48th Annual Meeting of the Aquatic Plant Management Society

and

30th Annual Meeting of the South Carolina Aquatic Plant Management Society

PROGRAM

The Mills House Hotel
Charleston, South Carolina
July 13-16, 2008

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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

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)

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)

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.
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Roselle, Illinois

BioSonics, Inc.
Seattle, Washington

Clean Lakes, Inc.,
Coeur d'Alene, Idaho

Diversified Waterscapes, Inc.
Laguna Niguel, California

Phoenix Environmental Care, LLC
Valdosta, Georgia

SePRO Corporation
Carmel, Indiana

UAP Distribution
Monticello, Arkansas

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

BASF Professional Vegetation Management
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Syngenta Professional Products
Greensboro, North Carolina

United Phosphorus, Inc.
King of Prussia, Pennsylvania

Silver

Aquatic Ecosystem Restoration Foundation
Flint, Michigan

Bronze

Applied Biochemists
Germantown, Wisconsin

Helena Chemical Company
Collierville, Tennessee

Phoenix Environmental Care, LLC
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South Carolina APMS
West Columbia, South Carolina

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Aquatic Control, Inc.
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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

Silent Auction

Applied Biochemists
Germantown, Wisconsin

Aquatic Ecosystem Restoration Foundation
Flint, Michigan

Duke Energy Carolinas
Huntersville, North Carolina

SePRO Corporation
Carmel, Indiana

United Phosphorus, Inc.
King of Prussia, Pennsylvania

Aquatic Control, Inc.
Seymour, Indiana

Diversified Waterscapes, Inc.
Laguna, California

Professional Lake Management
Caledonia, Michigan

Syngenta Professional Products
Greensboro, North Carolina

Exhibitors

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

Applied Biochemists

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.

AquaMaster Fountains & Aerators

AquaMaster is a worldwide industry leader in the manufacturing of equipment and products geared towards pond and lake water quality improvement and aesthetics. Products offered are fountains, aeration systems, and microbial bioaugmentation products.

Aquatic Control, Inc.

Since 1966, Aquatic Control, Inc. has been providing 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 Professional Vegetation Management

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™ 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.

Brewer International

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.

Cygnet Enterprises, Inc.

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, Cerexagri, 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.

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 these water features on commercial properties, municipalities, golf courses, homeowner associations and the ag industry. The line consists of: F-10 Foamkill, a defoaming agent that eradicates foam; F-20 Enviro Clear, a water clarifier that brings clarity to your water; F-30 Algae Control, a double chelated copper sulfate that controls and eliminates pesky alga; F-40 Enviro Blue, a water colorant that brings your water to a pleasing blue; F-50 Bio Pure, a natural bacteria that enhances water quality and clarity; F-51 Sludge Reducing Pellets, a high volume sludge and organic waster digester; and F-55 Bio Zyme, a natural enzyme that enhances natural bacteria and breaks down organic contaminants. 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”.

Enviroquip

Enviroquip is a company specializing in specialty spray applications such as aquatics. Enviroquip brings products such as Intelli-Spray, Tiger WetCut, and bulk chemical handling equipment that revolves around the Aqumix chemical management system. Enviroquip is also the only place to find the E3 backpack sprayer which is the only commercial duty backpack on the market today.

Hach Environmental

Hach Environmental helps water resource professionals generate reliable water quality and quantity data to drive water resource management decisions. Hydrolab(r) Series 5 multi-parameter water quality instruments and OTT level, discharge, and precipitation sensors are based on the industry's leading technologies, providing world-class data accuracy and dependable water measurements. Hach Environmental provides customers the technical support, repair service, and sales assistance they've come to expect to maximize the value of Hydrolab and OTT products to getting their jobs done. Call 1-800-949-3766 or email sales@hachenvironmental.com. Please visit us at www.hachenvironmental.com today to get started.

Helena Chemical Company

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.

North Star Helicopters, Inc.

North Star Helicopters is committed to providing the highest quality of precision aerial application services to customers with unique and specialized aerial application needs. We achieve this quality of service for our customers while always maintaining the highest level of safety and environmental stewardship. Our company will continue to focus on the development of technology, equipment and personnel that has made us the leader in the industry. North Star Helicopters aerial application is experienced in many services and markets, such as range and pasture, invasive species, aquatics, fire ants and right-or-ways

Nufarm Americas

Nufarm is committed to the goal of providing our customers Value with a Difference. Nufarm is a leading manufacturer and marketer of crop protection, turf and ornamental, and industrial vegetation management/forestry products. Nufarm offers a diversified product portfolio of herbicides, insecticides, fungicides, and plant growth regulators that help protect against damage caused by weeds, pests, and disease. In addition to providing quality products, Nufarm places a high value on customer service. Our experienced sales and marketing teams, knowledgeable regulatory and product development resources, and responsive operational team work daily to provide our customers Value with a Difference.

Phoenix Environmental Care, LLC

Phoenix Environmental Care manufactures a broad line of specialty products for the Turf, Nursery, Ornamental and Aquatic markets. Phoenix presently offers to the aquatics industry, Avocet Aquatic Glyphosate, Current Aquatic Herbicide, and Symmetry Aquatic Algaecide. Phoenix Environmental Care looks forward to additional aquatic product offerings starting late 2007 and 2008.

ReMetrix, LLC

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.

SePRO Corporation

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, and Renovate® aquatic herbicide. *(*Trademark of SePRO Corporation ®Trademark of SePRO Corporation, ™Trademark of SePRO Corporation, ®Renovate is a Trademark of Dow AgroSciences, LLC, manufactured for SePRO Corporation)*

Syngenta Professional Products

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 available from Syngenta include Reward® and Touchdown PRO®.

UAP Distribution, Inc.

UAP Distribution supplies a complete product line for the aquatic market. Products include herbicides, algaecides, lake dyes and surfactants. Our professional sales staff offers expertise in developing very cost-effective and environmentally sound prescriptions for your aquatic weed, algae and aesthetic problems.
UAP Distribution strives to bring the latest innovations in applied technology to the invasive/noxious vegetation management arena in a format consistent with an Integrated Pest Management (IPM) strategy. UAP Distribution is a nationwide distributor supplying the aquatics, vegetation management, forestry and invasive plant management markets. UAP Distribution has over 300 distribution facilities strategically located in the United States and Canada to better serve our customers needs.

United Phosphorus, Inc.

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 manufacturer of post patent solutions, UPI is geared to provide growers with high-quality products built to defend crops and increase yields.

U.S. Army Engineer Research and Development Center

The U.S. Army Engineer Research and Development Center (ERDC) is one of the most diverse engineering and scientific research organizations in the world. The ERDC conducts R&D in support of the soldier, military installations, and the Corps of Engineers (CE) civil works mission, as well as for other federal agencies, state and municipal authorities, and with U.S. industry through innovative work agreements. The ERDC’s Aquatic Plant Control Research Program (APCRP) is the Nation’s only federally authorized research program providing the technology to manage invasive aquatic plant species. The objective of the program is to develop cost-effective, environmentally compatible aquatic plant management technologies, which address national needs and priorities in water resources management.

Vertex Water Features

Vertex Water Features is a customer-focused lake aeration and floating fountain manufacturer. We will cultivate long-term, mutually beneficial relationships with our customers and our employees. Success in our mission will promote enhancement of our customer's property and increased business opportunity for Vertex Water Features. With the introduction of the XL AirStation™ and AerationJet fountain, Vertex maintains its diffuser technology leadership and the ability to offer complete water quality solutions to golf courses, lake communities, marinas and other waterways seeking improved water quality. This reflects Vertex's strong commitment and vision to provide the best equipment for high efficiency and low-cost lake aeration systems.

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South Carolina APMS Honorary Members

Howard Roach (1988)

Lewis Decell (1997)

Danny Johnson (2007)

South Carolina APMS Award of Honor

Lewis Decell (1990)
Johnnie Frizzell (1992)
Howard Roach (1994)
John Gallagher (1998)

South Carolina APMS Member of the Millennium

John Inabinet (2000)
Danny Johnson (2000)

South Carolina APMS Presidents and Meeting Sites

1979	Howard Roach	Santee Cooper's Wampee Plantation
1980	John Inabinet	Fort Johnson Marine Lab
1981	Ron Dillon	Santee Cooper's Wampee Plantation
1982	Jim Preacher	SCE&G's Pine Island, Lake Murray
1983	Mac Watson	Clemson University Outdoor Lab
1984	Danny Johnson	Fort Johnson Marine Lab
1985	Lamar Robinette	Santee Cooper's Wampee Plantation
1986	Harold Ornes	SCE&G's Pine Island, Lake Murray
1987	Steve de Kozlowski	Clemson University Outdoor Lab
1988	Tim Drake	Santee Cooper's Somerset Point
1989	Cindy Aulbach-Smith	Charlestowne Landing State Park
1990	Ken Manuel	Duke Energy's World of Energy
1991	Howard Roach	Santee Cooper's Somerset Point
1992	Phil Fields	SCE&G's Sand Dunes Club, Sullivan's Island
1993	Jerry McSwain	Omni Hotel, Charleston
1994	Lewis Decell	SCE&G's Pine Island, Lake Murray
1995	Larry McCord	Springmaid Beach, Myrtle Beach
1996	Dave DeMont	Springmaid Beach, Myrtle Beach
1997	Chip Davis	Duke Energy's World of Energy
1998	Jack Whetstone	Litchfield Beach
1999	Stratford Kay	SCE&G's Pine Island, Lake Murray
2000	Larry Dyck	Clemson University Madren Center
2001	Chris Page	Springmaid Beach, Myrtle Beach
2002	Troy Diel	Springmaid Beach, Myrtle Beach
2003	John Hayes	Cypress Gardens
2004	Steve Hoyle	Springmaid Beach, Myrtle Beach
2005	John Inabinet	Springmaid Beach, Myrtle Beach
2006	Bo Burns	Springmaid Beach, Myrtle Beach
2007	Tammy Hughes Lark	Springmaid Beach, Myrtle Beach

South Carolina APMS Sponsors

The South Carolina Aquatic Plant Management Society appreciates the generous support of the following sustaining members / meeting sponsors:

Aeration Technologies, Inc.
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AquaMaster
BASF Corporation
BioSafe Systems
Brewer International
C3M Summit Helicopter
Charleston Aquatic Nurseries
Clear Lakes and Wetland Services
CWC Enterprises
Cygnet Enterprises, Inc.
Dow AgroSciences, LLC
Future Horizons, Inc.
Helena Chemical Company
Monsanto Corporation
Palmetto Aquatic Plant Management, Inc.
Peroxygen Solutions
Phoenix Environmental Care, LLC
Professional Lake Management
ReMetrix, LLC
SePRO Corporation
Southern Farm Equipment Company
Syngenta Professional Products
UAP Distribution
United Phosphorus, Inc.
Vertex Water Features

General Information

Program Organization
The Agenda is organized by day and time. The Abstracts are organized in alphabetical order by presenting author and title.

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 Lobby of the Mills House Hotel. For specific times, please see the Agenda in this Program. Messages will be posted at the meeting registration desk.

Speaker Ready Room
Need to check your PowerPoint presentation? The speaker ready room will be located in the Robert E. Lee Room of the Mills House Hotel and will be equipped with a notebook computer, LCD projector, and screen. For specific times, please see the Agenda in this Program.

Exhibits
Exhibits will be open for viewing from 7:30 a.m. Monday to 12:00 p.m. Wednesday on the First Floor of Hibernian Hall.

Posters
Posters will be open for viewing from 7:30 a.m. Monday to 12:00 p.m. Wednesday on the First Floor of Hibernian Hall. A special Poster Session and Reception will be held on Monday from 5:30 p.m. to 7:00 p.m. on the First Floor of Hibernian Hall. Presenters of posters are required to attend the special Poster Session and answer questions as needed. In addition, presenters are requested to be in attendance during scheduled refreshment breaks.

Refreshment Breaks
A continental breakfast, mid-morning refreshment break, and afternoon refreshment break, graciously sponsored by Syngenta Professional Products, will be served each day of the meeting on the First Floor of Hibernian Hall. 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 Rutledge Room of the Mills House Hotel. 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, APMS Director and Student Affairs Committee Chair, will be the moderator, please contact Tyler by 12:00 p.m. Sunday and confirm your attendance. This luncheon is graciously sponsored by Phoenix Environmental Care, LLC.

APMS Annual Business Meeting
The APMS Annual Business Meeting will be held Monday, 4:30 p.m. - 5:00 p.m. on the Second Floor of Hibernian Hall. 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 Indigo and Cotton Exchange Rooms of the Mills House Hotel. Two representatives from each APMS regional chapter are invited to

attend this breakfast. Greg MacDonald, APMS Vice President and Regional Chapters Committee Chair, will be the moderator for discussions on aquatic plant management activities within each region. Please contact Greg by 6:00 a.m. Monday and confirm your attendance. This breakfast is graciously sponsored by Helena Chemical Company.

APMS Past Presidents' Luncheon

The Past Presidents' Luncheon will be held Tuesday, 12:00 p.m. - 1:30 p.m. in the Indigo and Cotton Exchange Rooms of the Mills House Hotel. Past Presidents of the APMS are invited to attend this luncheon. Don Doggett, Immediate Past President and Past Presidents' Advisory Committee Chair, will be the moderator for discussions on affairs of the Society. Please contact Don by 12:00 p.m. Monday and confirm your attendance. This luncheon is graciously sponsored by Valent Professional Products.

South Carolina APMS Annual Business Meeting

The SCAPMS Annual Business Meeting will be held Tuesday, 4:30 p.m. - 5:00 p.m. in the Lynch Room of the Mills House Hotel. All SCAPMS members are encouraged to attend.

APMS Special Events

President's Reception*, Sunday, July 13, 7:00 p.m. - 9:00 p.m., Pool Deck, The Mills House Hotel.* The APMS cordially invites all registered delegates, guests, and students to the President's Reception, graciously sponsored by SePRO Corporation. 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.

Guest Tour*, Monday, July 14, 8:00 a.m. - 1:00 p.m., Planters Suite, The Mills House Hotel.* The APMS cordially invites all registered guests to the Guest Tour, graciously sponsored by Applied Biochemists. This year's Guest Tour will begin with a buffet breakfast in Planters Suite of the Mills House Hotel. After breakfast a native Charlestonian will guide guests on a stroll through historic and beautiful Charleston. Highlights will include rainbow row, antebellum mansions, hidden gardens, churches, and historic buildings. After strolling the streets of Charleston, lunch will be served at Magnolias, one of the city's finest dining establishments. Non-registered guests may purchase tickets at the meeting registration desk.

Poster Session and Reception*, Monday, July 14, 5:30 p.m. - 7:00 p.m., First Floor, Hibernian Hall.* 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/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.

2nd Annual APMS/SCAPMS Scholarship Fund Duck Racing and Reception*, Tuesday, July 15, 6:00 p.m. - 7:00 p.m., Pool Deck, The Mills House Hotel.* The APMS and the SCAPMS cordially invites all registered delegates, guests, and students to the 2nd Annual APMS/SCAPMS Scholarship Fund Duck Racing and Reception, graciously sponsored by BASF Professional Vegetation Management and South Carolina APMS. At this relaxed and sporty get-together, you will enjoy your favorite beverage, while cheering your duck to victory.

Awards Banquet*, Tuesday, July 15, 7:00 p.m. - 10:00 p.m., Second Floor, Hibernian Hall.* The APMS cordially invites all registered delegates, guests, and students to the APMS 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.

Membership Information

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.

Post Conference Student Tour

Immediately following the meeting, students will have the opportunity to participate in a tour to observe and learn about regional weed issues. The tour is graciously being sponsored by AERF, SC APMS, Duke Energy and Santee Cooper. The group will be departing the Mills House at 1:30 on Wednesday and returning Thursday at 2:15 pm. Tour stops include sites that contain arundo, Chinese tallow, phragmites, and hydrilla control projects, as well as a tour of local research lab(s). Please see Tyler Koschnick, APMS Director and Student Affairs Committee Chair, for more details.

Agenda

Sunday, July 13

Sunday's Agenda-at-a-Glance

7:30 am - 5:00 pm	APMS Board of Directors Meeting *(Indigo and Cotton Exchange Rooms)*
12:00 pm - 5:00 pm	Exhibits Setup *(Hibernian Hall, First Floor)*
12:00 pm - 5:00 pm	Posters Setup *(Hibernian Hall, First Floor)*
1:00 pm - 5:00 pm	Registration *(Lobby)*
1:00 pm - 5:00 pm	Speaker Ready Room *(Robert E. Lee Room)*
3:00 pm - 5:00 pm	SCAPMS Board of Directors Meeting *(Lynch Room)*
7:00 pm - 9:00 pm	President's Reception *(Pool Deck)* *Sponsored by SePRO Corporation*

Monday, July 14

Monday's Agenda-at-a-Glance

7:30 am - 8:00 am	Continental Breakfast *(Hibernian Hall, First Floor)*
	Sponsored by Syngenta Professional Products
7:30 am - 5:00 pm	Registration *(Lobby)*
7:30 am - 5:00 pm	Speaker Ready Room *(Robert E. Lee Room)*
7:30 am - 5:00 pm	Exhibits Open *(Hibernian Hall, First Floor)*
7:30 am - 5:00 pm	Posters Open *(Hibernian Hall, First Floor)*
8:00 am - 12:00 pm	Session I: Presidential Address and Special Session on Economic Impacts of Invasive and Nuisance Aquatic Plant Species and Models for Funding *(Hibernian Hall, Second Floor)*
8:00 am - 1:00 pm	Guest Tour *(Planters Suite)*
	Sponsored by Applied Biochemists
9:30 am - 10:00 am	Refreshment Break *(Hibernian Hall, First Floor)*
	Sponsored by Syngenta Professional Products
12:00 pm - 1:30 pm	Lunch on Own
12:00 pm - 1:30 pm	APMS Student Affairs Luncheon *(Rutledge Room)*
	Sponsored by Phoenix Environmental Care, LLC
12:00 pm - 1:30 pm	Aquatic Ecosystem Restoration Foundation Meeting *(Heyward and Lynch Rooms)*
1:30 pm - 4:30 pm	Session II *(Hibernian Hall, Second Floor)*
3:00 pm - 3:30 pm	Refreshment Break *(Hibernian Hall, First Floor)*
	Sponsored by Syngenta Professional Products
4:30 pm - 5:00 pm	APMS Annual Business Meeting *(Hibernian Hall, Second Floor)*
5:30 pm - 7:00 pm	Poster Session and Reception *(Hibernian Hall, First Floor)*
	Sponsored by BASF Professional Vegetation Management

Session I: Presidential Address and Special Session on Economic Impacts of Invasive and Nuisance Aquatic Plant Species and Models for Funding

8:00 am - 12:00 pm
Hibernian Hall, Second Floor
Moderator: Jim Petta, *APMS President, Syngenta Professional Products, Corpus Christi, Texas*

8:00 am **Opening Remarks and Announcements**

8:05 am **Presidential Address**
Jim Petta
Syngenta Professional Products, Corpus Christi, Texas

8:25 am **Keynote Speaker: Economics of Invasive and Nuisance Aquatic Species**
Marilyn Katz
Environmental Protection Agency, Washington, District of Columbia

8:50 am **South Carolina**
Steve deKoslowski
South Carolina Department of Natural Resources, Columbia, South Carolina

9:10 am **Louisiana**
Rachael Walley
Louisiana Department of Wildlife and Fisheries, Baton Rouge, Louisiana

9:30 am **Refreshment Break** *(Hibernian Hall, First Floor)*

10:00 am **Indiana**
David Isaacs
Aquatic Control, Inc., Seymour, Indiana

10:20 am **Florida**
Jeff Schardt
Florida Department of Environmental Protection, Tallahassee, Florida

10:40 am **California**
Patrick Akers
Sacramento, California

11:00 am **Idaho**
Eric Anderson
State Legislature, House of Representatives, Priest Lake, Idaho

11:20 am **The Federal Perspective**
Jim Skillen
Responsible Industry for a Sound Environment (RISE), Washington, District of Columbia

11:40 am **Panel Discussion: All Session Presenters**
Please submit questions to the moderator prior to discussion.

12:00 pm **Lunch on Own**

Session II

1:30 pm - 4:30 pm
Hibernian Hall, Second Floor
Moderator: John Madsen, *GeoResources Institute, Mississippi State University,Mississippi State, Mississippi*

1:30 pm ***Nymphoides cristata* – It's Hard to Break a Floating Heart**
Kenneth A. Langeland
University of Florida, Gainesville, Florida

1:45 pm **Influence of pH on Flumioxazin Selectivity of Submerged Aquatic Plants**
Christopher R. Mudge[1] and William T. Haller[2]
[1]U.S. Army Engineer Research and Development Center, Environmental Laboratory, Vicksburg, Mississippi
[2]University of Florida, Center for Aquatic and Invasive Plants, Gainesville, Florida

2:00 pm **Aquatic Weed Risk Assessment as a Tool to Manage Potential Weeds in the Aquarium/Pond Plant Trade**
P. D. Champion, John S. Clayton, and David A. Burnett
National Institute of Water and Atmospheric Research (NIWA), Hamilton, New Zealand

2:15 pm **Developing Use Patterns for Emergent and Submersed Vegetation with the Newly Registered Aquatic Herbicide Clearcast®**
Dan Beran, Bo Burns, and Todd Horton
BASF Corporation, Des Moines, Iowa

2:30 pm **Impacts of Aquatic Vegetation Management on the Ecology of Small Impoundments**
Trevor Knight and Michael P. Masser
Texas A&M University, Texas Cooperative Extension, College Station, Texas

2:45 pm **Lake-Wide Temporal Surveys to Assess Aquatic Vegetation and Herbicide Efficacy of Waterhyacinth Control *(Student Presentation)***
Wilfredo Robles and John D. Madsen
Mississippi State University, GeoResources Institute, Mississippi State, Mississippi

3:00 pm **Refreshment Break** *(Hibernian Hall, First Floor)*

3:30 pm **Plant Camp 2008 – The Effects of Spending Five Straight Days with 27 Curious, Enthusiastic, and Incredibly Chatty Science Teachers and Their Potential Influence on Florida's Future Citizenry and Invasive Plant Management**
Amy Richard
Invasive Plant Education Initiative, University of Florida, Gainesville, Florida

3:45 pm **Evaluation of Diets in Bluegill (*Lepomis macrochirus*) After a Shift in a Plant Community Due to Eradication of Eurasian Watermilfoil (*Myriophyllum spicatum L.*) *(Student Presentation)***
Krisan Webb and Eric Dibble
Mississippi State University, Department of Wildlife and Fisheries, Mississippi State, Mississippi

4:00 pm **Assessing the Potential of Creating Management-Quality Invasive Plant Maps of Lake Gaston with Data Generated by Volunteer Scouts *(Student Presentation)***
Bridget R. Lassiter, Robert J. Richardson, and Gail G. Wilkerson
North Carolina State University, Department of Crop Science, Raleigh, North Carolina

4:15 pm **Combinations of Diquat and Methylated Seed Oil for Control of Duckweed and Watermeal *(Student Presentation)***
Joshua C. Cheshier, Ryan M. Wersal, and John D. Madsen
Mississippi State University, GeoResources Institute, Mississippi State, Mississippi

4:30 pm **Adjourn**

Poster Session

5:30 pm - 7:00 pm
Hibernian Hall, First Floor

Comparison of Subsurface and Foliar Herbicide Applications for Control of Parrotfeather (*Myriophyllum aquaticum* Vell. Verdc.) *(Student Poster)*
Ryan M. Wersal and John D. Madsen
Mississippi State University, GeoResources Institute, Mississippi State, Mississippi

Restoring Native Aquatic Macrophytes in Little Bear Creek Reservoir *(Student Poster)*
Jonathan P. Fleming, Joshua C. Cheshier, and John D. Madsen
Mississippi State University, GeoResources Institute, Mississippi State, Mississippi

Responses of Several Aquatic Weeds to ALS Inhibiting Herbicides *(Student Poster)*
Rory L. Roten, Sarah L. True, Amanda M. West, and Robert J. Richardson
North Carolina State University, Raleigh, North Carolina

Flumioxazin and Carfentrazone Efficacy on Selected Weeds *(Student Poster)*
Amanda M. West, Rory L. Roten, Sarah L. True, and Robert J. Richardson
North Carolina State University, Raleigh, North Carolina

Turfgrass Response to Herbicide-Treated Irrigation Water
Andrew P. Gardner, Rory L. Roten, and Robert J. Richardson
North Carolina State University, Raleigh, North Carolina

Tobacco Response to Herbicide-Treated Irrigation Water *(Student Poster)*
Virginia A. Johnson, Andrew P. Gardner, Rory L. Roten, and Robert J. Richardson
North Carolina State University, Raleigh, North Carolina

A New Web Database for Aquatic Weed Information
Steve T. Hoyle, Michael G. Burton, Jenifer J. Reynolds, Emily J. Erickson, Bridget R. Lassiter, Gail Wilkerson, and Robert J. Richardson
North Carolina State University, Raleigh, North Carolina

Summary of Three Years of Watermeal Control Trials *(Student Poster)*

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

Hydrilla Sensitivity to Imazamox and Imazapyr: Growth and ALS Activity

Mercedes Royuela[1, 2], Atul Puri[3], William T. Haller[3], and Gregory E. MacDonald[1]
[1]*University of Florida, Agronomy Department, Gainesville, Florida*
[2]*Universidad Pública de Navarra, Pamplona, Spain*
[3]*University of Florida, Center for Aquatic and Invasive Plants, Gainesville, Florida*

Integration of Chemical and Biological Control of Waterhyacinth Using *Neochetina* spp. Weevils and Fungal Plant Pathogens

Patrick Moran[1], H. Enrique Cabinillas[1], and Connie Graham[2]
[1]*U.S. Department of Agriculture, Agricultural Research Service, Beneficial Insects Research Unit, Weslaco, Texas*
[2]*U.S. Department of Agriculture, Agricultural Research Service, Integrated Farming and Natural Resources Research Unit, Weslaco, Texas*

Monitoring Aquatic Vegetation Using High-Resolution, Hyperspectral Aerial Imagery in Lakes Marion and Moultrie, SC

Richard Dirks[1] and Michael Frank[2]
[1]*ReMetrix LLC, Carmel, Indiana*
[2]*Galileo Group, Inc., Melbourne, Florida*

The Application of Grass Carp (*Ctenopharyngodon idella*) as Biological Control Agent for the Over-Abundant Growth of Aquatic Weeds in Irrigation Canal Systems of Sugar Company, Richard Toll in North Senegal

A. A. Badiane[1], D. Jeandrain[2], C. Mélard[3], F. X. Cogels[3], C. Rougeot[3], C. Prignon[3], and I. Sow[4]
[1]*Aquaculture Promotion Agency (APA)*
[2]*APEFE*
[3]*University of Liège, Aquaculture Research and Education Center, Chemin de la Justice, Tihange, Belgium*
[4]*Compagnie Sucrière Sénégalaise*

Comparing Survey Techniques to Assess a Submersed Aquatic Plant Community Following a Systemic Herbicide Treatment

H. J. Theel[1, 2], K. D. Getsinger[1], C. Owens[3], L. Esman[4], and E. Dibble[2]
[1]*U.S. Army Engineer Research and Development Center, Environmental Laboratory, Vicksburg, Mississippi*
[2]*Mississippi State University, Department of Wildlife and Fisheries, Mississippi State, Mississippi*
[3]*U.S. Army Engineer Research and Development Center, Environmental Laboratory, Lewisville Aquatic Ecosystem Research Facility, Lewisville, Texas*
[4]*Purdue University, West Lafayette, Indiana*

***Egeria densa* and *Eichhornia crassipes* Biomass Soil Incorporations Improving the Physical, Chemical and Biological Properties of a Degraded Soil**

Angélica M. C. M. Pitelli[1], Pedro L. C. A. Alves[2], Manoel E. Ferreira[2], and Robinson A. Pitelli[2]
[1]*São Paulo State University, SP, Botucatu, 18603-970, Brazil*
[2]*São Paulo State University, SP, Jaboticabal, 14884-900, Brazil.*

Aquatic Macrophytes Associations and its Relevance in the Weed Management in the Aimorés Reservoir, Brazil

R. L. C. M. Pitelli[1], L. Jesus[2], R. M. Dolabella, and R. A. Pitelli[1]
[1]*Ecosafe Agriculture and Environmental Sciences, Jaboticabal, Brazil*
[2]*Aimores Hydropower Company, Aimores, ES, Brazil*

Application Techniques of Diquat in the Control of Submerged Aquatic Weeds in a Reservoir in Brazil

Edivaldo D. Velini[1], Caio A. Carbonari[1], Robinson A. Pitelli[2], Dagoberto Martins[1], Fernando T. Carvalho[1], Eduardo Negrisoli[1] and José R. M. Silva[1].
[1]*São Paulo State University, SP, Botucatu, Brazil*
[2]*São Paulo State University, SP, Jaboticabal, Brazil.*

Evaluation of Diquat for *Egeria densa* and *Egeria najas* Control in Brazil
Caio A. Carbonari, Edivaldo D. Velini, Luis F. N. Bravin, Marcelo R. Correa, and Rodrigo Martinez e Caio V. S. Rossi
São Paulo State University, SP, Botucatu, Brazil

Biological Control of Eurasian Watermilfoil by *Euhrychiopsis lecontei*: Assessing Efficacy and Timing of Sampling *(Student Poster)*
Justin L. Reeves[1], P. D. Lorch[1], M. W. Kershner[1], and M. A. Hilovsky[2]
[1]*Department of Biological Sciences, Kent State University, Kent, Ohio*
[2]*EnviroScience, Inc. Stow, Ohio*

Effect of Nutrient Levels on Biometric Characters of *Vallisneria americana* Michx.
Lyn A. Gettys and William T. Haller
University of Florida, Center for Aquatic and Invasive Plants, Gainesville, Florida

Avian Myelinopathy: Epizootic Assessment, Putative Toxin Extraction, and *In Vitro* Assay Development
Rebecca Haynie and Susan Wilde
University of Georgia, Athens, Georgia

Common Reed: *Phragmites australis* (Cav.) Trin. Ex Steud: Life History in the Mobile River Delta, Alabama *(Student Poster)*
Joshua C. Cheshier and John D. Madsen,
Mississippi State University, GeoResources Institute, Mississippi State, Mississippi

Herbicide Movement in Torpedograss (*Panicum repens*) as a Function of Water Depth *(Student Poster)*
K. Vollmer, **Courtney Stokes**, G. MacDoanld, J. Ferrell, and K. Langeland
University of Florida, Gainesville, Florida

Aquatic Macrophytes and Algae in the Cacota Lagoon *(Student Poster)*
Gina Suescun Otero
Universidad De Pamplona, Biology Department, Columbia, South America

Tuesday, July 15

Tuesday's Agenda-at-a-Glance

6:30 am - 8:00 am	APMS Regional Chapters Presidents' Breakfast (Indigo and Cotton Exchange Rooms) *Sponsored by Helena Chemical Company*
7:30 am - 8:00 am	Continental Breakfast *(Hibernian Hall, First Floor)* *Sponsored by Syngenta Professional Products*
7:30 am - 5:00 pm	Registration *(Lobby)*
7:30 am - 5:00 pm	Speaker Ready Room *(Robert E. Lee Room)*
7:30 am - 5:00 pm	Exhibits Open *(Hibernian Hall, First Floor)*
7:30 am - 5:00 pm	Posters Open *(Hibernian Hall, First Floor)*
8:00 am - 9:30 am	Session III *(Hibernian Hall, Second Floor)*
9:30 am - 10:00 am	Refreshment Break *(Hibernian Hall, First Floor)* *Sponsored by Syngenta Professional Products*
10:00 am - 12:00 pm	Session IV: Special Session on Impacts of Water Exchange on Herbicide Effectiveness *(Hibernian Hall, Second Floor)*
12:00 pm - 1:30 pm	Lunch on Own
12:00 pm - 1:30 pm	APMS Past Presidents' Luncheon *(Indigo and Cotton Exchange Rooms)* *Sponsored by Valent Professional Products*
12:00 pm - 1:30 pm	SCAPMS Board/Committee Chairs Recognition Luncheon *(Tea Cozy Room)* *Sponsored by SePRO Corporation*
1:30 pm - 4:30 pm	Session V *(Hibernian Hall, Second Floor)*
3:00 pm - 3:30 pm	Refreshment Break *(Hibernian Hall, First Floor)* *Sponsored by Syngenta Professional Products*
4:30 pm - 5:00 pm	SCAPMS Annual Business Meeting *(Lynch Room)*
6:00 pm - 7:00 pm	2nd Annual APMS/SCAPMS Scholarship Fund Duck Racing Competition and Reception *(Pool Deck)* *Sponsored by BASF Professional Vegetation Management and SCAPMS*
7:00 pm - 10:00 pm	Awards Banquet *(Hibernian Hall, Second Floor)* *Sponsored by United Phosphorus, Inc.*

Session III
8:00 am - 9:30 am
Hibernian Hall, Second Floor
Moderator: Tyler Koschnick, SePRO Corporation, Medina, Ohio

8:00 am **Eurasian Watermilfoil Monitoring and Eradication Assessment in the Pend Oreille Lake and River System, Idaho**

John D. Madsen[1], Ryan M. Wersal[1], and Thomas E. Woolf[2]
[1]Mississippi State University, GeoResources Institute, Mississippi State, Mississippi
[2]Idaho State Department of Agriculture, Boise, Idaho

8:15 am **Comparative Response of Eurasian, Northern, Hybrid, and Variable Watermilfoil to Aquatic Herbicides and Environmental Conditions**

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

8:30 am **Response of Hybrid Milfoil to Low Use Rates and Extended Exposures to 2,4-D and Triclopyr**

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

8:45 am **Influences of Water Column Nutrient Loading on the Growth of Parrotfeather (*Myriophyllum aquaticum* Vell. Verdc.) *(Student Presentation)***
Ryan M. Wersal and John D. Madsen
Mississippi State University, GeoResources Institute, Mississippi State, Mississippi

9:00 am **The Impact of Various Growth Solutions on the Photosynthesis of *Hydrilla verticillata*: Implications on the Importance of Nutrients and Carbon Availability for Aquatic Plants Grown Without Sediments**
Brett W. Bultemeier and William T. Haller
University of Florida, Center for Aquatic and Invasive Plants, Gainesville, Florida

9:15 am **Monoecious Hydrilla Tuber Bank Response to Management *(Student Presentation)***
Justin J. Nawrocki[1], Andrew P. Gardner[1], Rory L. Roten[1], Robert J. Richardson[1], Tyler Koschnick[2], and Mark Heilman[2]
[1]North Carolina State University, Raleigh, North Carolina
[2]SePRO Corporation, Carmel, Indiana

9:30 am **Refreshment Break** *(Hibernian Hall, First Floor)*

Session IV: Special Session on Impacts of Water Exchange on Herbicide Effectiveness

10:00 am - 12:00 pm
Hibernian Hall, Second Floor
Moderator: Kurt Getsinger, *U.S. Army Engineer Research and Development Center, Environmental Laboratory, Vicksburg, Mississippi*

10:00 am **Use of Herbicides in High Water Exchange Environments: Overview**
Kurt D. Getsinger
U.S. Army Engineer Research and Development Center, Environmental Laboratory, Vicksburg, Mississippi

10:20 am **Managing Aquatic Weeds in Tidal Systems: Going with the Flow Pays Off!**
Lars W. J. Anderson
U.S. Department of Agriculture, Agricultural Research Service, Exotic and Invasive Weed Research Davis, California

10:40 am **Partial Lake Treatments in New Zealand Lakes**
John Clayton and Fleur Matheson
National Institute of Water and Atmospheric Research (NIWA), Hamilton, New Zealand

11:00 am **Aquatic Herbicides in Flowing Water**
Donald R. Stubbs
U.S. Environmental Protection Agency, Office of Pesticide Programs, Washington, District of Columbia

11:20 am **Filling in the Blanks on Aquatic Weed Control in Flowing Water**
William T. Haller
University of Florida, Center for Aquatic and Invasive Plants, Gainesville, Florida

11:40 am **Panel Discussion: All Session Presenters**
Please submit questions to the moderator or designee prior to discussion.

12:00 pm **Lunch on Own**

Session V

1:30 pm - 4:30 pm
Hibernian Hall, Second Floor
Moderator: Kenneth A. Langeland, University of Florida, Gainesville, Florida

1:30 pm **Washington Update**
Lee Van Wychen
Weed Science Society of America, Washington, District of Columbia

1:45 pm **ALS Enzyme Assay as a Tool for Herbicide Resistant Management in Hydrilla (*Hydrilla verticillata*)**
Atul Puri[1], Mercedes Royuela[2,3], William T. Haller[1], and Michael D. Netherland[4]
[1]*University of Florida, Center for Aquatic and Invasive Plants, Gainesville, Florida*
[2]*University of Florida, Agronomy Department, Gainesville, Florida*
[3]*Universidad Publica de Navarra, Pamplona, Spain*
[4]*U.S. Army Engineer Research and Development Center, Environmental Laboratory, Gainesville, Florida*

2:00 pm **Controlling Sago Pondweed with Endothall**
Cody J. Gray[1], Gerald Adrian[2], and K. Jayne Walz[2]
[1]*United Phosphorous, Inc., Peyton, Colorado*
[2]*United Phosphorous, Inc., King of Prussia, Pennsylvania*

2:15 pm **Evaluation of Sago Pondweed (*Stuckenia pectinatus*) Control In Dewatered Irrigation Canals Using Imazamox, Imazapyr, Flumioxazin, Fluridone, and Penoxsulam *(Student Presentation)***
Joseph D. Vassios, Scott J. Nissen, and Galen R. Brunk
Colorado State University, Fort Collins, Colorado

2:30 pm **Efficacy of Dry Ground Applications of Penoxsulam and Fluridone on Sago Pondweed**
Tyler J. Koschnick, S. Miller, and S. Schuler
SePRO Corporation, Carmel, Indiana

2:45 pm **Responses of Seven Algal Species to Exposures of Algimycin®-PWF *(Student Presentation)***
West M. Bishop, Brenda M. Johnson, and John H. Rodgers, Jr.
Clemson University, Department of Forestry and Natural Resources, Clemson, South Carolina

3:00 pm **Refreshment Break** *(Hibernian Hall, First Floor)*

3:30 pm **A Risk and Management Assessment for *Lyngbya wollei* in Kings Bay/Crystal River, Florida *(Student Presentation)***
Brenda M. Johnson, West M. Bishop, and John H. Rodgers, Jr.
Clemson University, Department of Forestry and Natural Resources, Clemson, South Carolina

3:45 pm **Progress with Targeted Algal Management**
John H. Rodgers, Jr., Brenda M. Johnson, and West M. Bishop
Clemson University, Department of Forestry and Natural Resources, Clemson, South Carolina

4:00 pm **Development and Impact of Biological Control of Giant Reed, *Arundo donax*, in the Rio Grande Basin of the U.S. and Mexico**
John Goolsby[1], **Patrick Moran**[1], James Everitt[2], Chenghai Yang[2], Maricela Martinez Jimenez[3], David Watts[4], Georgianne Moore[4], David Spencer[5], Emily Seawright[6], Ron Lacewell[6], Ed Rister[6], Jim Manhart[4], Alan Pepper[4], Daniel Tarin[4], and Fred Nibling[7]
[1]*U.S. Department of Agriculture, Agricultural Research Service, Beneficial Insects Research Unit, Weslaco, Texas*
[2]*U.S. Department of Agriculture, Agricultural Research Service, Integrated Farming and Natural Resources Research Unit, Weslaco, Texas*
[3]*Instituto Mexicano de Tecnologia del Aqua, Juitepec, Morelos, Mexico*
[4]*Texas A and M University, Department of Biology, College Station, Texas*
[5]*U.S. Department of Agriculture, Agricultural Research Service, Exotic and Invasive Weed Research Unit, Davis, California*
[6]*Texas A and M University, Department of Ecosystem Science and Management, College Station, Texas*
[7]*U.S. Bureau of Reclamation, Ecological Research, Denver, Colorado*

4:15 pm **The Explosion of Exotic Island Apple Snails in Florida – Impact and Control**
William T. Haller, Lyn A. Gettys, and Tomas F. Chiconela
University of Florida, Center for Aquatic and Invasive Plants, Gainesville, Florida

4:30 pm **Adjourn**

Wednesday, July 16

Wednesday's Agenda-at-a-Glance

7:30 am - 8:00 am	Continental Breakfast *(Hibernian Hall, First Floor)* *Sponsored by Syngenta Professional Products*
7:30 am - 12:00 pm	Registration *(Lobby)*
7:30 am - 12:00 pm	Speaker Ready Room *(Robert E. Lee Room)*
7:30 am - 12:00 pm	Exhibits Open *(Hibernian Hall, First Floor)*
7:30 am - 12:00 pm	Posters Open *(Hibernian Hall, First Floor)*
8:00 am - 12:00 pm	Session VI *(Hibernian Hall, Second Floor)*
9:30 am - 10:00 am	Refreshment Break *(Hibernian Hall, First Floor)* *Sponsored by Syngenta Professional Products*
12:00 pm - 5:00 pm	APMS Board of Directors Meeting *(Lynch Room)*
12:00 pm - 5:00 pm	Exhibits Teardown *(Hibernian Hall, First Floor)*
12:00 pm - 5:00 pm	Posters Teardown *(Hibernian Hall, First Floor)*
1:30 pm	Post Conference Student Tour Departs Mills House

Session VI
8:00 am - 12:00 pm
Hibernian Hall, Second Floor
Moderator: Carlton Layne, *Aquatic Ecosystem Restoration Foundation, Marietta, Georgia*

8:00 am **Ultrasonic Algae and Bio-Film Control**
Kevin Hutchinson and George Hutchinson
AlgaeControl.US Division, McClellanville, South Carolina

8:15 am **Cooperative Aquatic Invasive Species Control Programs in the Winyah Bay Focus Area, SC**
Jack M. Whetstone[1], Chris L. Page[2], and M. C. Nespeca[3]
[1]*Clemson University, Clemson, South Carolina*
[2]*South Carolina Department of Natural Resources, Columbia, South Carolina*
[3]*The Nature Conservancy, Charleston, South Carolina*

8:30 am **Alligator weed – Trials for Control**
Deborah Hofstra and Paul Champion
National Institute of Water and Atmospheric Research (NIWA), Hamilton, New Zealand.

8:45 am **Herbicide Resistance in Aquatics**
Greg MacDonald
University of Florida, Gainesville, Florida

9:00 am **Assessing Progress in Brazilian Waterweed Management in the Sacramento-San Joaquin Delta, CA: Efficacy Results from 2007 Broad-scale Herbicide Treatment in Frank's Tract**
Scott A. Ruch
ReMetrix LLC, Berkeley, California

9:15 am **Use of Diquat and Suction Dredging in the Management of *Lagarosiphon major* in New Zealand Lakes**
John Clayton and Fleur Matheson
National Institute of Water and Atmospheric Research (NIWA), Hamilton, New Zealand

9:30 am **Refreshment Break** *(Hibernian Hall, First Floor)*

10:00 am **A Success Story – Controlling a *Lyngbea wollei* Outbreak in the High Point North Carolina Drinking Water Supply**
William Frazier
Public Services Department, High Point, North Carolina

10:15 am	**Analysis of Invasive Plants, Epiphytic Algae and Water Quality Data from Reservoirs Affected by Avian Vacuolar Myelinopathy (AVM), 1998 -- 2007** **Susan Wilde** *University of Georgia, Athens, Georgia*
10:30 am	**An Unofficial History of Aquatic Plant Management on Lake Gaston** **Robert J. Richardson** *North Carolina State University, Raleigh, North Carolina*
10:45 am	**Lake Cypress Spring – A Decade of Results** **J. R. Alphin, Jr.** *Franklin County Water District, Mount Vernon, Texas*
11:00 am	**Melaleuca in the Zapata Swamp of Cuba** **Kenneth Langeland**[1] and Amy Ferriter[2] [1]*University of Florida, IFAS Agronomy Department and Center for Aquatic and Invasive Plants, Gainesville, Florida* [2]*Idaho Department of Agriculture, Boise, Idaho*
11:15 am	**Responsible Industry for a Sound Environment (RISE) Update** **Jim Skillen** *Responsible Industry for a Sound Environment, Washington, District of Columbia*
11:30 am	**Macrophytes and Algae in the Cacota Lagoon** **Gina Suescun Otero** *Universidad De Pamplona, Biology Department, Columbia, South America*
11:45 am	**APMS Chapter Updates** *Brazil, Florida, MidSouth, Midwest, Nile Basin, Northeast, South Carolina, Texas, Western*
12:00 pm	**Closing Remarks and Adjourn 48th Annual Meeting** **Jim Petta**, Syngenta Professional Products, Corpus Christi, Texas

NEXT YEAR
49th Annual Meeting
July 12-15, 2009
Hyatt Regency
Milwaukee, Wisconsin

Abstracts

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

Managing Aquatic Weeds in Tidal Systems: Going with the Flow Pays Off!

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

The movement of water in tidal systems presents unique challenges and opportunities for controlling aquatic weeds. Daily and seasonal tidal cycles result in fairly predictable, but highly variable amplitude of water levels, velocities, volume-flows, and duration of flows. For successful efficacy, conventional applications methods, timing and monitoring have to be modified and tailored to optimize placement, contact time and concentration of herbicides around target weeds. Although tidal flows certainly complicate application methods, these same flows can be "harnessed" to assist in distributing herbicides once tidal patterns and "wash-out" rates are understood. The successful *Spartina alterniflora control* project in San Francisco Bay, using imazapyr, and management of *Egeria dens*a in the Sacramento-San Joaquin Delta using multiple formulations of fluridone, show that focused research and adaptive management can lead to acceptable efficacy while also meeting stringent demands for protection of sensitive (i.e. listed) species. Development of new methods for these highly dynamic tidal systems will be increasingly important as the incidence of invasive algae (e.g. seaweeds) in coastal and estuarine habitats increase. However, meeting this emerging need for "marine" herbicides will require increased resources and changes in research approaches at publicly funded agencies, coupled with cooperative research in the private sector.

The Application of Grass Carp (*Ctenopharyngodon idella*) as Biological Control Agent for the Over-Abundant Growth of Aquatic Weeds in Irrigation Canal Systems of Sugar Company, Richard Toll in North Senegal

A. A. Badiane[1], D. Jeandrain[2], C. Mélard[3], F. X. Cogels[3], C. Rougeot[3], C. Prignon[3], and I. Sow[4]
[1]*Biologist, option aquaculture Aquaculture Promotion Agency (APA)*
[2]*Biologist, APEFE*
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The overabundant proliferation of aquatic weeds in Senegal water conveyance systems cause a series of operational problems. Aquatic weed impede flow and reduce the capacity of irrigation canals to a significant extent. In the worst case scenarios, irrigation scheme managers are faced with situations where they are enable to deliver water at the downstream ends of canal systems. In Guiers lake, this proliferation reduce fish capture and accessibility of the water plane. This paper is the product of five years research project funded by the Region Wallonne (Belgium) to investigate the possible application of sterile (triploid) grass carp (*C. idella*) as biological control agent on aquatic weeds in open irrigation canal of Senegalese Sugar Company (CSS). The aims of this project were firstly to test efficacy of grass carp as bio-control agent of plants, secondly to evaluate the economic feasibility of this biological approach against the current chemical, physical and mechanical control methods and thirdly to propose a management plan for the operational application of grass carp as a bio-control agent in irrigation canals. After 1,5 year all submersed and floating plant species were eradicated in all canals. Submersed aquatic plants were effectively controlled for a period of 7 month to 1 year according the stocking rates, though emersed species were also greatly reduced. Impact on vegetation was significantly 2 fold lower for 50 kg/ha stocking rates than 100 and 200 kg/ha ($p<0,05$). No significant difference was found for 100 and 200 kg/ha stocking rates and for 500 and 1000 g fish body weight. Small grass carp (200 g) don't eat emergent plants (*Typha, Phragmites, Cyperus*) but can prevents reeds by reducing the number of new shoots growing from rootstock. In our study, the survival rate (29%) and final mean fish body weight (532 g) are very low in high stocking rates (200 kg/ha) in canal 5. Vegetation was eaten in four month and food was not available. In unvegetated area grass carp can lose weight. At low stocking rate (50 kg/ha) vegetation removal proceed slowly and was eliminate 3 years after.

Responses of Seven Algal Species to Exposures of Algimycin®-PWF *(Student Presentation)*

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Problematic algae vary widely in sensitivity to algaecides such as Algimycin®-PWF, and the seven species involved in these experiments responded to a fraction of the maximum allowable label rate. Laboratory experiments were conducted to evaluate the responses of seven algal species (*Nostoc punctiforme*, *Ankistrodesmus falcatus*, *Haematococcus pluvialis*, *Eudorina elegans*, *Pandorina charkowiensis*, *Desmidium* sp., and *Microcystis aeruginosa*) to exposures of the weakly chelated, copper-based algaecide, Algimycin®-PWF. Chlorophyll-*a* concentrations and cell densities were measured to estimate EC_{99} values (effective concentration for 99% decrease in algae compared to untreated controls). The planktonic green algae (*Ankistrodesmus falcatus* and *Haematococcus pluvialis)* were the more sensitive of these species to Algimycin®-PWF exposures followed by the colonial green algae (*Eudorina elegans* and *Pandorina charkowiensis*), blue-green algae (*Nostoc punctiforme* and *Microcystis aeruginosa)* and the least sensitive species was the filamentous green algae (*Desmidium* sp.). Information from these laboratory efficacy experiments can be used to adjust field applications to maximize the margin of safety for non-target species.

The Impact of Various Growth Solutions on the Photosynthesis of *Hydrilla verticillata*: Implications on the Importance of Nutrients and Carbon Availability for Aquatic Plants Grown Without Sediments.

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Submersed aquatic plants survive as excised fragments and grow without rooting into sediment. An aquatic plants response to a variety of parameters can be measured via photosynthesis in growth chambers because these plants will survive without sediment. Experiments were conducted to identify an appropriate growth solution that provided the highest photosynthetic rates for *Hydrilla verticillata* (hydrilla). Carbon availability (as supplied by $NaHCO_3$) and nutrient availability (as supplied by Hoagland's solution) effects on hydrilla was observed by measuring conductivity and pH of the solutions and by calculating net photosynthesis measured by changes in dissolved oxygen. Hyrdrilla photosynthesis was highest and the most consistent in treatments that contained both $NaHCO_3$ and Hoagland's solution. Conductivity and pH were also more stable in treatments that contained both $NaHCO_3$ and Hoagland's solution. The photosynthesis of hydrilla plants placed in distilled water alone was greatly reduced compared to the other treatments. Solutions with just $NaHCO_3$ had initial photosynthesis similar to treatments with $NaHCO_3$ and Hoagland's, but over time photosynthesis of hydrilla in solutions with just $NaHCO_3$ steadily declined. Decreased photosynthesis in the absence of nutrients implies that nutrient stores in aquatic plants are likely minimal despite their often reported luxury consumption. These studies highlight the importance of selecting an appropriate growth solution for aquatic plants if experiments are to be performed without rooting plants in sediments.

Evaluation of Diquat for *Egeria densa* and *Egeria najas* Control in Brazil

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A field experiment was carried out in 2005 in Jupiá Reservoir, Tietê River, located in the western region of São Paulo State, Brazil. Diquat was applied by direct injection in three depths of the water body. The submerged plants colonization and the thermal stratification are two factors that can limit the homogeneity of the herbicide concentration along the depths. Prior experiment showed that the strategy of product injection in three depths was the most efficient method in order to avoid those adverse effects. The average depth in the experimental area was evaluated in 120 points at the time of application and in the period of herbicide action. The depth oscillated between 0.68 and 2.37 m, with an average of 2.003 m, spending 260L of Reward to reach an initial concentration of 400 μg/L in the 7.8 ha. The application spent 50 minutes considering application strips of 25m and 27m. After herbicide application there was a time space of 30 minutes, after which it was made a new application of diquat during two hours. The application consumed more 231 L of Reward, being restricted to the water entrance in the experimental plot, region with the highest rate of water renewal. Consequently, it was possible to apply an amount of diquat enough to reach the concentration of 400μg/L in the 69,345.38 m^3 of water that arrived per hour in the experimental area. An airboat was used for herbicide application, provided by a piston bomb operated with gasoline and a tank of 200 L. The equipment has a GPS navigation system, light bars and a flux control that automatically corrects the flow of the herbicide injection, correcting the changes in the boat speed. The 50 minutes application, the 30 minutes break and the stripes applications for 2 hours allowed extending the application to 3:20 hours increasing the time of contact between the plants and the herbicide in a concentration close to 400μg/L of diquat. This contact time promoted good control rates and uniformity of the herbicide in the treated areas.

Aquatic Weed Risk Assessment as a Tool to Manage Potential Weeds in the Aquarium/Pond Plant Trade

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The aquatic weed risk assessment model (AWRAM) developed by Champion and Clayton (2001) has been used as a decision support tool to determine which cultivated freshwater plants should be banned from entry into New Zealand, or prevented from deliberate dispersal through the nursery trade. A total of 30 aquatic plants are banned from sale under the National Pest Plant Accord and a further 8 species not known to be present in New Zealand are given the status of “Unwanted Organism”. Where a species has yet to establish as a naturalised species, or has only recently naturalised, it may be difficult to quantify weed potential using the AWRAM and without risking unimpacted natural environments. A series of competition experiments where candidate species are grown with selected competitor species (which included both known weeds and native species) have been carried out both in New Zealand and Australia. More recent trials have used the experimental design of Burnett et al. (2007) to replicate a range of water temperatures approximating other climatic zones of Australia. The displacement or severe reduction of competitor species in these experiments would indicate significant weed potential providing a basis for banning the deliberate distribution of these species.

Combinations of Diquat and Methylated Seed Oil for Control of Duckweed and Watermeal *(Student Presentation)*

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Duckweed (*Lemna minor* L.*)* is a free floating plant that is native to the southeastern United States. However, duckweed and watermeal both have an invasive growth habit and can overtake stagnant waters in both lakes and rivers. A replicated tank study was conducted outdoors at the R.R. Foil Plant Science Research Center, Mississippi State University. Duckweed and watermeal were grown in 150 L tanks, amended with Miracle-Gro®[3] 15-30-15 fertilizer at a rate of 30 mg complete mixture L^{-1} per week to maintain plant growth. Each species were assigned 20 tanks, there were 5 treatments with 4 replications. Duckweed and watermeal were both treated with diquat at 0.37 parts per million (ppm) injected into the water, diquat at 0.37 ppm with a methylated seed oil (MSO) at 1% v/v injected into the water, diquat at 935 L ha^{-1} with 1% MSO applied to the surface, and 1% MSO alone. Biomass of both species was collected using a 0.002 m^2 PVC harvesting device developed for these species and dried to obtain a constant weight. Duckweed biomass was significantly reduced 3 days after treatment ($p < 0.01$) with all treatments. Watermeal biomass was significantly reduced by foliar treatments ($p<0.01$). However watermeal was not controlled by subsurface treatments. Foliar applications of diquat without any surfactant provide adequate control of duckweed and watermeal.

Common Reed: *Phragmites australis* (Cav.) Trin. Ex Steud: Life History in the Mobile River Delta, Alabama *(Student Poster)*

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Common reed (*Phragmites australis*) is a non-native invasive perennial grass that is problematic in aquatic and riparian environments across the United States. The ability to reproduce quickly combined with its ability to cycle nutrients has made *P. australis* an aggressive invader of aquatic environments. *Phragmites* often forms monotypic stands that displace native vegetation which provide food and cover for wildlife. In order to help maintain native habitats and manage populations of common reed in the United States, an understanding of its phenological cycle is needed. Twelve biomass samples using a 0.1 m^2 quadrat were taken from each of four sites throughout the Mobile River delta in southern Alabama every month from January to December for two consecutive years. Relative chlorophyll content was measured in field using a Konica Minolta SPAD 502 meter. Samples were then separated into aboveground and belowground biomass, dried and weighed. Aboveground biomass peaked from September through December at 3400 g DW $m^{2\,(}$$p<0.01$) whereas the below ground biomass (2520 g DW m^2) ($p<0.01$) as well as chlorophyll content (35.2 SPAD) ($p<0.01$) stayed constant throughout the entire year. Understanding the phenological cycle of common reed will provide information to guide management strategies of this invasive plant.

Partial Lake Treatments in New Zealand Lakes

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Submerged invasive weed species provide a particular management challenge due to their initially inconspicuous growth and underwater habitat; however successful eradication has been achieved in lakes where surveillance strategies have led to early detection followed by effective incursion response. Although eradication is not always possible, effective containment and targeted biomass control can be achieved through strategic use of herbicide. Large deep lakes can prove especially problematic in achieving effective control of submerged weed species using herbicides on account of the difficulty in gaining adequate contact time. Although diquat is fast acting and a cost-effective tool for submerged weed control, successful results are by no means guaranteed. An experienced applicator will ensure appropriate herbicide rates and application procedures are used, but good judgement is also needed in selecting suitable weather conditions and product formulation for any given treatment. Despite adopting reasonable precautions to help ensure a successful outcome, there is no guarantee that any given diquat treatment will succeed. Key factors rarely considered by management agencies or chemical applicators are potential interference from water quality, condition of target plants and edge effects from partial treatments within large waterbodies. Three case studies (Lakes Wanaka, Benmore and Karapiro) are discussed that illustrate how diquat can be spectacularly successful one day yet on another occasion an identical treatment can fail totally. Results from a diquat trial will be also presented comparing four different application procedures on a narrow weed bed along the margin of a large deep lake. Results from the addition of rhodamine dye to herbicide applications will also be used to illustrate how valuable information on water movement patterns can help ensure more strategic placement. Diquat can be an effective tool for large scale biomass reduction, but complete recovery is common within one year. Knowledge of the growth strategy of target weed species also has a bearing on treatment procedures. For example, with *Lagarosiphon major* a second application 6-8 weeks after an initial knock-down can prevent further vegetative recovery potential by destroying young germinating vegetative buds. Successful double diquat treatments can provide highly effective control for this species.

Use of Diquat and Suction Dredging in the Management of *Lagarosiphon major* in New Zealand Lakes

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Lagarosiphon was first recognised in New Zealand in1950, and has since spread to many waterbodies. Although legislation banning sale & distribution in 1982 slowed its spread, accidental escape from ornamental ponds and recreational movement of boats have enabled continued spread. Submerged invasive weed species such as lagarosiphon provide a particular management challenge due to their initially inconspicuous growth and underwater habitat; however successful eradication has been achieved in lakes where surveillance strategies have led to early detection followed by effective incursion response. Although eradication is not always possible, effective containment and targeted biomass control can be achieved through strategic use of diquat followed by suction dredging. Two case studies (Lakes Wanaka and Benmore) illustrate how diquat and suction dredging can be used in combination. Diquat is an effective tool for large scale lagarosiphon biomass reduction, but complete recovery is common within one year. A second diquat application 6-8 weeks after an initial knock-down can prevent further vegetative recovery potential by destroying young germinating vegetative buds. A successful double diquat treatment followed by suction dredging to mop up remaining low density growth can provide highly effective control. Although diquat is often a cost-effective tool for submerged weed control, successful results are by no means guaranteed. Precautions must be taken in selecting suitable weather conditions and product formulation. An experienced applicator will ensure appropriate rates and application procedures are used. Addition of rhodamine dye to diquat applications can provide valuable information on water movement patterns and help ensure more strategic placement of herbicide. Despite adopting reasonable precautions to help ensure a successful outcome, there is no guarantee that any given diquat treatment will succeed. Two key factors rarely considered by management agencies or chemical applicators are potential interference from water quality and condition of target plants. These factors are discussed along with the potential to develop a quick pre-treatment suitability assessment tool to help reduce the risk and economic burden of failed treatments.

Turfgrass Response to Herbicide-Treated Irrigation Water *(Student Poster)*

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Bermudagrass, creeping bentgrass, tall fescue, and zoysiagrass were selected for this research. Sod was dug from a commercial farm and transplanted into pots at the NCSU greenhouses. Turfgrass was allowed to establish in pots prior to treatment. Herbicide treatments included atrazine (141 to 9000 ppb), diquat (71 to 4500 ppb), diuron (141 to 9000 ppb), glyphosate (71 to 4500 ppb), imazamox (35 to 2250 ppb), and imazapyr (35 to 2250 ppb), each applied at seven rates. A

non-treated control was included for comparison. Herbicides were applied twice by hand with appropriate water volume to simulate 0.5 inch of irrigation. Digital images of each treatment were collected for visual documentation. Turf injury was visually rated on a weekly basis using a scale of 0% (no injury) to 100% (plant death). Regression curves were created based on the visual rating data. In general, extremely high rates of each herbicide were required to induce turf injury, thus, injury should not be expected in normal field situations.

Use of Herbicides in High Water Exchange Environments: Overview

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Infestations of invasive submersed plants are increasing in systems with high water-exchange environments such as rivers, littoral shelves in large lakes/reservoirs, tidal systems and irrigation/flood control canals. These infestations are posing serious threats to our nation's waterways by blocking water movement, obstructing intakes, reducing biodiversity, and degrading habitat of threatened and endangered species. Until these infestations are checked and reduced, negative impacts will continue to cause adverse environmental consequences and economic costs, and serve as sources for re-introduction and/or spread to other water bodies. Understanding water exchange characteristics and required herbicide concentration and exposure time relationships are key to obtaining successful weed control in flowing water environments. Developing environmentally compatible chemical management strategies (i.e. herbicides and plant growth regulators) will provide an efficacious and cost-effective means for controlling plants in flowing water. At present, there are few products registered for this use, and strategies for using them effectively have not been fully developed. Ignoring this emerging problem will result in the inability to quickly and effectively respond and manage new invasive, aquatic plant infestations in flowing water systems. Products needed to meet this requirement should expand upon chemical control strategies and techniques currently developed for other use patterns (lakes, ponds, and reservoirs) with the technology modified and transferred for use in high water exchange or flowing water systems.

Response of Hybrid Milfoil to Low Use Rates and Extended Exposures of 2,4-D and Triclopyr

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Hybrid milfoil (*Myriophyllum spicatum* x *M. sibiricum*) and its parent species Eurasian watermilfoil (*M. spicatum* L.) are problematic and coexist in the Great Lakes and the Pacific Northwest regions. Triclopyr and 2,4-D are commonly used to control both species in the field at use rates of 1.25 mg L^{-1} and 2.0 mg L^{-1} respectively. Recent field and mesocosm data suggest that following some early season applications, control of milfoil may be related to extended exposures to low concentrations of these herbicides. A greenhouse study was conducted to determine the efficacy of lower rates and longer-term exposures of 2,4-D and triclopyr on hybrid milfoil. Rates tested included 25, 70, 100 and 250 µg L^{-1} 2,4-D amine or triclopyr, as well as an untreated control. Results at seven weeks post-treatment indicate that triclopyr at rates of 70 to 250 µg L^{-1} controlled hybrid milfoil by 88 to 100 percent. The 25 µg L^{-1} triclopyr was not different from the untreated control. The 2,4-D treatments of 25 to 100 µg L^{-1} were not different from the untreated control, whereas the 250 µg L^{-1} treatment resulted in a 95% reduction in biomass. Results from this study indicate that low rates and long exposures of both triclopyr and 2,4-D can be effective at controlling milfoil. The ability to utilize low concentrations of these compounds in areas with limited water exchange may represent a cost-effective, selective, and large-scale treatment strategy not fully utilized today. The differences noted between the efficacy of the low use rates of triclopyr and 2,4-D are the first to suggest a difference in the activity of these two auxin mimic compounds. A second greenhouse study is currently being conducted on Eurasian watermilfoil using the same rates and exposure as the first study.

Controlling Sago Pondweed with Endothall

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The task of controlling aquatic vegetation in irrigation canals is an extremely important venture, especially in the western United States. The waters supplied by these canals are the primary, and in some locations the only, source of water for irrigating agronomic crops. In other locations, these waters supply industrial water users as well. Therefore, the control of aquatic weeds in irrigation canals becomes extremely critical; however, the tools available to canal managers for weed control are limited. Grass carp are used in some locations, but the task of keeping the carp in the desired location is difficult, and they do not provide adequate control of some aquatic weeds. Dredging and chaining canals can be employed for weed removal; however, these tactics are dangerous, very labor intensive, expensive, and offer only a temporary solution to the problem. The final option is the use of herbicides for weed control. Herbicides currently labeled for use in irrigation canals are acrolein, xylene, and copper formulations. The copper formulations are effective in removing problematic algae infestations, but provide minimal control of vascular plants. Acrolein and xylene have label restrictions that do not allow their use in some canal locations, and they are not labeled in all states. In addition, these products are extremely hazardous to applicators and handlers. At recommended labeled rates, these products are toxic to fish and other aquatic organisms. Endothall has been used since the 1960's for controlling aquatic vegetation in ponds, lakes, and streams. In recent months, residue trials (EPA Guidelines, OPPTS 860.1500 Crop Residue Trials) have been conducted for endothall as required for an EPA approved unrestricted FIFRA Section 3 label to allow treated water to be used on irrigated crops during herbicide applications. Sago pondweed [*Stuckenia pectinatus* (L.) Börner] is a native aquatic perennial that forms dense troublesome infestations in irrigation canals and drainage ditches; thereby, not allowing for proper water delivery or flow. In 2007, experimental trials were conducted to evaluate endothall efficacy for sago pondweed control in irrigation canals. Treatments resulted in greater than 95% sago pondweed control for up to 8 weeks after treatment. Results from these trials indicate endothall will provide a safer, more effective tool for controlling aquatic weeds in irrigation canals compared to other alternative control methods.

Filling in the Blanks on Aquatic Weed Control in Flowing Water

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Having drawn the short straw to present information last on the difficulties of submersed weed control in flowing water, I have chosen not to guess the content of the earlier presentations and will use the time allocated to direct a short discussion of this subject... I believe is obvous that it is critical to maintain a lethal concentration of herbicide in the water for the proper contact time in order to achieve control. There is no magic formula to chose the proper herbicide, site, plot size or application method experience will dictate what might or might not work-and there are sites where herbicides will not work regardless of the applicators best intentions. In aquatic situations we have been fortunate to be able to push the envelope and try herbicides in marginal locations, its pretty rare that suppliers are forced to assume the costs of an aquatic weed control failure as commonly occurs in agricultural situations. In large lakes, reservoirs and other flowing water situations, it will be generally best to use fast acting herbicides, those that are absorbed in lethal doses in a short period of time, and work your way down the scale over time. Large systems have unique wind tides, internal secches, and Langmuir currents which will affect herbicide treatments. Also, if the rumor is true that EPA has proposed a definition of treated area, then the difficulties of treating slow moving water may even become more challenging in the future.

The Explosion of Exotic Island Apple Snails in Florida – Impact and Control

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There are approximately 120 species of apple snails in the genus *Pomacea*. One species – *P. paludosa* – is native to Florida and is the primary food source for the endangered Everglades snail kite (*Rostrhamus sociabilis*). Five other species of apple snails have become naturalized in the southeastern United States. One of these is the island apple snail (*P. insularum*), which was introduced through the aquarium trade and has been present in Florida waterways since the 1970s. The number of island apple snails in Florida has increased dramatically over the last decade and these large populations of exotic herbivores are thought to be responsible for complete decimation of all native and exotic aquatic plants in at least two bodies of water in the state. Island apple snails have also invaded a number of other southern states and are major agricultural pests in many parts of the world. As a result, the USDA now requires permits for importation or interstate shipment of species of *Pomacea*. We will discuss the distribution, basic biology and food preferences of the island apple snail and will outline possible control methods to prevent the spread of this damaging invasive species.

Alligator weed – Trials for Control

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As the invasive plant Alligator weed (*Alternanthera philoxeroides*) continues its spread in New Zealand better control methods are sought to thwart its progress. Alligator weed was accidentally introduced into New Zealand, and is now widespread in the north of the North Island. As an aquatic weed it poses a serious risk to further waterways in New Zealand as it continues to spread south, increasing its range and deleterious impact on the biodiversity and function of rivers, wetlands, drainages and irrigation systems. Control methods include mechanical, classical biocontrol and chemical. Of these mechanical harvesting provides immediate control but also results in fragmentation and potential further spread, and biocontrol agents have not been particularly successful in the cooler climes and are ineffective where plants spread to terrestrial situations. Chemical control has been successful, but only short term and several repeat applications have been required per season. Hence a multi year programme was undertaken to evaluate the efficacy of a greater range of herbicides (glyphosate, metsulfuron, triclopyr triethylamine and imazapyr) on alligator weed. This has provided new insights for alligator weed control.

A New Web Database for Aquatic Weed Information

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The Department of Crop Sciences is currently developing a database-driven website dedicated to aquatic plant and weed information. The non-cropland *aquatic plants and weeds* commodity was chosen as the design basis for developing a preliminary plant and commodity crop information structured database. The database is focused on defining plant criteria and informational groupings specific to the needs of the individual plant, as a commodity, and in cases where applicable -as a weed. The first (and arguably most important step) to developing any web application site is to define a relational-database structure. The database design must both contain the information and allow it to be accessed in meaningful groupings with a speed appropriate to web use. The database structure for *aquatic plants and weeds* required a greater diversity in plant characteristics development than traditional cropland commodities. In essence, creating a more complete database structure necessary for *aquatic plants and weeds* allows later commodities to fit under the umbrella of its informational demands. What that means is, the skeleton of the database may be used for corn, or grass, etc. –only the content and images would change with the commodity. Updated by extension faculty and graduate students, the database will serve as the informational backbone to dynamically driven comprehensive *aquatic plants and weeds* based website. Once information is moderated, updates will automatically load into the web page-eliminating or greatly reducing the need of faculty to understand and code in HTML or related web languages. This structure will allow multiple authors to easily contribute content and images to the site while tracking their entries. This system will also provide a unified look and feel to the presentation of the data.

Ultrasonic Algae and Bio-Film Control

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Algae blooms are natural and are a healthy development as a food source for herbivores, oxygen becomes abundant, and plenty of energy moves out through the food web. It is only when a pond receives an excessive amount of nutrients that spark a rampant algae bloom. Being able to control the vast majority of algae present in a body of water in any given month without using chemicals is well worth the investment. Ultrasound is capable of healing, or on the extreme other end of the spectrum. capable of killing. The effectiveness depends on two things: 1) The amount of power behind the signal; 2) The signal must match the vibrational frequency of what is to be affected. The LG Sonic ultrasound devices work by matching the resonance frequency of the algae cells with just enough power behind it to influence the algae cells in the following manner. The blue-greens (cyanobacteria) have a gas vesicle system (hundreds to thousands of these tiny organelles) that is easily broken by the ultrasonic sound waves. In effect they lose their ability to control their buoyancy and sink, and their life cycle processes disrupted, and ultimately succumb to bacterial attack. The roaming types (green, brown, black, filamentous, etc.) do not have the gas vesicles and the LG Sonic units affect their inner membrane called the plasmalemma causing it to separate from the outer sheath. Once the separation is complete, the cell can no longer get nutrients, control its internal pressure, or get rid of waste products, etc. Ultrasound has also been shown to significantly reduce biofilm formation. Bacteria excrete polysaccharide glue out their pili and attach to surfaces anywhere from 20 minutes to 3 hours after a surface has been cleaned. Under the influence of ultrasound waves, the bacteria sense they are in turbulent water and remain free swimming. Without biofilm, algae have no where to attach in your system. The LG Sonic has been used successfully in the following applications: ponds, lakes, lagoons, reservoirs, water gardens, swimming pools, aquaculture, irrigation, potable water and waste water municipalities, industrial cooling towers and waste ponds.

A Risk and Management Assessment for *Lyngbya wollei* in Kings Bay/Crystal River, Florida *(Student Presentation)*

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As critical water resources have been more extensively and intensively utilized, management of those resources with emphasis on multiple uses has become increasingly important. When additional pressures on those waters are brought to bear by population growth, drought or invasive plant species, public interest grows concomitantly. The advent of *Lyngbya wollei* in Kings Bay located in Crystal River, Florida, provided an opportunity to comprehensively investigate site specific management options so informed management decisions could be made that are environmentally sound, economically viable and socially acceptable. Specific objectives included thorough evaluation of the specific *Lyngbya* strain (the target species), investigation of the current management approach (mechanical harvesting), evaluation of potential chemical management options, and identification and evaluation of other management options (biological, physical, mechanical) for this situation. Mechanical harvesting was effective in unobstructed areas, when *Lyngbya* biomass is great ($\geq$200gDW/m^2), and for floating mats. In laboratory experiments, we measured the relative sensitivity of *L. wollei* from Kings Bay to organic, copper, and peroxide algaecides. Other potential management tactics included ultrasonic devices or combinations of management techniques. From this analysis, the need was clear for adaptive management involving a coherent and coordinated strategy for this complex situation. This approach provides data so citizens and water resource managers can make informed decisions regarding risks and benefits of control of invasive species and other threats to uses of critical waters.

Tobacco Response to Herbicide-Treated Irrigation Water *(Student Poster)*

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A greenhouse study was conducted to determine tobacco response to simulated irrigation contamination with six to seven rates of atrazine, mesotrione, and glyphosate. Visible tobacco injury was not observed with glyphosate treatments, but was observed with atrazine and mesotrione. Injury was 8 to 10% with simulated atrazine contamination at 282 and 564 ug/L and was 41 to 60% with rates of 2,250 to 4,500 ug/L. Injury from mesotrione treatments did not differ by treatment and was 18 to 24%. Nontreated tobacco dry weight was 18.3 g in the atrazine trial and dry weight decreased with increasing atrazine rate to 13.3 g with 4,500 ug/L. In the mesotrione trial, nontreated dry weight was 15.8 g and decreased to 10.8 g with simulated contamination of 211 ug/L mesotrione. Increasing glyphosate rate also reduced tobacco dry weight. Dry weight of the nontreated was 19.2 g and decreased to 17.7 g with the highest rate of 4,500 ug/L. In general, reduced tobacco growth was well correlated to increasing rates of atrazine, mesotrione, and glyphosate with r^2 values of 0.65, 0.83, and 0.73, respectively. In summary, it is possible that tobacco would be injured by surface water contaminated with these herbicides so care should be exercised with herbicide applications in rotational crops to prevent off-target movement.

Impacts of Aquatic Vegetation Management on the Ecology of Small Impoundments

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Aquatic vegetation management and fisheries management are inseparable, however, conflicts are often perceived between the two. We investigated the effects of biological, chemical, and no vegetation control on the ecology of private impoundments stocked with largemouth bass and bluegill sunfish. Nine ¼ acre ponds were obtained at the Aquaculture Research & Teaching Facility of Texas A&M University near Snook, TX in the fall of 2005. Southern naiad (*Najas guadalupenis*) was transplanted into each pond at a stocking rate of one ton per surface acre. The vegetation was allowed to grow and colonize the ponds over the winter so that southern naiad could become established. One of three treatments was then randomly assigned to each pond. The treatments were replicated three times and consisted of: an herbicide treatment using Reward and Cutrine, a triploid grass carp treatment, and an unmanaged control treatment. Fathead minnows (*Pimephales* promelas), bluegill sunfish (*Lepomis macrochirus*), and largemouth bass (*Micropterus salmoides*) fingerlings were stocked in each pond. The treatments were initiated on May 31, 2006. Prior to the initiation of the treatments, sampling of each pond occurred for hardness, total phosphorus, nitrite, nitrate, ammonia-nitrogen, dissolved oxygen, turbidity, pH, and temperature. Phytoplankton, zooplankton, and macroinvertebrate samples were collected from each pond. Post-treatment sampling was conducted on the

Reward treatment and the control at day 2, day 7, day 14, day 28, and monthly there after. Post-treatment sampling on the triploid grass carp treatment was conducted at day 14, day 28, and monthly there after. Upon preliminary analysis of the water quality data, there appear to be no significant differences between treatments. Preliminary analysis of phytoplankton and zooplankton samples has shown significant differences between ponds and treatments. Differences in species richness as well as biomass were observed between all ponds in the study. Marcoinvertebrate species richness and biomass appeared to be correlated with macrophyte abundance in each pond with no significant difference between treatments. Further research on this subject is required throughout broader geographic areas in order to more accurately determine the impact that various aquatic vegetation management options have on the ecology of small impoundments.

Efficacy of Dry Ground Applications of Penoxsulam and Fluridone on Sago Pondweed

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Many western irrigation canals are dewatered for much of the fall and winter. This period allows a potential opportunity to apply herbicides for pre-emergence submersed weed control. Herbicide application to dry ground during the dewatered phase must sustain residues for a period after flooding to achieve control of immature seedlings. Sago pondweed (*Stuckenia pectinatus* (L.) Boerner) is one of the predominant submersed weeds in irrigation canals, and reproduces both through seed and tuber formation. A study was designed to evaluate the efficacy of fluridone (1-methyl-3-phenyl-5-[3-(trifluoromethyl)phenyl]-4(1H)-pyridinone) and penoxsulam (2-(2,2-difluoroethoxy)--6-(trifluoromethyl-N-(5,8-dimethoxy[1,2,4] triazolo[1,5-c]pyrimidin-2-yl))benzenesulfonamide) on sago pondweed in two different sediment types (sand and potting soil) after application to dry ground. Sediment type and water-in phase did not impact efficacy. Fluridone generally inhibited sago biomass, but distinguishing significant differences was compromised by high variance and poor sago growth in sand. Most treated plants were still exhibiting chlorosis at harvest. Penoxsulam did not inhibit tuber sprouting, but 0.1, 0.5, and 1.0 #/acre (0.112, 0.56 and 1.12 kg/ha) generally reduced biomass and stem length by > 90%. Data from additional trials will be reviewed. Penoxsulam (trade name: Galleon ®) was issued an Experimental Use Permit (EUP) and fluridone (trade name: Sonar ®) received EPA approval in 2007 for application to dewatered canals.

Melaleuca in the Zapata Swamp of Cuba

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La Cienaga de Zapata (the Zapata Swamp of Cuba) is located on the southern side of Cuba, about 100 miles southeast of Havana. A portion of the 1.5 million acre swamp is designated as a UNESCO Biosphere Reserve. The habitat, consisting of fresh and saltwater marshes, mangroves, palm savannahs and hammocks, sawgrass, and tree islands, is similar to the Florida Everglades. Like the Everglades, the Zapata Swamp suffers from previous hydrologic alterations and introductions of invasive species. Efforts are underway by Cuban government agencies to ameliorate these problems. Recently, melaleuca (*Melaleuca quinquenervia*) has become a top priority for conserving the Zapata Swamp. In December 2006, sponsored by the Wildlife Conservation Society, we attended “Taller Zapata 2006", an annual workshop at which Cuban agencies, involved in restoration of the Zapata Swamp, share information on restoration issues. At the workshop, we learned that melaleuca is estimated to occupy more than 50,000 acres in the Park. We observed large heads of 25 to 35 year-old melaleuca trees, surrounded by younger trees and saplings, and numerous seedlings, indicators of a rapidly expanding melaleuca population. The Cubans are well aware of problems with melaleuca in Florida and management methods that we use; and, they were very receptive to additional suggestions that we provided. Park service personnel have a plan in place to manage the melaleuca problem, however the effort will be, initially, constrained by limited resources such as unavailability of herbicides and application equipment. In addition to melaleuca, coast Australian pine (*Casuarina equisetifolia*), marabu (*Dichrostachys cinerea*), lead tree (*Leucaena leucocephala*), water hyacinth (*Eichhornia crassipes*), and water lettuce (*Pistia stratiotes*) are considered priorities. We are not only confident that our suggestions were helpful to the Cuban friends that we made but we also learned valuable information from them. We hope to not only continue this relationship but to expand it to include other invasive plant issues in the two countries and have more of our colleagues in the US become involved.

Assessing the Potential of Creating Management-Quality Invasive Plant Maps of Lake Gaston with Data Generated by Volunteer Scouts *(Student Presentation)*

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Lake Gaston, located on the border of Virginia and North Carolina, is colonized by several aquatic invasive species including hydrilla (*Hydrilla verticillata*) which cover over 15% of the lake. Hydrilla forms dense mats, and restricts swimming, boating, and suppresses property values. Hydrilla also displaces natural vegetation, reduces habitat quality for fish, provides breeding habitat for mosquitoes, impedes commercial navigation, reduces drainage and increases flooding, and blocks intakes for hydroelectric turbines and potable water. Few management tools are available for aquatic weeds. Proper selection and integration of management techniques requires annual and accurate vegetation surveys. The accuracy of these maps could be increased or the cost of production decreased by utilizing trained volunteers. Volunteer scouts (Lake Gaston residents) were trained in the identification of seven aquatic plant species, (including hydrilla) and the use of handheld GPS units. Fourteen volunteers worked alone or in groups of two to scout weeds during the months of October and November. Scouts sampled in areas of their own choosing, and used their own boats (both motor boats and kayaks). Volunteers recorded GPS coordinates using a specialized computer program written by one of the volunteers. The scouts measured water clarity and depth, as well as presence or absence of hydrilla and 6 other aquatic weeds. Over 100 man-hours of labor were spent scouting an estimated 67 miles of shoreline (approximately 20% of total lakeshore) from at least 1,400 distinct sampling points. Data points were overlaid on existing topographic maps for relatively detailed documentation of hydrilla presence or absence in certain areas. Volunteers recorded the locations of floating mats of hydrilla, grass carp sightings, length of hydrilla shoots, whether the area had been treated with herbicides, and condition of the plants collected. Current efforts will be extended through 2008 with additional volunteers expected. Volunteers were surveyed to determine time investment of each volunteer, as well as difficulties encountered with the project. The data collected from this research may serve as a complement to data collected by the independent contractors. Future efforts will include integrating volunteer scouting efforts with the survey conducted by the contractor to maximize ground truthing.

Eurasian Watermilfoil Monitoring and Eradication Assessment in the Pend Oreille Lake and River System, Idaho

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The Pend Oreille Lake and River system is the largest freshwater body in the State of Idaho, encompassing 37,200 ha. Eurasian watermilfoil (*Myriophyllum spicatum* L.) has spread throughout much of the systems littoral zone, reducing native plant growth and diversity. We surveyed the entire littoral zone of the lake and river using a point intercept survey covering 1671 points in both June and August of 2007. These points were located in a uniform grid with points 250 m apart in waters of less than 15m deep. This survey indicated that 26% of points in the June survey and 23% in the August survey were occupied by Eurasian watermilfoil. We also surveyed almost 2000 points in June and August/September of 2007 in locations selected for management. The three treatments assessed were herbicide treatments using either a granular formulation of fluridone (2.3 to 7.9 kg ai ha^{-1}, treated in early July) or a granular formulation of the triethylamine salt of triclopyr (25 to 43 kg ae ha^{-1}, treated in late July), and diver-operated suction dredging. Eurasian watermilfoil frequency before treatment with fluridone was 45% of points, and 40% of points after treatment. This difference was not significant based on a McNemar's Test ($p=0.35$). Fluridone efficacy may improve with additional exposure time. Eurasian watermilfoil frequency of occurrence before triclopyr treatment was 61%, and 18% after treatment, and was highly significant (McNemar's Test $p<0.0001$). Triclopyr treatments were effective overall in reducing Eurasian watermilfoil occurrence. Eurasian watermilfoil frequency of occurrence before treatments at diver dredge sites was 36% before treatment, and 46% after treatment; but the difference was not statistically significant (McNemar's test $p=0.65$). Fluridone treatments were not effective by the time of evaluation. Triclopyr treatments, however, were effective in reducing the occurrence of Eurasian watermilfoil. Diver-operated suction harvesting did not appear effective. Additional herbicides, application times, and management strategies should be evaluated in the future.

Development and Impact of Biological Control of Giant Reed, *Arundo donax*, in the Rio Grande Basin of the U.S. and Mexico

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Giant reed (*Arundo donax* L.) also known as giant reed or carrizo cane, is an exotic perennial grass that has infested over 60,000 hectares along riparian corridors in the southwestern U.S. The most severe infestations are in the Lower Rio Grande Basin (RGB), where giant reed along the Rio Grande and Mexican tributaries threatens critical water resources in Texas and northern Mexico. Molecular studies indicate that the invasive genotype of A. donax in the RGB is a match with populations in the native range in Mediterranean Spain. This invasive clonal population of giant reed removes water valued at up to $20 million per year, alters stream flow patterns, increases stream bank erosion, exacerbates flood damage to water resource and transportation infrastructure, fuels wildfires along rivers, displaces native plants and the animals that depend on them, and hinders access for law enforcement personnel. Currently, giant reed infestations are being managed in limited areas with chemical and mechanical control, which must be repeated frequently and cause collateral damage to native plants. The USDA-Agricultural Research Service has developed a biological control program for giant reed involving several insects from the native range of A. donax in Mediterranean Europe. Studies on the host range and biology of a stem-galling wasp, *Tetramesa romana*, and a scale insect, *Rhizaspidiotis donacis*, that feed on stems, side shoots and rhizomes, have been completed and petitions for the release of these agents into the field in North America are in review. We have shown that these agents do not harm non-target native grasses, crops, or habitat associates. Laboratory experiments on the wasp and scale insect and field studies of an adventive population of *T. romana* wasps near Laredo, Texas, demonstrated that both of these agents produce many offspring on giant reed, complete multiple generations per year, and can be mass-reared, demonstrating that they can rapidly establish on mature and regrowth shoots of giant reed. In greenhouse studies, the wasp and the scale insect reduced plant height and water use, altered shoot branching patterns and increased shoot mortality compared to plants protected from attack. Laboratory studies are underway on additional biological control agents, including a fly that feeds on and kills juvenile giant reed shoots as they emerge from the soil, and a leafminer that feeds on leaf collars. Technology is now being developed to inundate field infestations of giant reed with biological control agents and to integrate this approach with mechanical and chemical controls. Our goal is to reduce the ecological and economic impacts of this harmful invader in the Southwestern U.S. and northern Mexico.

Integration of Chemical and Biological Control of Waterhyacinth Using *Neochetina* spp. Weevils and Fungal Plant Pathogens

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Waterhyacinth (*Eichhornia crassipes*) remains a major economic and ecological problem in the southeastern U.S., despite the release of several exotic biological control agents and the availability of numerous chemical control tools. The combined augmentation of waterhyacinth weevils (*Neochetina* spp) and fungal plant pathogens (*Cercospora piaropi* and others), and the use of chemical controls at sublethal doses could generate additive or synergistic weed control. The hypothesis that *Neochetina* spp weevils can carry fungal inoculum on their bodies and thereby increase disease symptoms and biological control impacts was tested in field tanks in south Texas. Twenty to thirty percent of the mature leaves on waterhyacinth leaves exposed to beetles that had been pre-inoculated with *C. piaropi* developed necrotic spotting, but direct application of fungal inoculum led to a higher level of symptom development (up to50% of the leaves). The use of a formulation containing canola oil and an emulsifier increased symptom occurrence on waterhyacinth leaves by 20% but also had toxic effects on *Neochetina* spp. weevils, causing 50% or greater mortality. A novel chemical herbicide containing penoxsulam induced leaf yellowing and reduced new leaf production and asexual shoot production at sublethal doses (1-5 parts per billion). The combined use of the two biological control agents and the herbicide produced additive, though not synergistic, negative impacts on shoot density. Use of the herbicide increased the number and density of leaf scars made by *Neochetina* spp. weevils but did not affect symptom production by the fungus *C. piaropi*. Direct exposure to the herbicide did not kill weevils or influence fungal spore germination. These chemical and biological control tools therefore appear to be compatible.

Influence of pH on Flumioxazin Selectivity of Submersed Aquatic Plants

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Flumioxazin is being evaluated as a subsurface treatment for control of hydrilla and other invasive aquatic plants. The degradation of this herbicide is influenced by the water pH (hydrolysis); consequently, target and non-target plants may be exposed to higher flumioxazin concentrations at lower pH. Therefore, flumioxazin was applied to the submersed aquatic plants coontail (*Ceratophyllum demersum* L.), egeria (*Egeria densa* Planch.), hydrilla (*Hydrilla verticillata* (L. f.) Royle), southern naiad (*Najas guadalupensis* (Spreng.) Magnus), and vallisneria (*Vallisneria americana* Michaux) at concentrations of 0, 100, 200, 400, 800, and 1600 µg active ingredient (a.i.) L^{-1} to plants cultured in high (9.0) and low (7.0) pH water. Plants grown in high pH water were more tolerant to flumioxazin than those plants cultured in low pH water. Based on calculated EC_{50} values (concentration of flumioxazin in water required to reduce plant dry weight by 50% compared to control plants), coontail would be the only submersed plant to be injured at the maximum label Experimental Use Permit (EUP) rate of 400 µg L^{-1}. All other plants evaluated in this study would require at least 8 times the maximum EUP concentration for biomass to be reduced by 50%. In contrast, all plants cultured in low pH water except egeria and vallisneria in the repeated experiment would be injured by flumioxazin. Increasing tolerance of plants (calculated EC_{50} values) based on dry weight were: coontail (34), naiad (51, experiment 2), hydrilla (77), naiad experiment 1 (517), vallisneria (853, experiment 1), egeria (3285), and vallisneria (3536, experiment 2). Flumioxazin concentrations as low as 50 µg L^{-1} at both pHs injured (bleaching, reddening, and defoliation) most plant species; however, they generally began to recover from treatment prior to harvest.

Monoecious Hydrilla Tuber Bank Response to Management *(Student Presentation)*

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Tuber surveys were initiated on three North Carolina lakes and one Indiana lake in 2007 to determine the effects of specific management techniques on monoecious hydrilla tuber numbers over time. Sampled lakes in North Carolina included Lake Gaston, Lake Tillery, and the Tar River Reservoir, while Lake Manitou, IN, was also surveyed. Tuber counts were conducted in spring and late fall during 2007 and spring 2008 on each lake using a four-inch core sampler. Two additional samples were collected on the Tar River Reservoir during summer 2007. In addition, sampling was 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 Lakes Manitou and 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 resulted in a 55 to 85% decrease in tuber numbers on the lakes sampled. If these rates remain steady, three to seven years would be required to achieve 99.5% reductions in tuber numbers.

Comparative Response of Eurasian, Northern, Hybrid, and Variable Watermilfoil to Aquatic Herbicides and Environmental Conditions

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The exotic invasive submersed plant *Myriophyllum spicatum* L. [Eurasian watermilfoil] has spread throughout the northern tier of the United States and it has required intensive management for several decades. The recent discovery of a hybrid genotype between exotic *Myriophyllum spicatum* and the native *Myriophyllum sibiricum* Komarov [Northern watermilfoil] has led to numerous questions regarding the ecological fitness of the hybrid as well as the potential for differences in response to herbicide management. In order to address these questions, both laboratory and mesocosm studies were conducted to evaluate the response of hybrids and parental species to herbicide management and different environmental conditions. Prior to conducting studies, genotypes were verified via genetic analysis. Laboratory and mesocosm trials evaluating various use rates of the herbicides 2,4-D, triclopyr, fluridone, and diquat revealed no difference in response between the hybrid and Eurasian watermilfoil. In contrast, Northern watermilfoil often showed reduced herbicide susceptibility. Outdoor mesocosm studies initiated in 2007 evaluated the growth response of three *Myriophyllum* genotypes to 3 different levels of light, 3 levels of nutrient regimes, 3 water depths, and low concentrations of the herbicide triclopyr. The hybrid and Eurasian genotypes showed a similar response to both the varying light intensities and nutrient regimes. One of the key early findings of this work indicates the hybrid genotype forms a turion similar to the parental Northern watermilfoil. The ecological implications of turion formation for the hybrid genotype remain unknown at this point in time. Current studies have not detected a strong difference in response to herbicides or environmental factors between the hybrid genotype and Eurasian watermilfoil. The native plant *Myriophyllum heterophyllum* Michx [variable watermilfoil] is considered highly invasive in the low alkalinity water bodies of the Northeastern United States. Laboratory and mesocosm trials were conducted to determine the relative sensitivity of this plant to ten different aquatic herbicides. Key findings of this work suggest that the ester formulation of 2,4-D was much more effective than either 2,4-D amine or triclopyr at equivalent use rates. In addition, evaluation of contact herbicides indicated that carfentrazone and flumioxazin were highly effective compared to the traditional contact products diquat and endothall. Findings from this research suggest that Variable watermilfoil responds quite differently to herbicide applications when compared to the exotic Eurasian watermilfoil.

Macrophytes and Algae in the Cacota Lagoon *(Student Poster)*

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The Cacota lagoon is located 3200 meters above sea level within the province of Pamplona in the state of Norte de Santander (Colombia, South America). A substantial reduction of the entire ecological system of the lagoon is taking place due to a combination of geological, environmental and anthropogenic factors. A preliminary study showed the site to have a high percentage of endemic species. The following plants were found to be present in the lagoon edge vegetation *Typha*, *Ranunculus*, *Rhynchospora* and *Spagnum*. With regards to algae, several phytoplactonic species were identified belonging to these predominant groups: *Bacillariophyceae*, *Chlorophyceae* and *Euglenophyceae.* The investigation methodology consists of using samples of the lagoon water and testing for the pH level, conductivity, temperature, solids and oligoelements. The project will formulate conservation strategies to preserve the limnetic ecosystem that can be used as a model for further study in the region.

Egeria densa and *Eicchornia crassipes* Biomass Soil Incorporations Improving the Physical, Chemical and Biological Properties of a Degraded Soil

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Two experiments were carried out under laboratory and greenhouse conditions aiming to evaluate the effects of the incorporation of *Egeria densa* and *Eichhornia crassipes* biomass on physical, chemical and biological properties of a degraded soil. In both experiments, it was adopted a completely randomized experimental design and the treatments were arranged in a 2 x 4 factorial scheme. The factorial variables were two aquatic weed species (*E. crassipes* and *E. densa*) and four doses of dry biomass incorporation (5, 10, 20, and 40 t/ha), plus a control treatment. In the first experiment, samples of 500g of soil and biomass were incubated at 25^{o}C for three periods (14, 28 e 42 days). At the end of each incubation period, soil samples was taken for physical, chemical and biological evaluations. In the second experiment samples of 2000g of soil received the biomass incorporation, were incubated at 25^{o}C for 42 days and then sowed with maize seeds. The maize plants height and biomass accumulation were evaluated at 30 days after the sowing. The soil incorporation of both macrophyte species increased microbial activity in the soil, but *E. densa* promoted faster e more intense increase of CO_2 evolution. *E. densa* was more effective increasing the soil contents of P and K, pH and CEC. *E. crassipes* was more effective increasing the soil contents of Ca and organic matter and the increasing soil imbibition's capacity. Twenty or 40 t/ha of macrophyte biomass were necessary to promoted a general increase in the soil fertility of this degraded soil, making possible a better growth of the maize plants. The aquatic weeds biomass produced by the mechanical harvesting may be very useful in the partial recuperation of exposed sub-soils, providing suitable conditions for plant colonization, at least pioneer plants, making possible the recovering of the original vegetation, after a succession process.

Aquatic Macrophytes Associations and Its Relevance in the Weed Management in the Aimorés Reservoir, Brazil.

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The Aimores Hydropower Company produces 330 MW of electric energy using a reservoir built by the deviation of Doce River inundating a small valley (330 ha). The reservoir has important proportion of shallow and lenthic areas. The Doce River water is eutrophyzed with high contents of plant nutrients specially nitrogen and phosphorus. The water nutrient richness and the shallow water layer provides suitable conditions for a profuse growth of aquatic weeds. *Eichhornia crassipes*, *Eichhornia azurea*, *Brachiaria arrecta*, *Pistia stratiotes*, *Salvinia molesta*, and *Salvinia herzogii* were the first populations colonizing the reservoir. After the floating macrophytes banks were well established, some epiphytic growths of other aquatic weeds were observed, mainly *Oxyscarium cubense*, *Paspalum repens*, *Neptunia alba*, *Polygonum lapathifolium*, and *Echinochloa polystachya*. These plants increase expressively the amount of biomass to be colleted by mechanical harvesting increasing the costs, delaying the process and demanding more disposal areas. The populations of *O. cubense*, *B. arrecta* and *P. repens* are able to growth on water hyacinth, water lettuce and giant salvínia banks, regardless anchored in shallow area or floating in deep parts of the reservoir, while the others species are more related to water hyacinth banks colonizing shallow areas. The weed epiphytic growth blocks the solar radiation to the support floating plants, reducing their vigor and survival. So, the plant associations lose floatability, sinking and are transported submerged by the water flow, reaching the turbines screens and requires expensive cleaning processes, including the use of divers and turbine stops. So, the Hydropower Company has been difficulties to maintain the amount of energy impaired with the Brazilian National Energy Organization (0NS), responsible to the energy distribution to the different parts of Brazil. Besides, the costs of the control and the lack of energy generation, the company is being penalized by the ONS when it is not able to provide the amount of energy predicted by contract.

ALS Enzyme Assay as a Tool for Herbicide Resistant Management in Hydrilla (*Hydrilla verticillata*)

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The development of fluridone resistance by hydrilla has significantly impacted hydrilla management and research is ongoing to develop alternate herbicides for effective hydrilla control. Currently, three ALS herbicides bispyribac (Experimental Use Permit), imazamox (Section 3), and penoxsulam (Section 3) are being evaluated for hydrilla control. Penoxulam, imazamox, and bispyribac sodium are classified as triazolopyrimidines, imidazolinones, and pyrimidinylthiobenzoate herbicides families, respectively. However, these herbicides have a similar mechanism of action in plants by a non-competitive inhibition of acetolactate synthase (ALS), the first enzyme in the biosynthesis of branched-chain amino acids valine, leucine and isoleucine. ALS inhibitors have a strong history of selecting for resistance in terrestrial agriculture and cross-resistance is common. Studies have been conducted to determine the baseline susceptibility of various hydrilla populations to 3 acetolactate synthase (ALS) inhibiting herbicides. We have developed enzyme assays to determine the baseline susceptibility of hydrilla to each ALS inhibitor. Results suggested that these three herbicides impact hydrilla at different concentrations with penoxulam and bispyribac sodium causing inhibition of ALS enzyme at much lower rates than imazamox. Research is ongoing to determine the comparative baseline susceptibility concentrations for numerous hydrilla populations throughout Florida as well as the threshold concentration requirements for each individual ALS compound. This enzyme assay will be useful in determining relative susceptibility of different hydrilla populations to each ALS inhibitor and can be used as a management tool to predict resistance development in hydrilla to ALS inhibitors.

Hydrilla Sensitivity to Imazamox and Imazapyr: Growth and ALS Activity

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Several of the herbicides that are used on crops are being developed as herbicides for aquatic vascular weed control. Imazapyr is a systemic herbicide that has been labeled for aquatic use, and recently, a new systemic herbicide (imazamox) was approved by the US Environmental Protection Agency for use in aquatic environments. Both herbicides belong to the imidazolinone herbicide family with the same mechanism of action, the inhibition of Acetolactate synthase (ALS) activity. Preliminary studies showed that the exotic submersed aquatic weed hydrilla (*Hydrilla verticillata*) had different sensitivity to both herbicides. A comparative study of effects of imazapyr and imazamox herbicides on hydrilla growth was conducted under greenhouse conditions. A complementary study of the sensitivity was conducted in the laboratory by extracting the ALS enzyme from control plants and applying the herbicides *in vitro*. The concentration required to inhibit ALS activity by 50% was determined for both herbicides and the I_{50} for ALS inhibition for both herbicides was 0.6 ppm. The imazamox I_{50} for growth was established as 43 ppb. In contrast, imazapyr did not show any effect on hydrilla growth even at 2 ppm. The fact that the I_{50} for the enzyme inhibition was higher than for growth is typical of imidazolinone herbicides because they are absorbed and accumulated into the plants. However, although the target (ALS) sensitivity is similar for both herbicides, the effect on the plants is very different. Studies on absorption and metabolism of both herbicides are being performed to determine the mechanism of imazapyr tolerance in hydrilla.

Lake-Wide Temporal Surveys to Assess Aquatic Vegetation and Herbicide Efficacy of Waterhyacinth Control *(Student Presentation)*

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Waterhyacinth (*Eichhornia crassipes* (Mart.) Solms) is an exotic free-floating aquatic plant species that affects ecological interactions within the water body and interferes with navigation. Large-scale waterhyacinth control programs rely on herbicides as a major management tool. However, ground-truth surveys are necessary in order to document herbicide efficacy and assess the reestablishment of aquatic vegetation in the system. Therefore, lake-wide aquatic vegetation surveys were conducted between 2005 and 2006 to determine the frequency and distribution of exotic and native aquatic plants before and after herbicide application. A broadcast herbicide application using 2, 4-D amine at 3.8 lb ae/acre was performed for waterhyacinth control. Surveys were performed using a point-intercept method utilizing global positioning system (GPS) which allows the user to return to the same points. One survey was performed in 2005 before herbicide application, and two surveys were performed in 2006 after herbicide application. Presence and absence of aquatic plant species was documented at each survey point. Frequency of occurrence data was analyzed in SAS using McNemar's test for dichotomous response variables to test for effects within year. A pair-wise comparison was made using the Cochran-Mantel-Haenszel statistic to test whether the presence of exotic and native species, including waterhyacinth, changed over time after herbicide application. It was found that before herbicide application, the frequency of exotic species was significantly higher than the native species, with waterhyacinth being the most frequently occurring exotic species ($p = 0.0004$). After herbicide application, however, the frequency of occurrence of waterhyacinth was reduced from 29% to 14% ($p < 0.05$). Reduced cover of waterhyacinth led to a significant recovery of native aquatic plant species, which increased from 5% before treatment to 16 % after treatment ($p < 0.05$). The increase of native species may be due to the creation of gap openings after waterhyacinth was controlled, with neighboring native plants colonizing those new empty niches.

Progress with Targeted Algal Management

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Noxious and invasive algae have continued to plague important water resources throughout the United States. Critical water resources are used intensively for multiple purposes including: fishing, recreation, irrigation, and drinking. An adaptive management strategy is often necessary to restore uses of these waters. When needs for unimpaired water are imminent, algaecides are often the preferred management approach. To efficiently and effectively target management for specific problematic algal species or strains, we developed and implemented Algal Challenge Testing (ACT). In ACT, problematic algae are exposed to algaecides in the laboratory and responses of algae are measured. These data can be used to accurately estimate field exposures required to manage the nuisance species. Information derived from both laboratory testing and through field monitoring before and after treatments has illustrated the practicality of this approach.

Responses of Several Aquatic Weeds to ALS Inhibiting Herbicides *(Student Poster)*

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Acetolactate-synthase (ALS) inhibiting herbicides have been commonly used in field crops and other terrestrial settings since the early 1980's. However, these herbicides have only recently been developed for use in aquatic plant management. Imazapyr (imidazolinone family) received U.S. Environmental Protection Agency federal registration for aquatic uses in 2003, becoming the first ALS-inhibiting herbicide for these sites. It was followed by penoxsulam (triazolopyrimidine family) in 2007, with imazamox (imidazolinone family), bispyribac-sodium (pyrimidinylthiobenzoate family), and others currently under research and development for potential registration. Research has been conducted at North Carolina State University to evaluate the efficacy of imazapyr, penoxsulam, imazamox, and bispyribac on selected aquatic weed species including water hyacinth [*Eichhornia crassipes* (Mart.) Solms], giant salvinia (*Salvinia molesta* Mitchell), alligatorweed (*A. philoxeroides*), creeping water primrose [*Ludwigia hexapetala* (Hook & Arn.) Zardini, Gu & Raven], parrotfeather [*Myriophyllum aquaticum* (Vell.) Verdc.], water lettuce (*Pistia stratiotes* L.), and others. Weed control was evaluated on a 0 to 100% scale, with 0% equal to no control and 100% equal to complete plant death. Non-ionic surfactant at 0.5% v/v was included with foliar applications of each herbicide. In penoxsulam greenhouse trials, *E. crassipes* and *S. molesta* were controlled at least 80% at 1 MAT with in-water application rates of 10 ppb and foliar application rates of 25 g ai/ha. Foliar penoxsulam applications at 105 g ai/ha controlled *A. philoxeroides* 97%. Foliar imazamox applications at 213 g ai/ha controlled *P. stratiotes* 89% and *A. philoxeroides* 96%. Imazamox at 568 g/ha imazamox controlled *M. aquaticum* and *L. hexapetala* 70 to 80%, but *S. molesta* control was less than 55%. Additional results will also be presented.

Assessing Progress in Brazilian Waterweed Management in the Sacramento-San Joaquin Delta, CA: Efficacy Results from 2007 Broad-Scale Herbicide Treatment in Frank's Tract

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Control of invasive Brazilian waterweed (*Egeria densa*) in the complex waterways of the Sacramento-San Joaquin Delta (SSJD) presents many challenges. Rapid tidal fluxes, varying and often strong current patterns, sediment composition, changing water temperature and turbidity, and a host of other factors can all influence the efficacy of aquatic herbicide treatment regimes. Understanding how and why submerged macrophyte cultures of *Egeria densa* react to management efforts throughout growing seasons in the SSJD is key to realizing the best methodology to use in regulating invasive growth. The semidiurnal tidal flux and significant turbidity of SSJD waters has historically rendered empirical measurements of Egeria coverage and biovolume unreliable. Hydroacoustic plant mapping technology, applied in Delta waters since 2003, has provided a breakthrough in solving this assessment problem. Combining hydroacoustic transects with underwater photographic surveillance and traditional point sampling techniques provides the most complete picture to date of submerged aquatic vegetation conditions in the unique shallow water habitats of the SSJD. Sites in the central Delta have been monitored since 2003 for submerged vegetation species, health, biocover, and biovolume. The goal of this ongoing monitoring approach is to measure actual efficacy and the factors that influence efficacy on Brazilian waterweed. Yearly summaries strongly contribute to adaptive management decision-making. Within the operational context of the goals of the California Department of Boating & Waterways *Egeria densa* Control Program, analysis results from Frank's Tract, a ~3,000-acre treatment site located in the central SSJD, will be utilized as an example of progress in managing volume and coverage of *Egeria*.

Aquatic Herbicides in Flowing Water

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All pesticides are required to be registered under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) prior to shipment and use in the United States. If the use will result in residues of the pesticide in food or feed, a tolerance must be established under the Federal Food Drug and Cosmetic Act. The Environmental Protection Agency (EPA) is responsible for the registration of pesticides in the United States and establishing tolerances for residues of pesticides. There are four ways to legally use pesticides under FIFRA. These include federal registration, state registration, experimental use and emergency use. To ensure protection of human health and the environment EPA reviews an extensive data base dealing with acute, subchronic, chronic, oncogenicity, developmental and reproductive animal toxicity, ecotoxicity, and fate of the chemical in the environment. These data are used to select endpoints of concern and carry out risk assessments to man and the environment. Risk assessments are used to develop label mitigation as well as use limitations (restrictions) that are required on labeling. Pesticides must be used in accordance with their label. Prior to registration of an aquatic herbicide residue levels in fish and shell fish, safe pesticide levels in drinking water and safety to swimmers must be addressed. If the pesticide is used in irrigation canals residues level in all irrigated crops must be established. Use of a pesticide in flowing water represents a unique challenge from the standpoint of both efficacy and potential hazards to non target organisms.

Comparing Survey Techniques to Assess a Submersed Aquatic Plant Community Following a Systemic Herbicide Treatment

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Although aquatic macrophyte survey techniques may be standardized within an agency, comparing data between agencies may prove more difficult especially if utilizing different sampling protocols. Previous research has investigated the differences in sampling gear and broadly comparing in-water vs. boat sampling, but there is a lack of knowledge directly comparing widely accepted aquatic macrophyte survey techniques that are used to assess herbicide efficacy. Therefore, our objectives were to compare data gathered from different aquatic macrophyte survey techniques (point intercept, line intercept, and random plots) and determine their sensitivity to detect changes in the aquatic plant community following a systemic herbicide application. In October 2000, fluridone was applied as the formulation Sonar® AS (SePRO Corporation) at a rate of 8.0 µg a.i./L as a whole-lake treatment to Perch Lake, Hillsdale County, Michigan. Three agencies, the U.S. Army Engineer Research and Development Center (USAERDC), the Michigan Department of Environmental Quality (MI DEQ), and Mississippi State University (MSU) separately evaluated the effects of the fluridone treatment on the aquatic plant community using different survey techniques.

Summary of Three Years of Watermeal Control Trials *(Student Poster)*

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Approximately 50 ponds with watermeal infestations have been experimentally treated since 2006. Treatments have included carfentrazone, diquat, flumioxazin, fluridone, penoxsulam, various herbicide mixtures, and repeated applications of diquat. Carfentrazone alone did not control watermeal at rates of 0.2 and 0.4 lb ai/A. Fluridone controlled watermeal consistently at rates of 45 and 90 ppb, but not at 30 ppb. Mixtures of 30 ppb fluridone with other herbicides also failed to provide acceptable control. Diquat controlled watermeal in greenhouse trials, but diquat rates of 2 gal product/A only provided acceptable control in 2 of 6 ponds treated. Research is ongoing with flumioxazin, penoxsulam, and repeated diquat applications.

Evaluation of Sago Pondweed (*Stuckenia pectinatus*) Control In Dewatered Irrigation Canals Using Imazamox, Imazapyr, Flumioxazin, Fluridone, and Penoxsulam *(Student Presentation)*

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Sago pondweed (*Stuckenia pectinatus*) is widespread across the United States and is a native to Colorado. In recent years it has appeared in irrigation canals across Colorado's Front Range, affecting the ability to efficiently deliver water to farmers on Colorado's eastern plains. Currently irrigation districts use one of two methods, either dredging canals with a backhoe or using multiple applications of acrolein. Both of these methods only provide temporary control and acrolein can be very hazardous to applicators. The aim of this study was to evaluate possible alternative treatments that could be applied to the dry bottom of irrigation canals in following water drawdown. Experiments were conducted under both greenhouse and field environments. Herbicides that were evaluated included imazamox, imazapyr, flumioxazin, fluridone, and penoxsulam. For greenhouse experiment sago pondweed tubers were collected from dry irrigation canals and potted in soil collected from the same canal. Treatments were applied using an overhead track sprayer and incorporated with 1cm of water. Pots were then placed in cold storage for two weeks and then submersed in water. Plants were then allowed to grow for 30 days. Following 30 day the plants were harvested and dry biomass was recorded. In addition to spraying a bare soil surface, other plants were grown in pots until they had extensive aboveground growth and were then removed from the water, aboveground biomass was removed, and these established plants received the same treatments as the plants grown from tubers. Field studies were

conducted in several irrigation canals along the Front Range to evaluate the efficacy of the same herbicides, and examined effects of both rate and timing on sago pondweed control. Initial greenhouse studies with only imazamox and imazapyr showed that both herbicides provided approximately 95% control, with no significant difference between rates. Another greenhouse study showed that imazamox, flumioxazin, fluridone, penoxsulam and a combination of fluridone and penoxsulam all resulted in significant control of sago pondweed. All of these herbicides seem to provide good control of sago pondweed in a greenhouse environment, and their performance needs to be further evaluated in a field environment.

Application Techniques of Diquat in the Control of Submerged Aquatic Weeds in a Reservoir in Brazil

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A field trial was carried out in a lateral channel of the Tietê River, in the Jupiá reservoir, western region of the Sao Paulo State, Brazil, aiming to set up the strategy of diquat application in the control of submerged aquatic weeds. The channel was densely colonized by *Egeria densa*, *Egeria najas* and *Ceratophyllum demersum.* Two water flux studies were done in the channels using rodamine and the dyer FDC-1 as tracers. The results showed that the channel has two regions completely different in terms of water renewal time. A region has a slower renewal time (22.28% per hour) than the other (55.71% per hour). The data obtained make possible to adjust the application strategy aiming to get a period of contact between the herbicide and the plants, according the recommended in the product label. The diquat was applied in the channel at September 18th, 2005, according to procedures determined by preliminaries studies of water flux in the channel. The diquat concentration in the samples was analyzed by High Performance Liquid Chromatography associated with Mass Spectrophotometer using MS/MS. The results showed that the diquat concentrations followed patterns similar to those observed with tracer concentrations, what was waited, once the conditions of the water flux, application techniques, plant colonization and sampling procedure were similar in both studies. The results suggested the use of diquat to control submerged weeds should be preceded by flux studies in order to choose the best strategy to obtain either one of the concentration regimes (400ug/L in 4 hours or 250ug/L in 6 hours) necessary to reach high levels of control on submerged weeds. Flux studies should be also used to validate the application and sampling methodologies.

Evaluation of Diets in Bluegill (*Lepomis macrochirus*) After a Shift in a Plant Community Due to Eradication of Eurasian Watermilfoil (*Myriophyllum spicatum L.) (Student Presentation)*

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Eurasian Watermilfoil (*Myriophyllum spicatum* L.)form dense stands that alter aquatic habitat and hinder native plant growth. Studies conducted using herbicide application to selectively remove these stands, have shown increase in native plant communities, creating heterogeneity in the littoral zone. Little is known how these changes in plant communities affect the diet of fish foraging. We evaluated the diets of Bluegill sunfish (*Lepomis macrochirus*) from four Minnesota lakes selected for having 80% coverage of Eurasian Watermilfoil. A low-dose endothall/2, -D treatment was applied to the two lakes and used as an experimental manipulation to shift the plant composition. Pre-treatment data were collected in 2003 and post-treatment data in 2004-2007. Bluegills were sampled in the summer during (June) and autumn (September) using electro-fishing. Transects were conducted within the littoral zone to collect fish, and 20 bluegill were randomly taken from these samples for diet analysis. The bluegills were preserved and transported to the lab were the stomach contents were analyzed. All macroinvertebrates were identified to taxonomic order. Dietary composition was compared before and after herbicide application, and among abundance level (stem densities) of Eurasian watermilfoil and native plants. Our results illustrate differences in the diets and potential preferences of prey by bluegill during a shift from a dominant exotic/invasive plant to a more diverse plant community.

Comparison of Subsurface and Foliar Herbicide Applications for Control of Parrotfeather (*Myriophyllum aquaticum* Vell. Verdc.) *(Student Poster)*

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Parrotfeather is an invasive aquatic plant that is native to South America. Parrotfeather has caused major problems in water-bodies in the United States, where infestations have reduced access, use, and runoff in ditches, streams, ponds, and shallow lakes. Parrotfeather is difficult to control and thrives in a variety of environmental conditions in addition to deploying management techniques. Our objectives were to examine the efficacy of subsurface applications of seven herbicides labeled for aquatic use and to compare those applications to herbicides that can also be applied to emergent foliage. A replicated mesocosm study was conducted in 378 L tanks beginning in August 2007. The maximum and half maximum labeled rates of copper, diquat (6,7-dihydrodipyrido (1,2-a:2',1'-c) pyrazinediium dibromide), endothall (7-oxabicyclo [2.2.1]heptane-2,3--decarboxylic acid), fluridone (1-methyl-3-phynyl-5-[3-(trifluoromethyl)phenyl]-4(1H)-pyridinone), triclopyr (3,5,6-trichloro-2-pyridinyloxyacetic acid), 2, 4-D (2,4-dichlorophenoxyacetic acid), and carfentrazone (a,2-dichloro-5-[4-(difluoromethyl)-4,5-dihydro-3-methyl-5-oxo-1*H*-1,2,4-triazol-1-yl]-4-fluorobenzenepropanoic acid, ethyl ester) were applied to designated tanks allowing for a 48 hour exposure time. Fluridone was applied as a static exposure. The maximum labeled rate for foliar applications of diquat, triclopyr, and 2,4-D were used to compare treatment methods. Parrotfeather was rated weekly for percent control for six weeks. At six weeks after treatment (WAT), healthy plant material was harvested, dried, and weighed to determine plant mass. Analyses were conducted using a Kruskal-Wallis test and means separated by the Student-Newman-Keuls method at a p=0.05 level of significance. Six WAT, copper, endothall, fluridone, and cafentrazone were not efficacious in controlling parrotfeather. Diquat at all rates and treatment methods significantly ($p<0.01$) reduced parrotfeather mass. Triclopyr as a subsurface treatment at 2.5 mg ae L^{-1} and as a foliar treatment significantly ($p<0.01$) reduced parrotfeather mass. The foliar treatment of 2,4-D resulted in acceptable control of parrotfeather. Future work needs to identify possible herbicide combinations and or application timings that could maximize treatment efficacy; as regrowth occurred in all tanks regardless of herbicide or treatment method and a second application would be necessary for complete control.

Influences of Water Column Nutrient Loading on the Growth of Parrotfeather (*Myriophyllum aquaticum* Vell. Verdc.) *(Student Presentation)*

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Nuisance growth of parrotfeather has been attributed to high nutrient environments. The uptake of nitrogen and phosphorus from sediments and their allocation have been documented in both natural and laboratory populations. However, the development of adventitious roots may allow uptake of water column nutrients in low nutrient environments. Our objectives were to determine if parrotfeather could survive through uptake of water column nutrients. Mesocosm experiments were conducted for 12 weeks in 2006 and 2007. Nitrogen (1.8, 0.8, and 0.4 mg L^{-1} as ammonium nitrate) and phosphorus (0.09, 0.03, 0.01 mg L^{-1} as potassium phosphate) concentrations were paired to identify a limiting nutrient and concentration. Each combination was replicated 4 times in 1100 L tanks. Nutrients were added weekly with water samples collected at 3, 6, 9, and 12 weeks. After 12 weeks, plants were harvested, sorted to emergent shoots, submersed shoots, stolons, and roots, and dried to assess biomass. Emergent tissues were then analyzed for nitrogen and phosphorus content. The combination of 1.80:0.01 mg N:P L^{-1} resulted in greater total ($p < 0.05$), emergent ($p < 0.01$), stolon ($p < 0.01$), and root ($p < 0.01$) mass. The combination of 1.80:0.03 mg N:P L^{-1} resulted in increased stolon and root mass. The growth of submersed shoots were not dependent upon nitrogen or phosphorus ($p = 0.99$) and are likely controlled by light intensity, photoperiod, and or temperature. Tissue nitrogen was greater for plants grown in the 1.80:0.01 mg N:P L^{-1} treatment, however, percent phosphorus in these tissues were lower than other treatments. The reduction in phosphorus may have occurred because nitrogen was supplied in excess, there was luxury consumption of phosphorus in other treatments, or there was increased phosphorus uptake by algae. These data provide further evidence that parrotfeather requires high levels of nutrients to achieve nuisance levels. Although plant mass was reduced when nitrogen concentrations were lowered, the plants did survive. Survival through uptake of water column nutrients may be a mechanism for survival during adverse conditions or a means of long distance dispersal via fragments.

Flumioxazin and Carfentrazone Efficacy on Selected Weeds *(Student Poster)*

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Two greenhouse trials were conducted to determine the response of selected aquatic weed species to foliar applications of flumioxazin and carfentrazone-ethyl. In trial one, flumioxazin and carfentrazone-ethyl were evaluated on the emergent species alligatorweed [*Alternanthera philoxeroides* (Martius) Grisebach], creeping water primrose [*Ludwigia grandiflora* (M. Micheli) Greuter & Burdet ssp. *hexapetala* (Hook. & Arn.) Nesom & Kartesz], and parrotfeather (*Myriophyllum aquaticum* (Vell.) Verdc.). In trial two, flumioxazin was evaluated on the floating species giant salvinia (*Salvinia molesta* D.S. Mitchell) and water lettuce (*Pistia stratiotes* L.). In both trials flumioxazin was applied at 0, 34, 168, 302, and 437 g ai/ha, while carfentrazone-ethyl was applied only in the first trial at 0, 56, 112, and 224 g ai/ha. At 4 weeks after treatment (WAT), flumioxazin controlled alligatorweed, giant salvinia, and water lettuce at least 91% with rates of 168 g/ha or higher.

Creeping water primrose and parrotfeather were controlled 73 to 81% with 437 g/ha. Calculated EC_{90} flumioxazin values were 35.6 g/ha for alligatorweed and 70.3 g/ha for water lettuce. Creeping water primrose, giant salvinia, and parrotfeather EC_{70} values were 120, 256, and 164 g/ha, respectively. Carfentrazone-ethyl did not control alligatorweed, creeping water primrose, or parrotfeather greater than 64% at the rates evaluated.

Cooperative Aquatic Invasive Species Control Programs in the Winyah Bay Focus Area, SC

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The Winyah Bay Focus Area Task Force, a coalition of public and private partners working to sustain the ecological integrity of the third largest watershed on the East Coast, is the leading local force in protecting this important coastal wetland complex. The 525,000-acre Winyah Bay Focus Area covers the lower drainage of the Black, Great Pee Dee, Little Pee Dee, Sampit and Waccamaw Rivers and their confluence into Winyah Bay itself. The Winyah Bay Focus Area Task Force has formed an Invasive Species Subcommittee composed of representatives of the Task Force, Clemson University, The Nature Conservancy, SC DNR, University of South Carolina, private industry and landowners to address the threat of invasive species in the Winyah Bay Focus Area. The Subcommittee has identified six major invasive species: common reed, beach vitex, giant reed, Chinese tallow, alligatorweed and water hyacinth. Projects have been initiated through public-private partnerships to develop control protocols, determine the extent of coverage of the invasive species, conduct demonstrations of potential control methods, develop cost-share programs for private landowners to conduct a organized control programs and conduct symposia on the latest biology and control information on the invasive species. Specific eradication programs for common reed and beach vitex are ongoing and control demonstrations on Chinese tallow, giant reed, alligatorweed and water hyacinth are initiated.