Aquatic Plant Ecology at the University of Georgia: An Overview of Current Research Projects

Susan B. Wilde, Rebecca S. Haynie, and James A. Herrin
D.B. Warnell School of Forestry and Natural Resources, University of Georgia, Athens, Georgia

Dr. Susan Wilde recently joined the University of Georgia's Warnell School of Forestry and Natural Resources and began establishing an algal and aquatic plant ecology research program. In addition to teaching duties and outreach programs, our lab is involved in a variety of projects ranging from algae control in wastewater treatment ponds to the risks toxic algae pose to humans and wildlife. We maintain a population of hydrilla (*Hydrilla verticillata*) with and without *Stigonematales* spp., an epiphytic toxic cyanobacterium that has been linked to Avian Vacuolar Myelinopathy (AVM), for testing purposes. We are currently evaluating the ability of the apple snail (*Pomacea paludosa*) to consume and concentrate this toxin. Snails that consume hydrilla with the Stigonematalean cyanobacterium colonies could potentially confer toxin to their predator, the federally endangered Snail Kite (*Rostrhamus sociabilis*). We also are working with the U.S. Army Corps of Engineers (USACE) to screen aquatic plants from around the country to track the spread of this toxic cyanobacterium. We are involved with local USACE biologists at Lake J. Strom Thurmond in an on-going project focused on the methods for and effects of hydrilla and algae control on fish, wildlife, and human resource users. Algae control is a relatively new component of our research focus. We are testing novel technology using immobilized algae to reduce nutrient loads and nuisance algae growth. We are working with city managers and engineers at a local wastewater treatment facility to measure the efficacy of their algae control efforts using algaecides and a SonicSolution system. Finally, and in sharp contrast to algae control, we are collaborating with the UGA Biorefinery to develop a bio-harvesting system for algae lipids used in creating biofuels.

Toxic Cyanobacteria and Their Effect on Wildlife and Human Health

Susan B. Wilde[1], Rebecca S. Haynie[1], and S. K. Williams[2]
[1]*D.B. Warnell School of Forestry and Natural Resources, University of Georgia, Athens, Georgia*
[2]*Belle Baruch Institute for Marine Biology and Coastal Research, University of South Carolina, Columbia, South Carolina*

Cyanobacteria produce liver and nerve toxins that can be fatal to wildlife and humans. Avian vacular myelinopathy (AVM), a neurological disease linked to toxic cyanobacteria is killing eagles and waterfowl across the southeastern United States. The working hypothesis is that the disease is caused by an unknown neurotoxin produced by a cyanobacterial epiphyte (*Stigonematales* sp.) growing densely on aquatic plants in the affected reservoirs. AVM sites are dominated invasive vegetation; primarily hydrilla (*Hydrilla verticillata*). The toxin is moving through the food chain from plant to waterfowl to predator. Recent research indicates that some neurological disorders in people may have an environmental component linked to neurotoxic algae. Specifically, neurotoxic amino acid ***beta***-N-methylamino-L-***alanine*** **(*BMAA*)** has been documented in brain tissues of victims of amyotrophic lateral sclerosis-Parkinsonism-dementia complex of Guam (Guam ALS-PD). The Chamorro people of Guam had a rate of ALS-PD disease that was 50-100 times the incidence in any other known population. Investigators determined that the most probable source of the toxin was a symbiotic cyanobacteria (*Nostoc*) growing within cycad roots. BMAA was detected in a variety of dietary items prepared by the Chamorro people including cycad tortillas and dumplings, and fruit bats (which consume cycad seeds). Recent evidence of elevated levels of BMAA in ALS patients from North America led to research on the connections between other cyanobacterial species known to produce this toxin and disease incidence. In a screening study conducted on a wide array of cyanobacteria including marine, benthic, sediment, symbiotic and planktonic algae, BMAA was detected in 95% of the genera tested. We submitted samples to determine if the AVM toxin suspect *Stigonematales* sp. cultures were producing BMAA. Additionally, samples of hydrilla collected from AVM positive and negative sites were hydrolyzed and analyzed by HPLC/FL. BMAA was detected in all samples except hydrilla collected from an AVM negative field site. BMAA levels were highest in the field collected hydrilla samples with heavy coverage of *Stigonematales*. Further research will test whether BMAA is the unknown AVM agent or if both neurotoxins are potentially moving through the food chains of these affected reservoirs.

Removing Invasives - One Partner at a Time

Wendy Woyczik
Fish and Wildlife Service, Horicon National Wildlife Refuge, Mayville, Wisconsin

Partnerships play a key role in the removal of invasive species at the Horicon National Wildlife Refuge. The Refuge benefits in many ways by working with others on this crusade. First, many hands make the removal go quicker whether it be pulling, cutting or spraying. Second, there is always a cost savings when partners are involved. Third, many partnerships start with removing invasive species but grow and become involved in other programs on the Refuge. We could not accomplish as much as we do without the help of others.

Do Eurasian and Northern Watermilfoils Hybridize More Frequently Than We Think? (*Student Presentation*)

Matthew Zuellig and Ryan Thum
Grand Valley State University, Muskegon, Michigan

Recently, numerous reports of reduced efficacy in Eurasian watermilfoil control have caused concern for lake managers and lake associations. Reductions in control efficacy could result from any number of factors, including the evolution of increased tolerance for control methods via hybridization with native northern watermilfoil. A critical first step for evaluating this hypothesis is the accurate identification of gene flow between Eurasian and northern watermilfoils. A widely employed method to detect gene flow among milfoils utilizes DNA sequence data from only one gene and consequently has a high potential to misidentify some classes of hybrids (e.g., F_2, backcrosses, etc) as pure Eurasian or northern watermilfoil. Here, I present research that examines whether an alternative multi-locus DNA fingerprinting method has higher power to detect gene flow compared to the widely-used single-gene DNA sequencing method.

Notes: